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ABSTRACTS

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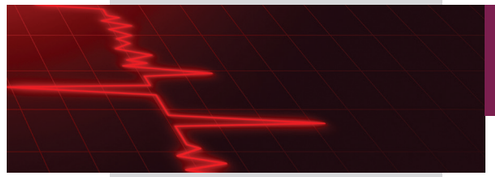
Volume 6 • SUPPLEMENT 1



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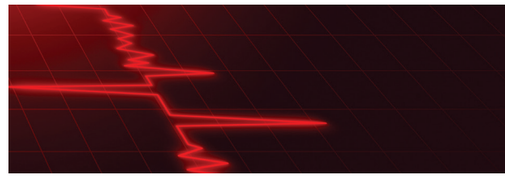

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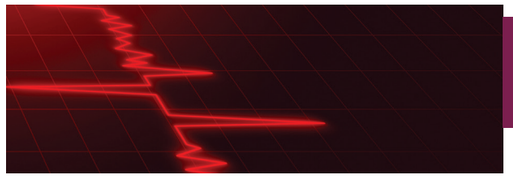

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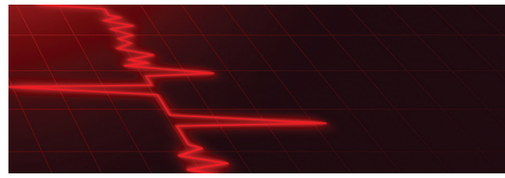

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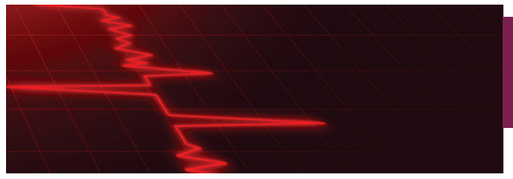

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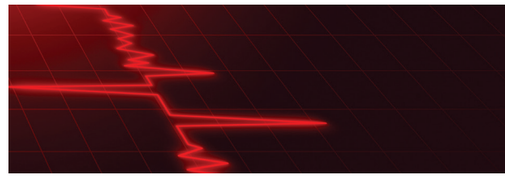

Young Investigators Competition – Basic Science

1/A comparison of ablation techniques to treat atrial fibrillation using a virtual cohort of patient-specific left atrial models

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr1

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Introduction: There are numerous approaches to treating Atrial Fibrillation (AF) using catheter ablation therapy. These approaches still require optimisation, with 41% of persistent AF patients reverting to AF 18 months after receiving pulmonary vein isolation (PVI). We aimed to use a virtual cohort of patient-specific left atrial models to compare ablation techniques targeting the anatomical, structural and electrical substrate of AF. We also wanted to investigate which factors are important for predicting simulated ablation response.

Methods: Atrial anatomy was segmented from contrast enhanced magnetic resonance angiogram (CE-MRA) images of 50 patients (20 with paroxysmal and 30 with persistent AF) and used to generate computational meshes. Human atrial ex-vivo DTMRI atlas endocardial and epicardial fibres were mapped to each anatomical mesh using the Universal Atrial Coordinate system. Fibrosis was incorporated into the models by registering late-gadolinium enhancement magnetic resonance imaging (LGE-MRI) with CE-MRA data. AF simulations were then run on the patient-specific models using Cardiac Arrhythmia Research Package (CARP) software which compute cellular transmembrane potentials across the epicardium and endocardium of the left atria during AF. Simulations were post-processed to generate endocardial phase singularity (PS) density maps indicating potential driver site locations (hotspots) over 15 seconds. 6 different ablation approaches were evaluated: a) PVI alone; or PVI and: b) box ablation; c) all driver hotspots; d) all fibrosis areas; e) single driver hotspot (largest driver site, identified as high PS density); f) single fibrosis area (largest fibrotic area, identified as high LGE-MRI intensity). Ablation lesion maps and transmembrane potential maps were generated for the resulting post-ablation models. *Figure 1* provides a visual representation of this model construction, AF simulation and ablation process. A machine learning random forest classifier was trained to predict simulated ablation outcome.

Results: Acute response to ablation was classified as AF (non-responders) and AT (atrial tachycardia) or termination (responders). The optimal ablation approach resulting in termination, or if not possible AT, varied among the virtual patient cohort: 20% PVI alone, 6% box ablation, 46% all driver hotspots, 4% all fibrosis areas, 2% single driver hotspot and 2% single fibrosis area. 20% of the virtual patients were non-responders to all 6 ablation approaches. The accuracy of classifier predictions improved from 0.73 to 0.83 by incorporating patient-specific and ablation pattern specific metrics, rather than simply including ablation type.

Figure 1

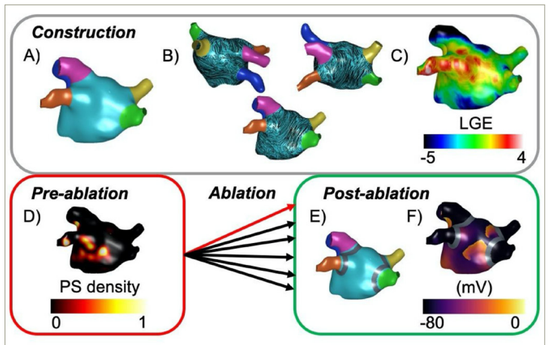

Figure 1. Example of model construction, AF simulation and ablation process. (A) Patient-specific anatomical models segmented from CE-MRA images. (B) Endocardial and epicardial fibres incorporated from a human atrial ex-vivo DTMRI atlas (3 different views of the same model). (C) Fibrotic tissue added through LGE-MRI data registration. (D) AF simulated and phase singularity density maps generated. Models were ablated using one of six (arrows) ablation approaches. (E) A post-ablation mesh (F) A post-ablation transmembrane potential map. In this example a PVI ablation approach (red arrow) was used.

Conclusion: Patient anatomy, patient-specific fibrosis properties and driver site locations are all important in determining individual AF mechanisms. The improvement in random forest classifier accuracy with the incorporation of patient-specific and ablation pattern specific metrics highlights the importance of these factors in predicting ablation success. When planning the approach for catheter ablation therapy and predicting acute response, these factors and the distribution of lesions must be considered. ❑

Young Investigators Competition – Basic Science

2/Enhancing mutant IKS channel activity by altering endogenous PIP2 levels and its interaction with PKA signalling pathway

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr2

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Phosphatidylinositol-4,5-biphosphate (PIP_2) is implicated in the regulation and modulation of the I_{KS} channel. The channel is formed at the plasma membrane by the co-assembly of KCNQ1 and KCNE1. Patients with Congenital Long QT 1(LQT1) syndrome are predisposed to Polymorphic VT due to mutations in KCNQ1, leading to impaired channel activity.

We initially transfect Human Embryonic Kidney (HEK) cells with a mammalian vector expressing KNCQ1 gene tagged with green fluorescent protein, along with KCNE1 to form the wild type (WT) I_{KS} channel. The cells were also transfected with a constitutively active PI(4)P 5-kinase(PIP5K), which converts the phospholipid Phosphatidylinositol-4-phosphate to PIP_2, therefore increasing endogenous levels of PIP_2. To ensure the enzyme remains localised at the plasma membrane we attached it to CFP-FKBP and we co-transfected the cells with cherry tagged Lyn11-FRB construct that tethers to the plasma membrane. When these cells were perfused with Rapamycin it induced chemical dimerization of CF-PIP5K to lyn11. We utilised an inactive PIP5K as a control. Using a site directed mutagenesis kit we introduced mutations in KCNQ1 and to mimic Long QT 1 patients the mutants were co-transfected with WT KCNQ1 and KCNE1 to generate heterozygous genotype.

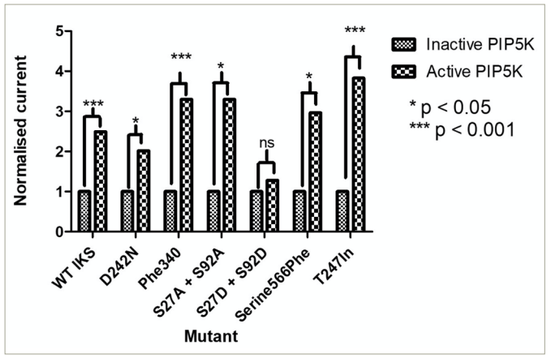
In the presence of CF-PIP5K, whole cell voltage clamp recordings demonstrated a 2.5 fold statistically significant increase in WT channel activity (at +80 mV, $p<0.001$), when compared to unaltered PIP_2 conditions. Heterozygous Serine566phe and Phe340del mutants had statistically significant reduction in current density compared to wild type in basal conditions. When these mutants were expressed with the active CF-PIP5K, Serine566phe and Phe340 had a 2.97 and 3.30 fold increase in current density, respectively ($p <0.05$). Homozygous Mutants D242N and T247in also showed statistically significant increase in channel activity.

We substituted serine with alanine at site 27 and 92(S27A/S92A) to generate a mutant known to disrupt cAMP mediated upregulation, there was a statistical 3.3 fold (+80 mV) increase in current density when co-expressed with CF-PIP5K. We then substituted serine with aspartic acid (S27D/S92D) to create a Phosphomimetic mutation, this mutant reproduces the effects of sympathetic mediated augmentation of I_{KS} channel. In the presence of enhanced PIP_2 levels, the S27D/S92D failed to demonstrate a statistical increase in current, implying the channel is at its maximum activity and hence we fail to observe any further modulation.

We then proceed to interrogate how PIP_2 interacts with sympathetic signalling system. Pseudojanin (PJ) causes depletion of PIP_2 hence perturbing channel activity. When PJ was expressed with KNCQ1 and KCNE1 we observed an 80% reduction in channel activity at +80 mV ($P <0.001$). When we perfused these cells with isoprenaline the channel activity was restored to normal.

Here we illustrate how increasing PIP_2 levels can revive I_{KS} channel activity in mutant genotype therefore supporting evidence of its capabilities as a potential therapeutic tool. This modulation is independent of the PKA-cAMP system. ❑

Figure



Young Investigators Competition – Basic Science

3/SK3 channels downregulation through antisense oligonucleotides confers potential protection against atrial fibrillation in rats

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr3

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Introduction: Antisense locked nucleic acids (LNA) GapmeRs are stable small oligonucleotides able to bind their mRNA target with high affinity and induce gene silencing. Small conductance calcium-activated potassium (SK) channels represent a novel target for rhythm control therapy in atrial fibrillation (AF). We designed specific SK3-LNA-GapmeRs, which *in vitro* demonstrated specific SK3-knockdown. Here, we show the effect of transient SK3 gene silencing *in vivo* to investigate the potential of LNA-GapmeRs in the treatment of AF.

Material and methods: 22 male Wistar rats were randomly assigned to receive either 50 mg/kg SK3-GapmeR or vehicle subcutaneously once a week for two weeks. Seven days after the last treatment, rats were euthanized by a IP lethal injection of sodium pentobarbital, organs were removed and Langendorff experiments were performed to investigate electrophysiological parameters, such as action potential duration (APD), effective refractory period (ERP) and AF propensity. SK3 channel activity was evaluated using the SK channel blocker, *N*-(pyridin-2-yl)-4-(pyridine-2-yl)thiazol-2-amine (ICA). SK3 protein expression level was assessed by Western Blot. The experiments were performed under the animal license (2017-15-0201-01231) authorized by the *Danish Animal Inspectorate* and in accordance with the EU legislations for animal protection and care.

Results: The designed LNA-GapmeR effectively downregulated the SK3 protein expression level in the heart ($p<0.01$). We found a 78% reduction in average duration of AF episodes elicited by burst pacing in the hearts of rats treated with SK3-GapmeR compared to controls (3.7 vs. 16.8 s, $p<0.05$). These AF events were also significantly shorter in duration ($p<0.05$). Refractoriness was not altered at the baseline. However, ICA did not prolong ERP in the SK3-GapmeR group.

Conclusion: The designed SK3-LNA-GapmeR silenced SK3 channels, preventing acutely induced AF in rats. Thus, GapmeR technology can be applied as an experimental platform for downregulating cardiac proteins and offers a potential modality for the treatment of cardiac arrhythmias. ❑

Young Investigators Competition – Clinical Science

4/Risk of mortality following catheter ablation of atrial fibrillation in a UK centre

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr4

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Introduction: Recently published data from a US nationwide database reported a strikingly high mortality rate of 0.46% within 30 days of a catheter ablation (CA) following atrial fibrillation (AF) procedure. We hypothesized that early mortality from AF ablation may generally be significantly higher than previously reported, and reported low mortality rates of <0.1% may be artefactual of incomplete follow-up. We sought to comprehensively assess the early mortality rate following catheter ablation in our high-volume, UK institution.

Methods: 2712 consecutive patients who underwent catheter ablation for AF in our institution between 1st June 2016 and 31st Dec 2019 were included in the study. Both *de novo* ablations and redo procedures were included and results analysed on a per-patient basis from a prospectively entered database. Our institutional procedural database was cross referenced with the SPINE and the Cerner NHS portal. SPINE is the NHS digital portal allowing exchange of information across local and national NHS systems, including primary care records and notifications of death. This significantly increases the validity and reliability of our mortality data in our patient cohort. Early mortality was defined as death within 30 days of the procedure.

Results: The database consisted of 2712 patients who underwent 2924 AF ablation procedures within the study period. 63% were male and mean age 59±16 years. 50% of patients had paroxysmal AF, 31% persistent and the remainder longstanding persistent AF. 62% of procedures were *de novo* and 51% were Cryo balloon ablation. Early all-cause mortality (within 30 days) was 0.03% (1 patient). This patient had a compassionate procedure in the context of severe complex congenital heart disease, complicated by congestive cardiac failure and later succumbed to nosocomial infection during the recovery period. A second patient died at 48 days following complications related to a procedure-related atrio-oesophageal fistula. Overall procedure-related mortality at 6 months was therefore 0.07% (2 patients); a total of 9 reported deaths (0.33%) occurred over 12 months follow up (*Figure 1*). 12 months survival was 99.6%. No late or missed intra-procedural complications were observed amongst the patients who died over 12 month follow up. Major complications occurred in 2.9% of patients underwent CA for AF (Figure 1). Pericardial effusion requiring drainage was the commonest complication (1.6%, 44 pts), with a small proportion (0.07%, 2 pts) presenting late as delayed tamponade following discharge. 17 patients had vascular complications requiring intervention and 13 patients had phrenic nerve palsies after ablation that had not resolved at 6 weeks. No non-fatal complications resulted in long-term disability.

Conclusion: This study demonstrates a very low single-centre mortality following AF ablation. Our contemporary real-world study used a national population wide database to ensure completeness of data, and can be seen as highly reassuring following concern after recently published US nationwide data. Our outcomes may directly reflect the positive outcome of reduced risks and early mortality in our high volume centre (nearly 800 AF ablations year) and therefore supports the argument that AF ablation should be concentrated in such centres. ❑

Figure

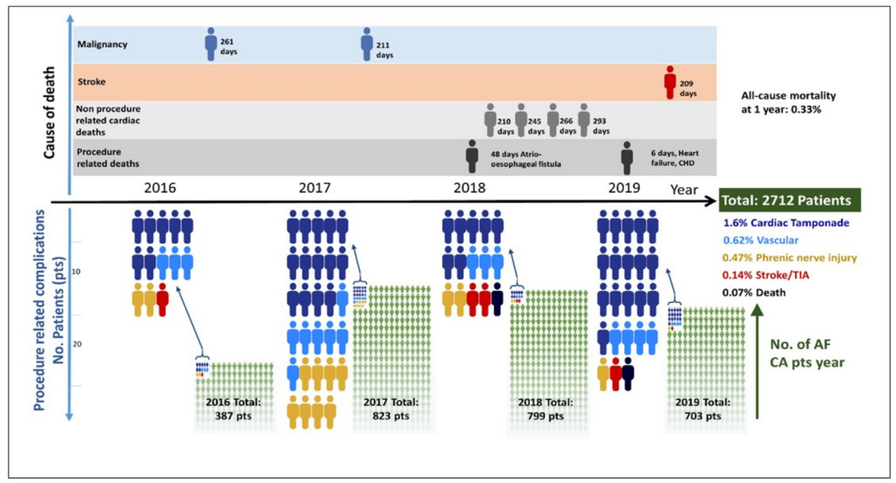

Figure 1
The figure summarizes the procedural complications and cause of death amongst the study patients. AF= Atrial fibrillation; pts= patients; TIA= Transient ischaemic attack; CHD= Congenital heart disease.

Young Investigators Competition – Clinical Science

5/Ganglionated plexus ablation to prevent atrial fibrillation (GANGLIA-AF)

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr5

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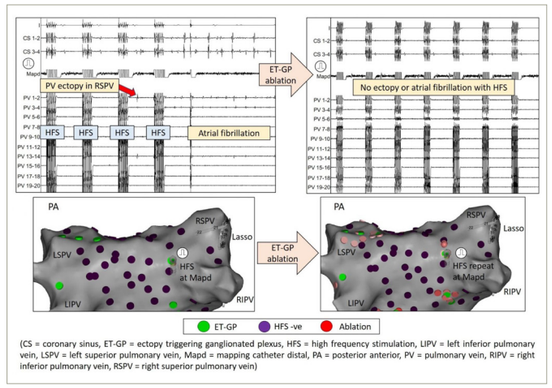
Background: The autonomic nervous system may be a driver for atrial fibrillation (AF). High frequency stimulation (HFS) can locate distinct ganglionated plexus (GP) that trigger PV or atrial ectopy/AF (ET-GP), and atrioventricular (AV) dissociation causing significant bradycardia (AVD-GP). We hypothesised that ablating these sites prevent AF.

Methods and results: In patients with paroxysmal AF, a 3-centre, prospective, randomised, controlled trial was performed (GANGLIA-AF; NCT02487654). GPs were identified using a Grass S88 Stimulator (Astromed) to deliver HFS from a CARTO Smart-Touch catheter. The primary aim was to target ET-GP during sinus rhythm by delivering HFS within the atrial refractory period and ablate these until non-functional (*Figure*). If triggered AF became incessant, the AVD-GP were ablated instead. The trial compared GP ablation (GPA) *without* any attempt to isolate the PVs against PVI by CARTO optimized workflow. Follow-up was for 12 months with 3-monthly 48 hr Holter monitors. The primary endpoint was ≥30s atrial arrhythmia in ECGs after a 3-month blanking period post-ablation. Secondary endpoints included complications and redo ablations. On an intention-to-treat (ITT) basis, 100 pts (57 GPA, 43 PVI) completed 1-year follow-up. 11 patients were withdrawn and 6 crossed over from GPA arm to PVI arm due to technical problems completing the GP mapping protocol. Randomisation was weighted towards GPA to maintain similar per-protocol (PP) numbers (43 GPA, 40 PVI). Patients undergoing GPA had on average 89 ± 27 HFS sites tested per patient, identifying 20 ± 11 (22.5%) GPs. The freedom from ≥30s atrial arrhythmia at 12-month follow-up in the ITT group was 54% (31/57) GPA vs 63% PVI (27/43) (HR 0.725 [95% CI 0.39-1.3], p=0.30). In the PP group: 49% (21/43) GPA vs 60% (24/40) PVI (HR 0.67 [95% CI 0.35-1.26], p=0.21). The primary endpoint in both ITT and PP groups showed no significant difference between the two arms. The average RF energy used in the GPA cases was significantly less than in the PVI cases: 35.4 kWs ± 15.6 vs 63.2 kWs ± 35.5 (p<0.0001). On a PP basis there was no significant difference in the freedom from redo ablations for symptomatic recurrence between the two arms: 65% (28/43) GPA vs 67.5% (27/40) PVI (p=0.82). 2 complications occurred in the GPA arm.To characterise the anatomical distribution of GP further, CARTO maps (n=54) were merged and transformed into one left atrial geometry using a semi-automated process. ET-GP and AVD-GP had distinct anatomical distribution that contrasted each other. Most ET-GP were in the roof and around the PV ostia, and therefore more likely to be inadvertently ablated during PVI. By studying ET-GP functional response to HFS in Langendorff-perfused whole porcine hearts (n=4), we were able to demonstrate significantly increased density of nerves in these locations (41 ± 44 vs 16 ± 20, p=0.04). We also studied the role of GPA in patients with previous AF ablation and durable complete PVI (n=3). Both AVD-GP and non-PV ET-GP were identified and ablated. 1 patient was rendered free of AF at 12 months follow-up, and 1 patient had recurrence at 11 months.

Conclusion: GPA can prevent AF without the need for PVI in patients with paroxysmal AF. In addition, GPA can be achieved with less RF energy than PVI implying a more specific technique on mechanistic grounds. GANGLIA-AF provides evidence that GPA may be an alternative or an adjunct technique to PVI. Further studies are warranted to investigate the role of GPA in patients with complete PVI. ❑

Figure



(CS = coronary sinus, ET-GP = ectopy triggering ganglionated plexus, HFS = high frequency stimulation, LIPV = left inferior pulmonary vein, LSPV = left superior pulmonary vein, Mapd = mapping catheter distal, PA = posterior anterior, PV = pulmonary vein, RIPV = right inferior pulmonary vein, RSPV = right superior pulmonary vein)

Young Investigators Competition – Clinical Science

6/The potential clinical utility of quantitative assessment of dynamic ST changes during 12-lead 24-hour ambulatory ECG in the Brugada Syndrome. A sub-study of the BHF RASE Brugada project

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr6

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Background: Data on quantitative assessment of dynamic ST changes during 12-lead 24-hour ambulatory ECG in Brugada Syndrome (BrS) are limited.

Aim: To investigate whether the quantitative analysis of ST changes during 12-lead 24-hour ambulatory ECG could contribute to the diagnosis and risk stratification of BrS.

Methods: A total of 147 BrS patients (55% male, mean age 47±15 years, 10 with spontaneous diagnostic type 1 pattern, 22 with arrhythmic events - syncope, aborted cardiac arrest or appropriate ICD intervention) and 68 healthy subjects (55% males, mean age 29±11 years) with no previous cardiac symptoms, no family history of sudden death and normal cardiac investigations, were included in the study. Digital 12-lead 24-hour ambulatory ECG were recorded. One-minute interval averaged values of the ST segment in lead V1-V2 positioned in the 4th, 3rd and 2nd intercostal spaces were obtained and plotted over time. Mixed-effects models were applied to the continuous longitudinal ECG data (log-transformed to account for the inter-individual and intra-individual variability) to evaluate their association with: 1) the diagnosis of BrS; 2) the response to sodium channel blocker challenge; 3) the presence of a diagnostic type 1 during the recording; 4) the presence of arrhythmic events.

Results: There were statistically significant differences in analysed 24-hour ST trends for: A) all subjects with a diagnosis of BrS vs controls; B) BrS patients with a drug-induced type 1 pattern only versus controls; C) BrS subjects with a spontaneous type 1 pattern during the recording versus those without; D) BrS with arrhythmic events versus those without. Average 24-hour trends showed different patterns across gender and clinical diagnosis of BrS (p<0.001) adjusted for age (*Figure 1*). *Table 1* shows the predicted ST segment amplitude averages obtained from the model in lead V1 recorded at 2nd intercostal space in BrS patients vs controls, also stratified by gender and four time segments during the 24-hour cycle.

Conclusions: The quantitative analysis of ST changes during 24-hour ambulatory ECG may be useful for the identification of subjects with a diagnosis of BrS, those with a spontaneous type 1 pattern and/or arrhythmic events. ❑

Figure 1

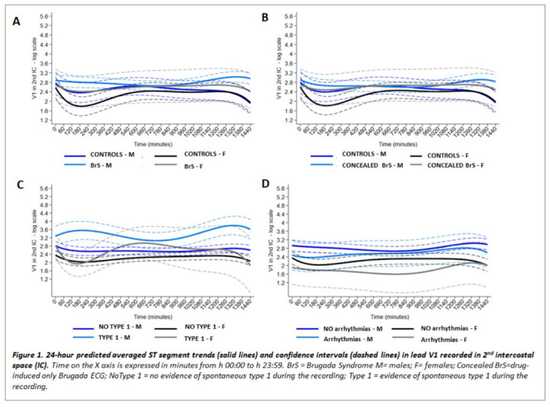

Figure 1. 24-hour predicted averaged ST segment trends (solid lines) and confidence intervals (dashed lines) in lead V1 recorded in 2nd intercostal space (IC). *Time on the X axis is expressed in minutes from h 00:00 to h 23:59. BrS = Brugada Syndrome M= males; F= females; Concealed BrS=drug-induced only Brugada ECG; NoType 1 = no evidence of spontaneous type 1 during the recording; Type 1 = evidence of spontaneous type 1 during the recording.*

24-hour averaged predicted ST segment amplitude time trends (solid lines) and confidence intervals (dashed lines) in leads V1 recorded in 2nd intercostal space (IC) by gender (p<0.001) adjusted for age in: A. BrS patients vs controls (p<0.001); B. BrS patients with drug-induced only (concealed) type 1 vs controls (p<0.001); C. BrS patients with spontaneous type 1 pattern during the recording vs those without (p<0.001); D. BrS patients with previous arrhythmic events vs those without (p<0.001)

Table 1. ST segment predicted values (uV, log scale) in V1 recorded at 2nd IC in BrS vs controls. Values are expressed as mean, minimum, maximum and standard deviation

24-hour		BrS		Controls	
	Mean	2.70		2.37	
	Min	2.40		1.79	
	Max	3.03		2.77	
	SD	.15		.20	
		Males	Females	Males	Females
	Mean	2.79	2.57	2.47	2.24
	Min	2.65	2.40	1.91	1.79
	Max	3.03	2.70	2.77	2.58
	SD	.11	.09	.13	.21
		Males	Females	Males	Females
00:00-06:00	*Mean*	2.81	2.47	2.45	1.95
	Min	2.76	2.40	2.36	1.80
	Max	2.88	2.69	2.77	2.60
	SD	.03	.07	.09	.19
06:00-12:00	*Mean*	2.70	2.56	2.60	2.30
	Min	2.65	2.47	2.50	2.02
	Max	2.76	2.62	2.63	2.43
	SD	.03	.04	.03	.12
12:00-18:00	*Mean*	2.71	2.64	2.52	2.40
	Min	2.65	2.62	2.47	2.38
	Max	2.83	2.67	2.60	2.43
	SD	.05	.01	.04	.17
18:00-24:00	*Mean*	2.96	2.63	2.33	2.32
	Min	2.83	2.43	1.91	1.94
	Max	3.03	2.68	2.47	2.40
	SD	.05	.08	.15	.12

Oral Abstracts – Allied & Service Development

7/Adapting to the new normal - early experience of adopting remote monitoring for patients with permanent pacemakers

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr7

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Background: The 2015 Heart Rhythm Society consensus statement on remote interrogation and monitoring of cardiovascular implantable electronic devices (CIEDs) recommends that all CIEDs be checked through direct patient contact 2-12 weeks post implant. The COVID19 pandemic forced our pacemaker (PPM) service to deviate from this recommendation. We enrolled patients to remote monitoring (RM) from implant and performed this check 'remotely' using RM technology.
We audited this change in practice to determine if we should continue with our approach post COVID and to look for areas of service improvement.

Method: Patients requiring a PPM between 23rd March and 4th June were implanted with a Boston Scientific PPM and enrolled to the Latitude® remote patient management system. The protocol followed is displayed in *Figure 1*. We retrospectively reviewed PPM reports and RM transmissions to assess:

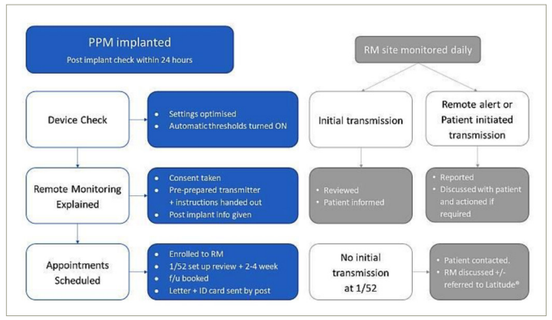
- time to transmitter set up
- patient compliance
- alerts received
- alerts requiring intervention
- effect of programming automatic thresholds on from the day of implant
- device function at the 2-12 week check

For comparison a control group of patients was collected where settings optimised at in-person 2-12 week checks were reviewed.

Results:

- 83 PPM implants were performed. 57% (n=47) were dual chamber pacemakers (DDD), 24% (n=20) were single chamber pacemakers and 19% (n=16) were generator changes.
- 81% (n=67) were implanted for syncope or pre-syncope.
- 57% (n=47) for AV block, 20% (n=17) for sinus node disease and 14% (n=12) for permanent AF with bradycardia.
- Median patient age at implant was 78 years old, range 30 to 104 years old.
- 93% (n=77) patients were consented to RM and received a RM transmitter on the day of implant.

Figure 1



- 64.9% (n=53) of these patients had set up RM in ≤ 3 days of implant.
- 97.5% (n=81) of all patients had set up RM within 2 weeks of implant.
- 23 remote alerts were received.
- 3 alerts in 2 patients resulted in early detection of lead complications requiring intervention.
- 52% (n=12) of alerts could have been avoided by better tailoring of patient alerts at implant.
- 84% (n=70) patients had automatic thresholds turned on in all system leads on the day of implant. 100% (n=70) of these patients had normal pacemaker function and appropriately set outputs at the 2-12 week follow-up.
- In a control group of 99 patients implanted with a PPM between September and December 2019 who attended for a 2-12 week check 60% (n=59) had their lead outputs optimised at this check.

Conclusion: Enrolling patients to RM at implant was possible with high patient compliance and was beneficial to patients in detecting early lead complications requiring intervention. Tailoring remote alerts at implant may help reduce the number of remote alerts received by >50%. Automatic threshold tests are reliable and safe to program on from implant when combined with RM and may reduce the need for patients to attend a 2-12 week post implant check. ❑

Oral Abstracts – Allied & Service Development

8/Outcomes from a cardiac clinical scientist-led clinic for patients with implantable cardiac devices prior to elective generator replacement

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr8

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Background: There is a gap in evidence regarding optimal management of patients approaching elective device replacement. We do not know what proportion of patients may benefit from a change in device prescription, whether upgrade or downgrade, as a result of changes in clinical status. To date there are no randomised controlled trials regarding changes to device type due to battery depletion, although the need for this has been recognised. In the UK there are no data regarding changes to device prescription at the time of generator replacement and systematic assessment is frequently not performed. We developed a clinical scientist-led clinic which provided individualised patient-centred assessment prior to generator replacement.
Objective: To assess the frequency with which patients are identified as having a change in pacing indication prior to generator replacement and describe the characteristics of patients who underwent an upgrade of their device.
Methods: All patients referred for or undergoing generator replacement between 1 January 2018 and 20 May 2020 were included. Patient records were reviewed to identify what procedure was undertaken and how the clinical history and diagnostics tests informed decision making.
Results: Of 158 patients considered for generator replacement, 82 were reviewed in the clinic. A total of 15/158 patients (9.4%) underwent a change in device type at the time of generator replacement. Of these, 10/82 (12.2%) patients in the clinic were identified as having a change in pacemaker indication. 5/76 (6.6%) patients who were not seen in the clinic were also identified as having a change in indication through alternative visits.
12 patients were upgraded: 5 PPM to CRTP, 1 PPM to ICD, 1 PPM to CRTD and 5 ICD to CRTD. 2 were downgraded from CRTD to CRTP, and 1 patient with CRTP did not have their device replaced. Among PPM patients receiving upgrade, ejection fraction was lower (p<0.001) than those with no change in pacing indication, with no significant difference in gender, %RV pacing, NTproBNP, paced QRS duration and presence of AF.
Conclusion: A significant proportion of patients requiring replacement of their implanted cardiac device do have a change in pacing indication from that at initial implant. This pilot study indicates that systematic assessment of these patients is more likely than standard care to allow timely identification of indications for upgrade or downgrade which can be undertaken at the time of generator replacement and suggests that further examination of patients' clinical parameters could be useful for identifying which patients are likely to require a change in pacemaker prescription. ❑

Proportion of patients seen in the clinic and having a change in device indication

	PPM (n=101)	CRTP (n=10)	ICD (n=13)	CRTD (n=34)
Total seen in clinic	66 (65%)	1 (10%)	6 (46%)	9 (26%)
Change in indication for all patients	7 (7%)	1 (10%)	5 (38%)	2 (4%)
Change in indication identified in clinic	6	0	3	1
Change in indication identified elsewhere	1	1	2	1

Oral Abstracts – Allied & Service Development

9/Two weeks' notice? 5000 face to face appointments? COVID 19 – We can make it work!

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr9

S Jones (Presenting Author) - Barts Health NHS Trust, London; C Monkhouse - Barts Health NHS Trust, London

Introduction: Covid 19-drove healthcare services to adapt in order to keep patients and staff safe from the virus. As a Cardiac Scientist (CS) manager, I was charged with developing a strategy for the Cardiac Device Follow-up service across a tertiary cardiac centre with satellite sites. We routinely performed face-to-face follow-up for 100 patients per day and over 40 via remote follow-up. Patients with high-voltage devices and implantable loop recorders were traditionally enrolled onto remote monitoring (RM) at implant. Pacemakers were typically not. These patients made up a large portion of the daily face-to-face attendees. Of the 18,000 patients within the clinic, 80% were in the high-risk category, according to Public Health England and therefore should not be attending hospital unless necessary.

Methods: Considerations for what would be necessary attend hospital and the pathway to attend the hospital were required, along with options to provide care outside of the hospital, either remotely or locality. Working with Consultant Cardiologists and Senior CS we developed a rescheduling protocol and changes in practice (*Fig 1*). Routine follow-up, CS called patients after triaging to explain their new schedule and advised if attendance was needed. If a device check was required, RM was considered, discussed and sent out to the patient. The GDPR aspects were documented, and verbal consent was considered sufficient by the MDT. New implants, all patients received RM. Patients were educated and set up with RM prior to discharge. This, combined with automatic testing, facilitated a virtual 1-month review with wound photos being emailed or video consultations.

Results: On 16th March, 1-week pre-lockdown, the strategy was started. Over the last three months, approximately 5,130 face-to-face appointments were rescheduled, limiting face-to-face appointments to 5 per day, these were for wound reviews or programming changes.

Discussion:

Our successes: With these service changes, we have captured displaced leads earlier, expedited wound reviews and avoided unnecessary exposure to the virus for thousands of patients.

Due to reduced outpatient visits I was able to facilitate CS working from home, performing RM via VDI connections to hospital. This aided social distancing on site, resilience within staffing, and improved efficiency to combat the increased workload from our rescheduling protocol.

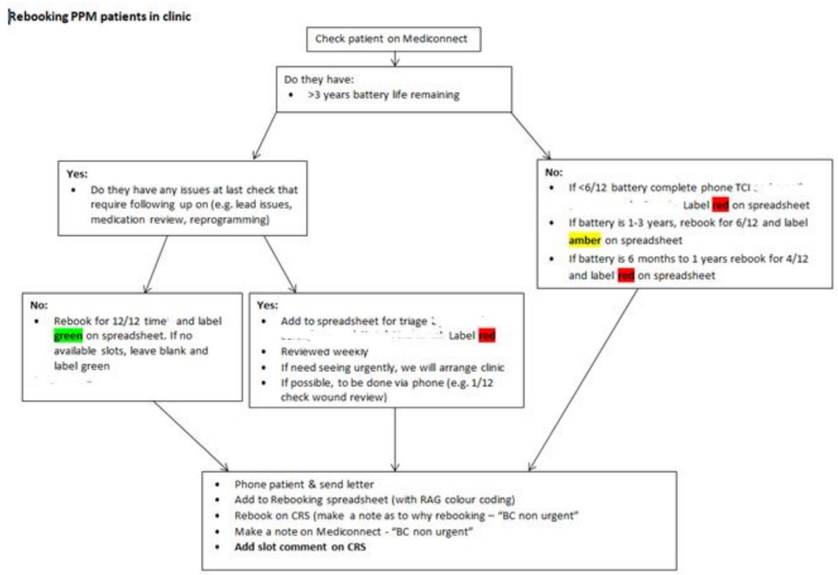
Our challenges: Implementing the rescheduling protocol with no admin support; the team had to balance this workload and the increased RM workload.

Contacting patients was a challenge. Often telephone calls were unanswered or the patient not available. This delayed the appointment change being relayed to the patient and had to be repeated. We were challenged with patients suffering mental health issues and anxiety, either brought on by the pandemic or exacerbated by it. Some patients refused to attend despite needing urgent box change and some safeguarding issues were raised.

A significant challenge pre-pandemic was the amount of disconnected home monitors. The team worked with industry providers to contact patients and support them to improve connectivity significantly.

Conclusion: At the onset of the pandemic the delivery of cardiac device management required fluidity, the team had to adapt quickly to changes in service delivery. With many challenges this has developed a new way of working for CS that can protect both patients and staff in the future. ❑

Figure 1



Oral Abstracts – Allied & Service Development

10/Prevention of AF related stroke through appropriate treatment with anticoagulation – a new centralised pharmacist model in Haringey primary care networks

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr10

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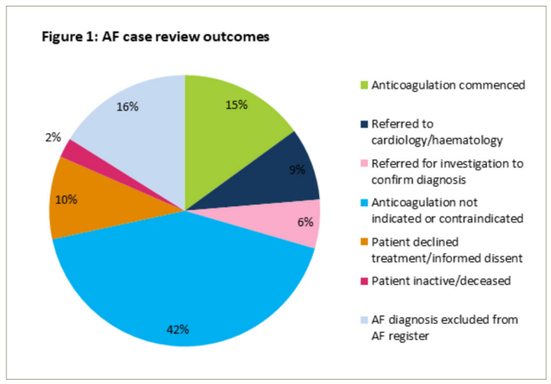
Introduction: Clinical pharmacists are a new workforce in Primary Care Networks (PCN) and can play a critical role in realising the NHS Long Term Plan ambition, principally through secondary prevention.[1] A centralised pharmacist model was implemented in the delivery of the NHSE Atrial Fibrillation (AF) patient optimisation demonstrator programme 2018-2020 aimed at preventing AF related stroke in Haringey.[2] The workforce supported practices to identify patients with undiagnosed AF and ensured patients with a confirmed diagnosis were prescribed appropriate anticoagulation. The focus was to reduce the treatment gap to match the national ambition of anticoagulation rate in high risk patients with AF.

Method: 13 clinical pharmacists covering 36 GP practices in Haringey received AF training. In-house education sessions, AF case review templates and AF detect, protect and perfect pathways were designed to support upskilling. The APL AF tool produced by UCL Partners helped identify AF patients with a CHADSVASC ≥2 that were not anticoagulated or on suboptimal therapy. The baseline data for all the practices in Haringey were obtained from the NHS quality and outcomes framework (QoF) indicators. Clinical pharmacists reviewed patients not prescribed anticoagulation treatment or prescribed aspirin as monotherapy. The cases were discussed in the virtual clinics with the specialist anticoagulation pharmacist and GPs. Actions post virtual clinic were also completed including patient follow ups for shared decision making with the practice-based pharmacist.

Results: In total, 807 AF case reviews were discussed in the virtual clinics for 36 practices. Of these reviews, 121 patients were commenced on anticoagulation, 70 patients were referred to cardiology/haematology, 47 patients were referred for investigation to confirm diagnosis and 340 patients were contraindicated or not indicated to treatment (see *Figure 1*). Overall, there was an increase in percentage of AF patients with a CHADSVASC ≥2 prescribed anticoagulant from 78% (2018/19) to 84% (2019/2020) in Haringey GP practices.

Figure 1



Conclusion: A centralised pharmacist model in primary care provided a sustainable borough wide approach in managing AF patients. The model also provided an opportunity for the pharmacists to upskill GPs and share learning with the multidisciplinary team to improve prescribing and ensure sustainability of the outcomes. Improved confidence of pharmacists in managing AF patents in primary care will continue to allow for better detection, protection and perfection of AF. ❑

References

1. National Health Service (NHS). 2019. The NHS long term plan. www.longtermplan.nhs.uk/
2. National Health Service (NHS) England. 2018. Memorandum of understanding for the delivery of the Atrial Fibrillation patient optimisation demonstrator programme 2018/19-2019/20.

Oral Abstracts – Allied & Service Development

11/Device interventions during COVID-19: a tertiary centre strategy for prioritising high-risk patients

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr11

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Background: On the 23rd March 2020 the UK went into lockdown due to COVID-19 with vulnerable patients advised to shield at home. Patients with implantable devices still required battery changes and other interventions during this period, both clinically urgent and routine. A new strategy for identifying those needing urgent procedures was introduced at a tertiary cardiac centre to balance the risks of delaying procedures vs coming out of shielding.

Method: In normal circumstances, we perform 20-30 device re-intervention procedures per month including box changes, lead revisions, device upgrades and wound revisions. Patients are referred via device clinic or directly by a Consultant. Routinely we aim to box change patients at the time elective replacement indicator (ERI) is triggered. Most elective work was cancelled and patients requiring procedures were identified and booked in first. Working closely with Electrophysiology (EP) Consultants we developed new groups to sort patients (*Table 1*). An earlier referral threshold of 6 months till ERI was set to plan procedures in advance. Legacy device patients were sent remote monitors (RM) to maintain safety and delay procedures. Regular downloads for patients approaching ERI allowed them to isolate as long as possible.

Results: During the months of March-May 2020 the number of requests increased from 25 to 56 requests (*Figure 1*). A peak in April 2020 of 50 device re-intervention procedures. Five patients hit ERI and had to be upgraded from Urgent to Very Urgent. Three of these had been delayed due to patient/family preference. One Fortify advisory had to be admitted due to prematurely triggering ERI. Three patients had their procedures done locally instead. Ten further patients have been referred for re-intervention locally. Three patients died on the waiting list, all sadly due to contracting COVID-19 in community. Two patients required input from the trust's safeguarding team due to lack of contact with patient at predicted ERI and non-compliance with RM. From Jan-July 2020 the average referral to treatment time (RTTT) constantly averaged at 50 days.

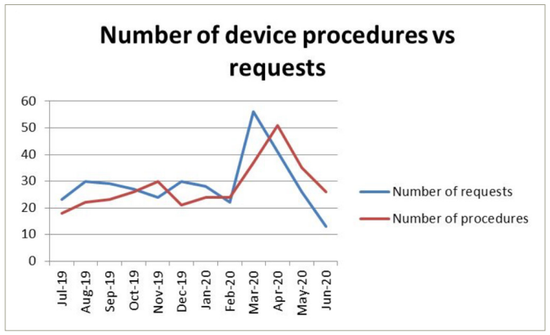
Discussion: Adaptations to this service involved multiple teams working together to maintain patient safety. This involved scheduling, pre admissions and Cardiac Scientists. We also transitioned to a Cardiac Scientist led service empowering the team to risk stratify patients.

A further challenge presented itself: a subgroup of patients declined procedures. We compromised with some patients; three patients had procedures at a local centre to avoid travelling into London. Linked trusts referrals to our centre increased during this period, likely due similar measures of lowering thresholds. Linked trusts did not have access to RM, requiring them to directly refer for box changes rather than having the luxury of delaying procedures. Some legacy patients had devices that were incompatible with RM or declined a RM. Since lowering the referral threshold, a rise in referrals was expected, however, the results suggest that a back log of referrals, as the RTTT was indifferent. Collaborating with colleagues internally, local centres and enrolling on RM maintained shielding and device safety towards end of battery. This exemplifies solidarity across cardiac services during the COVID pandemic. ❑

Table 1

Categories for admissions	Criteria
1	Very urgent or inpatient
2	Urgent
3A	Time dependent, not urgent benefit>risk of COVID
3B	Time dependent, not urgent benefit<risk of COVID
3C	Not time dependent e.g. reveal

Figure 1



Oral Abstracts – Allied & Service Development

12/Comparisons of patient management in the COVID era, the patient's perspective

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr12

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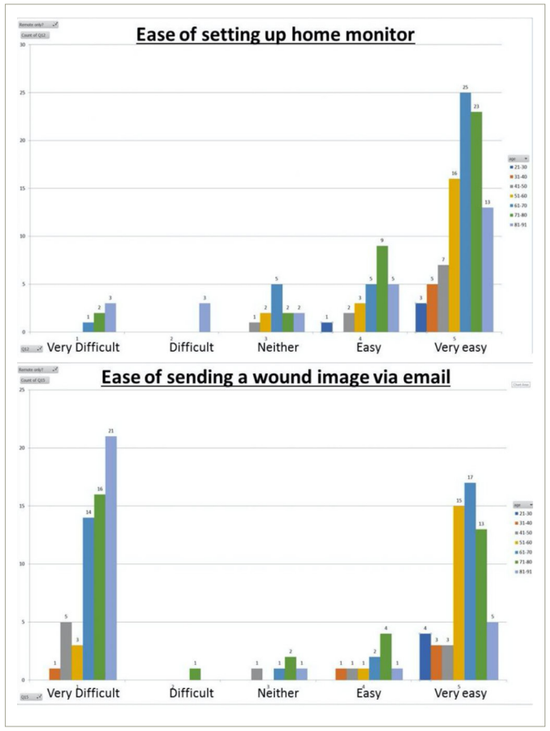
Introduction: Device follow up was routinely performed in persons pre-March 2020. When the COVID pandemic caused lockdown in the UK this led to new methods of performing the 4-6-week check: utilising remote monitoring and patients sending wound images. We wanted to investigate the patient's perspective of this experience: comparing traditional follow up vs remote only follow up. We hypothesised that this would have no effect on satisfaction but would show limitations of remote only working in particular patient groups.

Methods: Patients who had a device procedure in the months Jan-April 2020 would be asked to complete a telephone survey, excluding ILR devices. This survey consists in 25 questions, which were divided into 5 parts to define the stages of patient journey: pre implant, post implant on the ward, wound management, one-month post implant appointment and overall satisfaction. Each question is rated from 1 to 5 (negative to positive depending in the question). We will compare the results of in person follow up and remote only follow up.

Results: A total of 222 patients completed the survey, 88 (40%) in the traditional face to face follow up and 134 (60%) in the remote only group. No difference was seen comparing the sections on pre implant, post implant, wound management and satisfaction of the two groups. For the 134 patients in the 1/12 virtual post implant check group, 92 patients found it very easy to set up their home monitor and 6 patients found it very difficult. Older patients found this slightly more difficult to set up the home monitor, however, patients up to the age of 91 did find this very easy. 60 patients found sending a wound image via email very easy and 60 patients found this very difficult. The age when patients started to struggle more was 71 years old (*Fig 1*). Of the 134 patients that received remote only follow up a total of £1317.50 was saved not having to pay for travel into clinic. Of these 134 patients 37 would have received free transport. For the 88 patients who visited clinic, £607.50 was spent to travel into clinic, of which 44 received free transport. For the future, 54% of patients would prefer remote only and 46% would prefer in clinic follow up. However, there was no difference in age for these patients.

Discussion: Patients appear to be satisfied with both follow up plans. However, this survey highlighted key limitations for remote only 1/12 follow up. The ability to set up a remote monitor did slightly decrease with age. This will be helped by the majority of patients having remote monitoring set up prior to discharge. The difference between patients who were able to send an email with a photo of the wound site highlights a difference in patients' technical ability at all ages, with older patients finding this more challenging. Centres wanting to adapt this model of care should be knowledgeable of this and consider other options, such as GP/practice nurse wound assessment, or in clinic follow up for these select patients. This difference would allow services to reduce their footfall into device clinics and financial savings to the patient. Unexpectedly patients were split in their option for future follow up which requires further investigation. Due to the COVID 19 pandemic services are socially distancing across the country. Remote only follow up has its limitations, most importantly being receiving the information from the patients. Services can develop pathways from this data to find out which patients would be best suited to this follow up schedule. ❑

Figure 1



Oral Abstracts – AF: Clinical

13/Atrial fibrillation in the United Kingdom: recognising and forecasting the cost drivers of atrial fibrillation-related costs

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr13

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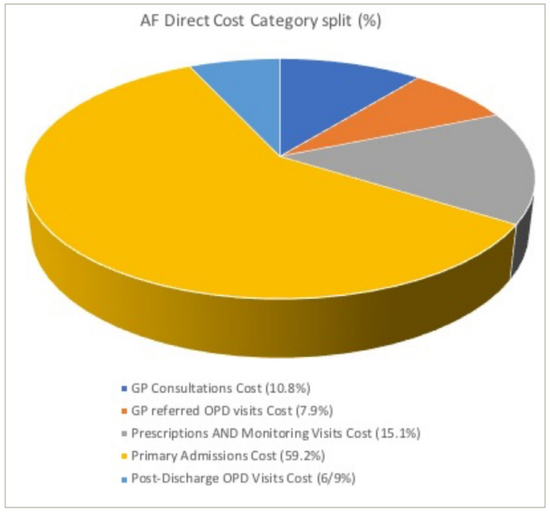
Background: Atrial fibrillation (AF) is a common arrhythmia and is associated with a high risk of mortality and morbidity due to stroke, heart failure and dementia. AF is a major contributor to healthcare costs, but we need greater understanding of the main cost drivers (e.g. hospitalisations) of this increasingly prevalent arrhythmia. Such data would help with NHS resource planning over the next decade.

Methods: Based on prior published data, we initially calculated direct costs of AF for 1995, and then again for 2000, using contemporary and extrapolated data that have been used as the basis for forecasting AF costs in the UK and as a share of total NHS expenditure. AF direct costs have been split between cost driver categories; GP consultations, GP referred OPD visits, prescriptions and monitoring visits, primary admissions and post-discharge OPD visits. Forecast assumptions used: (i) NHS expenditure from 2020 onwards assumed to increase at annual rate of 3%/year; and (ii) the UK inflation rate to increase by 2% annually. Sensitivity modelling of 3%, 4% and 6% projected annual increase in AF prevalence amongst the population was applied.

Results (see *Figure 1*): The estimated direct and proportion of NHS expenditure of AF in 2020 for each of the assumed increases of 3%, 4% and 6% would be £1,435m (0.91%), £1,741m (1.11%) and £2,548m (1.62%) respectively. By far the largest contributor to the total direct AF costs in 2020 was for Primary Admissions (nearly 60%), with a further 7% with post-discharge Outpatient Clinic visits. Taken together the total for these two categories would cost the NHS between £949m and £1,685m, depending on the projected increase in annual rate of AF prevalence.

The full cost of AF related hospitalisations may still be underestimated, due to the other admissions associated with a secondary coding of AF, which in 2020 are forecast to cost between £2,269m and £4,030m, depending on the annual population increase of AF prevalence. There will be an increasing number of patients discharged to a nursing home after a hospital admission associated with a principal AF diagnosis. The cost estimate for this in 2000 was £111m which is predicted to rise to somewhere between £346m and £614m by 2020.

Figure 1



Conclusions: Focussing on 2020 and *direct* costs alone, AF is predicted to cost between 1-1.6% of NHS expenditure, mostly from primary admissions. If hospitalisations can be avoided or reduced, we would substantially reduce the healthcare costs of AF to the NHS. Improved strategies to reduce the NHS healthcare cost burden of AF are urgently needed with a particular focus on reducing the number of hospitalisations. ❑

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Heart Rhythm Congress 2020 Abstracts

Oral Abstracts – AF: Clinical

14/Efficacy and predictors of nurse led same day discharge in patients undergoing atrial fibrillation ablation in a district general hospital

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr14

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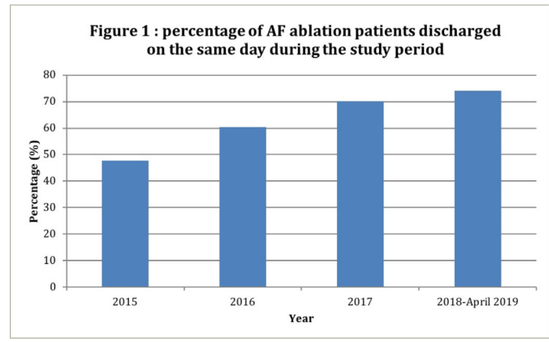
Introduction: Atrial fibrillation (AF) ablation is the most common arrhythmia procedure performed worldwide. The number of AF ablation procedures has increased exponentially over the past decade. This has a significant impact on healthcare resources and cost implications. The aim of this study is to evaluate the efficacy and safety of a same-day nurse led discharge protocol in a district general hospital in patients undergoing AF ablation.

Methods: This was a single centre study of all patients undergoing AF ablation from January 2015 to April 2019 at Eastbourne District General Hospital. All patients were admitted as day case procedures with the intention of same day discharge. Nurses discharged patients in the evening of the procedure if there were no procedural complications and if the effects of sedation had subsided. The primary efficacy outcome was the proportion of successful same-day discharges.

Results: A total of 716 patients (mean age 65.9 ± 9.9) underwent AF ablation during the study procedure. The proportion of same day discharges significantly (p<0.001) increased from 47.8% in 2015 to 74% in 2018/19 (*Figure 1*). The majority of cases (56.4%) were performed using cryoablation. 21.4%, 6.1% and 16% of ablations were performed using PVAC catheter, nMARQ catheter and point by point catheters. The proportion of procedures performed using cryoablation increased year on year from 23% in 2015, 58% in 2016, 52% in 2017 and 72% from 2018 to April 2019. 96.1% of cases were performed using conscious sedation only. In patients who were discharged the same day there were no readmissions 24 hours after the procedure. Patients were who were discharged the same day were more likely to have a shorter procedure time (67.6 ± 26.2 vs 84.0 ± 33.7 minutes, p<0.001) and a lower CHA2DS2-VASc score (2.3 ± 1.5 vs 2.7 ± 1.6, p value <0.001). Cases performed on morning lists were more likely be discharged the same day (74.5% vs 52.6%, p<0.001). Patients who had a procedural complication were also more likely to be admitted for monitoring and an overnight stay (8.8% vs 1.9%, p<0.001).

Figure 1



Conclusion: Same day nurse led AF ablation discharge is feasible and safe in the majority of patients. This helps to reduce costs and increase the number of beds available in the hospital trust. Over the study period the proportion of same day discharges increased which is likely due to increased confidence of the nursing staff to discharge patients on the same day and the increased use of cryoablation technology. ❑

Oral Abstracts – AF: Clinical

15/Same-day discharge following catheter ablation of atrial fibrillation: a safe and cost-effective approach

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr15

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Introduction: The frequency of catheter ablation for atrial fibrillation (AF) has increased dramatically, stretching resources. Discharge on the same day as treatment may increase the efficiency and throughput. There are limited data regarding the safety of this strategy.

Methods: We performed a retrospective analysis of consecutive patients undergoing AF ablation in a tertiary centre and in a district general hospital, and identified those discharged on the same day of treatment. The safety endpoint was any major complication and/or presentation to hospital in the 48-hours post discharge. We performed an economic analysis to calculate potential cost saving.

Results: Among a total population of 2628 patients, we identified 727 subjects (61.1±12.5 years, 69.6% male) undergoing day-case AF ablation. Most of them suffered from paroxysmal AF (58%) and underwent a *de novo* procedure (86.1%). Cryoballoon technique was used in 79.2% of the day-cases, and 91.6% of the procedures were performed under conscious sedation. 1.8% (13) of the participants met the safety composite endpoint, however only 0.7% (5) required at least one day of hospitalisation. Bleeding/haematoma at the femoral access site (0.5%) and pericarditic chest pain (0.5%) were the main reasons for readmission. None experienced cardiac tamponade or other life-threatening complications in the 48-hours post-discharge. Our day-case policy resulted in a cost-saving of approximately £287,422 for our hospital (average of £83,927 annually).

Conclusion: In this large multicentre cohort, same-day discharge in selected patients following AF ablation appears to be safe and cost-effective, with a very low rate of early readmission or post-discharge complication. ❑

Oral Abstracts – AF: Clinical

16/Medium term outcomes of left atrial appendage occlusion in high-risk AF patients: 4-year follow up data

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr16

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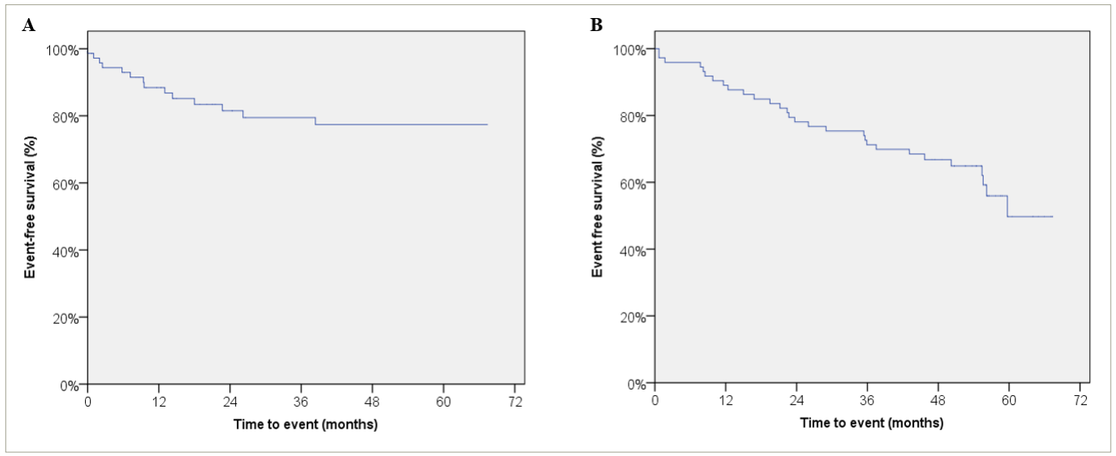
Background: Left atrial appendage (LAA) occlusion is offered for stroke prevention in patients with atrial fibrillation (AF) who are unsuitable for lifelong oral anticoagulation. Medium to long term follow up (FU) data for this high-risk cohort are sparse.

Methods: We report 4-year FU outcomes in 73 patients (median age 78 [73-82] years; 34.2% female) who underwent successful LAA occlusion with the Amulet device at our centre between November 2014 and March 2017.

Results: Median CHA_2DS_2-VASc and HAS-BLED scores were 4 (4-5) and 2 (2-3), respectively; 69 (94.5%) patients had a previous major haemorrhagic event (intra-cranial haemorrhage in 57.5%, gastro-intestinal bleed in 27.4% and other sites 9.6%). Other co-morbidities included hypertension (71.2%), diabetes mellitus (37.0%), congestive cardiac failure (17.8%), coronary artery disease (11.0%), peripheral vascular disease (11.0%) and carotid artery disease (2.7%). Imaging at FU was performed in 67 (91.8%) patients, including trans-oesophageal echocardiography in 54 and contrast-enhanced cardiac computed tomography in 13 patients. 14 (19.2%) had evidence of a minor peri-device leak of <5 mm, and none had a major leak of >5 mm. One (1.4%) patient had a device-related thrombus soon after the procedure that resolved with a short-course of apixaban, with no late sequelae. Over the median FU period of 46 (19-56) months, seven patients suffered an ischaemic stroke or transient ischaemic attack and three suffered from haemorrhagic stroke. Five (6.8%) patients suffered from a major extracranial bleeding event, including three gastro-intestinal bleeds, one haemoptysis and one epistaxis. A total of 29 (39.7%) patients died during this period (*Figure*). The antithrombotic regime in the remainder (n=44) was aspirin only in 16 (36.4%), clopidogrel only in 5 (11.4%), apixaban in 2 (4.5%), dual-antiplatelet therapy in 1 (2.3%) and no antithrombotic in 20 (45.5%). The rate of ischaemic stroke with LAA occlusion was significantly lower than that predicted without treatment based on the CHA_2DS_2-VASc score (9.6% vs 24.9%). Using multivariable analyses, independent predictors of mortality were age >80 years (HR 2.42 [95% CI, 1.03 - 5.68]) and diabetes mellitus (HR 2.66 [95% CI, 1.13 - 6.25]), after adjusting for other risk factors.

Conclusion: Left atrial appendage occlusion using the Amulet device appears to be effective at reducing the risk of ischaemic stroke in high-risk AF patients who are deemed unsuitable for oral anticoagulation. These patients have a high rate of mortality over the medium term, and an ongoing risk of thrombotic and bleeding events. This has cost efficacy implications, and underscores the need for careful patient selection, especially in patients >80 years of age and those with diabetes mellitus. ❑

Figure 1



Oral Abstracts – AF: Clinical

17/Long term outcomes of second-generation cryoablation without electrical mapping in paroxysmal atrial fibrillation patients

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr17

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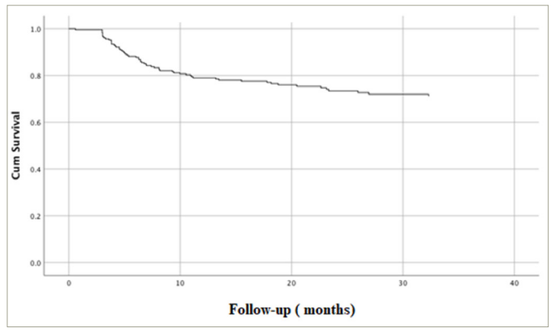
Introduction: Second-generation cryoballoon ablation is safe and effective in patients with paroxysmal atrial fibrillation (AF). Previous studies have found there to be high acute rates of pulmonary vein (PV) isolation with the Artic Front Advance catheter. Reaching a nadir temperature of -40° has also been shown to achieve electrical isolation of the pulmonary veins. The aim of this study is to report the long-term outcomes of paroxysmal AF patients who underwent cryoablation without concurrent electrical mapping.

Methods: 228 patients (mean age 66.7 ± 10.0) who underwent cryoablation without electrical mapping from January 2015 to April 2019 in Eastbourne District General Hospital were followed up for a mean duration of 26.8 ± 16.7 months. The primary endpoint was freedom from AF, atrial flutter, or atrial tachycardia ≥30s after a 90-day blanking period.

Results: The mean procedure and fluoroscopy time was 55.6 ± 12.1 and 10.7 ± 4.6 minutes respectively. The mean temperatures achieved in the PV were as follows: left upper -48.8° ± 6.0°, left lower -47.3° ± 5.6°, right upper -48.6° ± 6.2°, right lower -46.9° ± 5.4°, respectively. Freedom from atrial arrhythmia was achieved in 167 of 228 of patients (73.2%; *Figure 1*). The proportion of patients who were European Heart Rhythm Association (EHRA) class 1 increased from 0.9% at baseline to 53.5% at final follow up. Subsequently, 34 of 228 patients (14.9%) underwent a second radiofrequency ablation and only 1 patient had third radiofrequency ablation during the follow up period. Electrical reconnection was found at redo ablation in: 11 left upper PVs, 11 left lower PVs, 8 right upper PVs, and 15 right lower PVs.

Figure 1: Kaplan–Meier estimation of the time to atrial arrhythmia occurrence after ablation in paroxysmal atrial fibrillation patients



Conclusion: Second-generation cryoablation without confirming pulmonary vein isolation using electrical mapping is effective resulting in a freedom from arrhythmia in the majority of patients in the long term. In addition, foregoing electrical mapping results in short procedure times, thus potentially increasing catheter lab capacity. ❑

Oral Abstracts – AF: Clinical

18/The impact of atrial fibrillation on the diagnostic yield of heart failure with reduced ejection fraction by open access echocardiography

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr18

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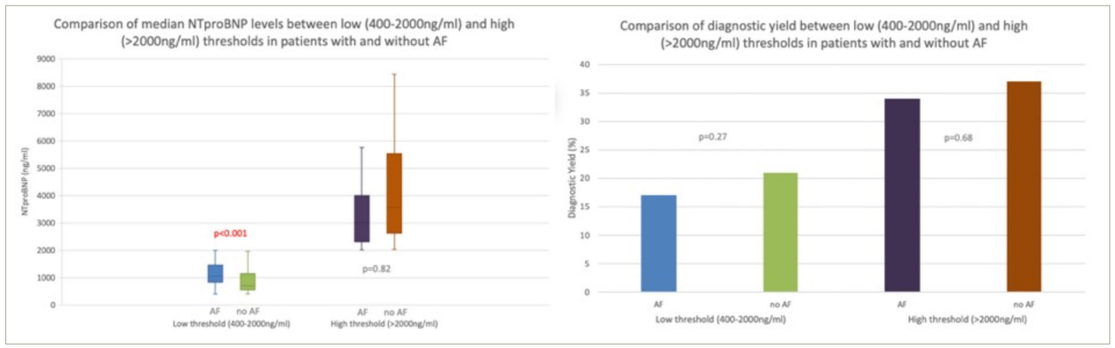
Introduction: Guidelines recommend providing primary care practitioners direct access to echocardiography (echo), prior to specialist cardiology input, in patients whom they suspect have heart failure, based on symptoms and raised N-Terminal pro Brain Natriuretic Peptide (NTproBNP). Early access can lead to increased detection of Heart Failure with a reduced Ejection Fraction (HFrEF). However, it is noted that Atrial Fibrillation (AF) may contribute to falsely raised NTproBNP levels, and this is thought to reduce the diagnostic yield of HFrEF. As a result, some services exclude patients with AF from their direct access pathways. We sought to determine the true burden of AF on the diagnostic yield within our local health economy, to evaluate whether existing Open Access Echocardiography (OAE) pathways should be modified in this group of patients to improve cost-effectiveness.

Methods: The study cohort included all consecutive patients who received an echo via the OAE pathway between January 2017 and September 2019. The cohort was grouped based on NTproBNP levels, pre-referral, into group A (400-2000 ng/L) and B (>2000 ng/L). The diagnostic yield in patients with and without AF in both groups were calculated as the percentage of patients with a positive diagnosis of HFrEF compared to those with a normal ejection fraction (nEF). These were compared using independent sample t-tests for nominal variables and chi-square tests for dichotomous and categorical variables.

Results: Over 32 months, 487 patients met our OAE criteria and received an echo. 164 patients were ≤75 years old and 323 were >75 years old. Median age was 77 years (IQR 72-84) and 48.8% were male. Overall diagnostic yield for HFrEF was 20.4% vs 35.7% in GpA vs GpB patients (p<0.001). In GpA, there were 140 patients with AF and 196 without AF. The median NTproBNP in the two subgroups were 1043 ng/mL (IQR 845-1443) vs 701 ng/mL (IQR 548-1137) (p<0.001), and diagnostic yield was 17% and 21% respectively (p=0.27). In GpB, there were 90 patients with AF and 61 without AF. The median NTproBNP in the two subgroups was 3019 ng/mL (IQR 2323-3986) vs 3567 ng/mL (IQR 2636-5298) (p=0.821), with diagnostic yield returning at 34% vs 37.7% respectively (p=0.68).

Conclusion: Our results demonstrate that very high NTproBNP levels were associated with a significantly higher diagnostic yield for HFrEF with a 15% improvement at the higher threshold. AF was associated with significantly higher NTproBNP levels in patients at the lower threshold but not at the higher threshold, however this did not translate into a clinically meaningful difference in the overall diagnostic yield of HFrEF. Based on our results, raising NTproBNP thresholds for AF patients or excluding them from screening pathways is not recommended. Alternative measures, such as the use of novel biomarkers, may improve the diagnostic yield of HFrEF in patients with modestly elevated NTproBNP. ❑

Figure 1



Oral Abstracts – High Scoring Abstracts

19/Reduction in healthcare utilization associated with the use of ablation index guided pulmonary vein isolation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr19

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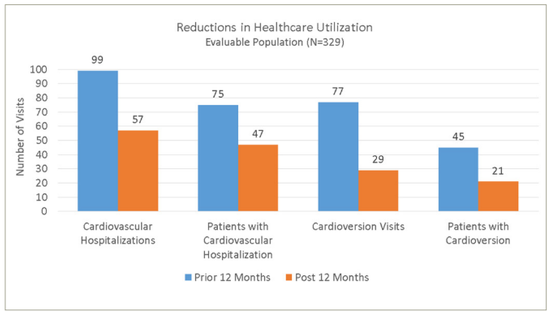
Background: Prior studies have shown that a standardized pulmonary vein isolation (PVI) workflow guided by a single ablation index (AI) value and a maximum interlesion distance (ILD) between corresponding ablation tags is associated with high single-procedure 1-year clinical success. Improvement in 1-year success may translate to lower cardiovascular healthcare utilization.
Purpose: To evaluate the effect of a standardized AI workflow in PAF ablation on cardiovascular healthcare utilization.
Methods: Patients were ablated for PAF in a prospective non-randomized clinical study across 17 European centres. Ablations followed a standard AI workflow (AI targets: 400 posterior, 550 anterior, ILD ≤6 mm) utilizing a contact force catheter, location stability settings of 2-3 mm for 3-5 s, 3 g force, and 25% force over time. Cardioversions and overnight cardiovascular hospitalizations were recorded for the 12-month periods pre- and post-ablation.
Results: A total of 329 patients were eligible and ablated with AI guidance (age 61 ± 10 years, 60.8% male, CHA_2DS_2-VASc 1.6 ± 1.4). Cardiovascular hospitalizations were reduced by 42% (99 to 57, p=0.0015) and cardioversions were reduced by 62% (77 to 29, p<0.0001) after ablation (*Figure*). The 57 post-ablation cardiovascular hospitalizations included 35 repeat ablations in 33 subjects (10%).

Figure 1: Kaplan–Meier estimation of the time to atrial arrhythmia occurrence after ablation in paroxysmal atrial fibrillation patients



Conclusion: A standardized workflow incorporating AI guidance with a maximum ILD for PAF ablation resulted in a substantial reduction in cardiovascular hospitalization in the 12 months following ablation compared to the 12 months prior. ❑

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Heart Rhythm Congress 2020 Abstracts

Oral Abstracts – High Scoring Abstracts

20/Dynamic high-density functional substrate mapping improves outcomes in ventricular tachycardia ablation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr20

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Background: The presence of dynamic substrate changes facilitates functional block and re-entry in ventricular tachycardia (VT) but are rarely studied as part of clinical VT mapping. We aimed to compare outcomes of ablation to dynamic functional substrate against standard institutional protocol.
Methods: Thirty patients (age 67 ± 9 yrs, 27 male) with ischemic cardiomyopathy undergoing clinical VT ablation for symptomatic ATP, symptomatic sustained VT or ICD shocks were enrolled form two UK centres. Mean ejection fraction was 25% (± 10%). Mapping was performed with the Advisor™ HD Grid multipolar catheter. A bipolar voltage map was obtained during sinus rhythm (SR) and RV Sensed Protocol (SP) single extra pacing. SP mapping (*Figure 1A*) involves finding the effective refractory period (ERP) of the single paced RV sensed extra (without a drive train), delivering single sensed extras at 20 ms above RV ERP every 5th beat, templating the morphology of this paced beat, and collecting points that match the template morphology to create a substrate map of this paced beat. SR and SP late potential (LP) and local abnormal ventricular activity (LAVA) maps were made and compared with critical sites for ablation, defined as sites of best entrainment or pace mapping (>96% pacematch), to assess their correlation to these regions. Ablation was then performed to critical sites and LP/LAVA identified by the SP at 50 W for 60 s. The outcomes of SP ablation were then compared to an institutional cohort of 30 patients who underwent historical VT ablation, matched for age and ejection fraction, where ablation was performed by conventional entrainment mapping ± sinus rhythm substrate mapping.
Results: At a median follow up of 12 months 90% of patients were free from symptomatic ATP or ICD shocks vs 60% from the historical institutional VT ablation cohort. *Figure 1B* shows the pre and post-procedure VT burden during SP VT ablation. SP pacing resulted in a larger area of LP identified for ablation 19.3 mm^2 vs 6.4 mm^2 during SR mapping (p=0.001), and SP derived LP displayed greater accuracy for critical regions for VT ablation with a true positive predictive value of 87% and false-positive predictive value of 4%, compared with 78% and 35% respectively in SR (*Figure 1C*). *Figure 1D* shows the Kaplan-Meier curve of the probability of ICD/CRT-D therapy with SP mapping vs standard institutional protocol. Patients were matched for Age (Age: SP vs Institutional: 67.2 ± 9.0 vs 68.5 ± 5.2, p=NS) and EF (EF: SP vs Institutional: 25.0 ± 9.6 vs 24.4 ± 7.8, p=NS), SP VT ablation resulted in a lower probability of VT(log-rank 0.006).

Figure 1:

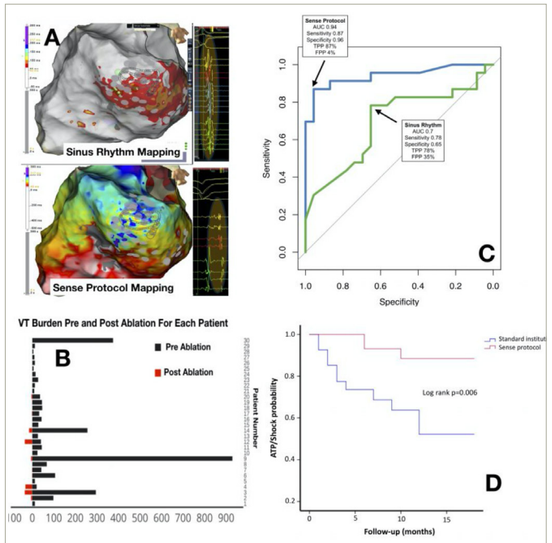

Figure. 1. (A) Colour maps of late potentials/activation. During Sinus rhythm substrate mapping there are no late potentials (LP). During single extra stimuli SP mapping there is unmasking of LP. **(B)** Outcomes from sense protocol mapping, 95% reduction in 12-month ICD therapy. **(C)** Improved sensitivity and specificity from sense protocol mapping to critical regions of the VT circuit defined by entrainment or pacemapping, compared to sinus rhythm mapping. **(D)** Kaplan-Meier curves demonstrating the probability of ICD therapy with institutional protocol vs Sense Protocol.

Conclusion: SP LP/LAVA showed a greater accuracy for critical regions in the VT circuit than sinus rhythm mapping. The combination of ablation to critical sites and SP derived LP/LAVA improved long term outcomes from VT ablation compared to a matched institutional historical cohort of patients who underwent VT ablation. ❑

Oral Abstracts – High Scoring Abstracts

21/Intentional coronary vein exit and carbon dioxide insufflation to facilitate epicardial access for ventricular tachycardia ablation: a multicentre registry

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr21

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Introduction: Access to the epicardial substrate is often required during scar-related ventricular tachycardia (VT) ablation, either as first approach or following a previous endocardial failure. Epicardial ablation is however far from being a widespread technique among electrophysiology labs, due to the intrinsic complications associated with this technique.

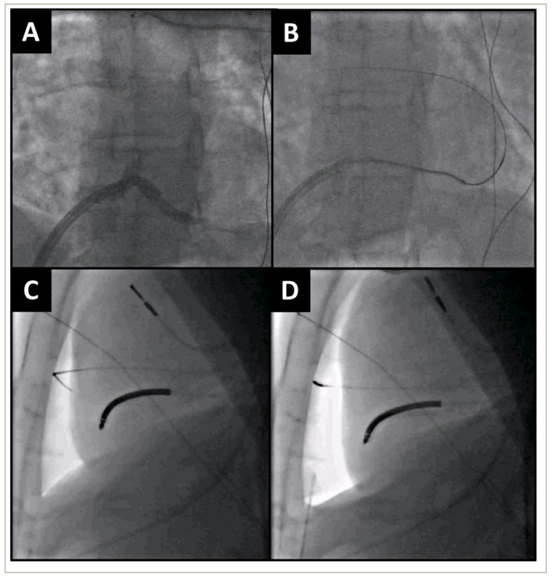
In 2017, we described our initial results using intentional coronary vein exit and carbon dioxide insufflation to facilitate subxiphoid epicardial access for VT ablation. Although this was a single centre experience with a small number of cases, this technique was shown to be feasible and safe. The aim of this multicentre registry was to demonstrate the reproducibility and safety of this approach to assist subxiphoid pericardial puncture in the setting of epicardial mapping and ablation for VT.

Methods: A branch of the coronary sinus (CS) was sub selected using a diagnostic JR4 coronary catheter inside a steerable sheath, via femoral access (*Figure 1A*). Intentional perforation by means of a high tip load 0.014-inch angioplasty wire was then performed at the distal portion of that branch (*Figure 1B*). Either a microcatheter or over-the-wire balloon was then passed over this into the pericardial space, allowing up to 200 ml of pericardial CO_2 insufflation (*Figure 1C*). This allowed direct visualization of the anterior pericardial space and facilitated subxiphoid puncture (*Figure 1D*).

Results: From January 2016 to January 2020, 105 consecutive patients undergoing epicardial access by means of this technique in any of the 16 participant centres were included in the registry. 21 different practitioners have undergone at least one procedure as first operator. Intentional coronary vein exit was achieved in all but 1 patient, whose coronary sinus did not communicate with the right atrium and could not be cannulated. In addition, significant pericardial adhesions were confirmed in 4 patients with previous epicardial ablation and therefore only endocardial ablation was performed.

Significant bleeding (>80 cc) due to intentional coronary vein exit occurred in 5 patients. Two of them had received intravenous heparin prior to perforating the CS branch, whilst in another two the branch had been perforated in a proximal position. No clear cause was identified in the fifth case. Bleeding stopped following administration of protamine in one of the patients who had received heparin, and spontaneously in the remaining cases. There were no other epicardial access complications.

Figure 1:



Conclusion: This multicentre registry confirms that coronary vein exit and carbon dioxide insufflation can be safely and reproducibly achieved to facilitate subxiphoid pericardial access in the setting of mapping and ablation of ventricular tachycardia. Given the excellent safety profile and the extremely short learning curve, this approach could contribute to expand the use of epicardial ablation. ❑

Oral Abstracts – High Scoring Abstracts

22/Catheter ablation of accessory pathways; the influence of anatomical location and requirement for multiple procedures to achieve lasting success

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr22

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Background: Catheter ablation (CA) is the treatment of choice for patients with symptomatic recurrent atrioventricular reciprocating tachycardia, pre-excited atrial fibrillation and for those with asymptomatic pre-excitation with dangerous anterograde accessory pathway (AP) conduction properties.[1] CA has a high acute success rate and low complication rate dependent upon AP location. Success rates at follow up are less good and not as well described.[2]

Aims: To assess procedural success and complication rates, both acutely and at follow-up, for AP ablations and compare the efficacy based upon AP location.

Methods: A retrospective study of consecutive AP ablations performed over 7 years at a single centre. ECGs, procedure reports and follow up clinic letters were reviewed. All cases were included to calculate acute success rate at first CA. Only patients with complete follow-up data were included for long term success.

Results: 240 patients had 268 procedures between August 2012 and July 2019. There were a total of 251 APs. 231 (96%) patients had a single AP, 9 (4%) patients had multiple pathways; 8 patients had 2, 1 had 4. Of the 251 APs 168 (67%) were manifest and 82 (33%) were concealed. Acute procedural success was achieved in 220 (92%) patients. Follow-up data were available for 224 patients. 185/224 (83%) patients had sustained success at their 3-month follow-up. Acute and first follow-up success was higher in left free wall and posteroseptal locations vs antero and mid-septal, right free wall and epicardial locations and those with multiple APs (see *Table 1*). 23 patients had 1 or more redo procedures; acute success at redo was 22/23 (96%). 12 patients declined a further CA after an initial failed procedure and 7 did not have redo for recurrence after initial successful CA. Cumulative success after all procedures at follow up was 202/224 (90%), and 202/205 (99%) in those with multiple CAs. There were 2 major complications (0.7%); 1 complete AV block needing a pacemaker, and 1 death within 30 days of an initially successful ablation for incessant AVRT using a concealed left free wall AP with re-admission to her local hospital again with incessant SVT which caused haemodynamic collapse.

Conclusion: AP ablations have low complication rates but variable success rates dependent upon location. Success rates at first follow up are lower than is often quoted to patients but remain high after multiple procedures. ❑

Table 1.

AP Location	Acute Success	Success at 1st FU	Cumulative Success	Success After Multiple CA
Left free wall (N = 145)	138 (95%)	120/135 (89%)	125/135 (93%)	125/127 (98%)
Right free wall (N = 15)	13 (87%)	8/13 (62%)	11/13 (85%)	11/11 (100%)
Antero and mid septal (N = 20)	18 (90%)	15/19 (79%)	16/19 (84%)	16/16 (100%)
Posteroseptal (N = 35)	33 (94%)	30/33 (91%)	32/33 (97%)	32/32 (100%)
Epicardial (N = 16)	11 (69%)	7/15 (47%)	11/15 (73%)	11/11 (100%)
Multiple (N = 9)	7 (78%)	5/9 (56%)	7/9 (78%)	7/8 (88%)
Total (N = 240)	220 (92%)	185/224 (83%)	202/224 (90%)	202/205 (99%)

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Oral Abstracts – High Scoring Abstracts

23/Effects of obesity on long-term outcomes of catheter ablation in atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr23

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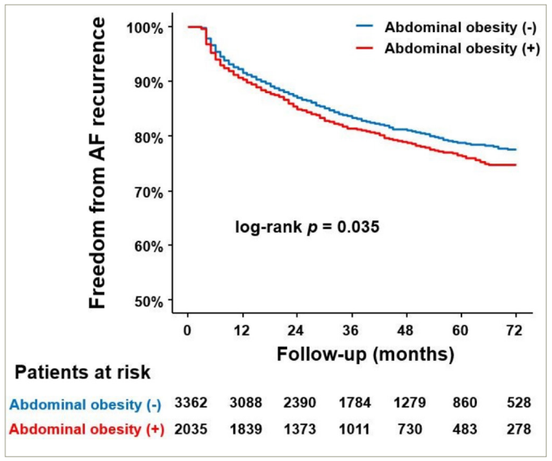
Background: As the best anthropometric surrogate of visceral adiposity, the effects of abdominal obesity on outcomes of catheter ablation in atrial fibrillation (AF) remain poorly investigated. In this study, we evaluate the effects of abdominal obesity on the long-term efficacy and safety of catheter AF ablation.

Methods: We utilised the Korean National Health Insurance cohort database, comprised of every citizen in South Korea, to identify patients who underwent AF ablation between 2006 to 2015. Abdominal obesity was defined as waist circumference ≥90 cm for males and ≥80 cm for females. The primary endpoint was AF recurrence following ablation, and secondary endpoints were cardioversion, repeat AF ablation, ischaemic stroke, intracranial haemorrhage and death. These endpoints were evaluated at 1, 3 and 6 year follow-up. Additionally, safety endpoints of peri-procedural complications were studied.

Results: Of the included 5,397 patients, 1,273 (23.6%) were females and the median age was 58 (IQR 51 - 65) years. Abdominal obesity was present in 2,035 (37.7%) patients who had an increased prevalence of concomitant diseases including chronic kidney disease, chronic obstructive pulmonary disease, diabetes mellitus, heart failure, hypertension, obstructive sleep apnoea, liver disease and peripheral vascular disease. The median CHA_2DS_2-VASc was greater in patients with abdominal obesity compared to those without abdominal obesity (2 [1 - 4] vs 2 [1 - 3], p<0.001). The rate of AF recurrence was not statistically different between the groups at 1-year (10.1 vs 8.7 events/100 PYs, p=0.094), though abdominal obesity was associated with significantly higher rates of AF recurrence at 3-year (7.3 vs 6.4 events/100 PYs, p=0.049) and 6-year (6.1 vs 5.3 events/100 PYs, p=0.019) follow-up. Kaplan-Meier survival analysis demonstrated similar results, with a log-rank p=0.035 (*Figure*). Using multivariable regression analysis, abdominal obesity was found to be an independent predictor for AF recurrence (HR 1.14, 95% CI 1.00 - 1.30, p=0.049), after accounting for other risk factors. Overall complications and length of hospital stay were comparable between both groups. However, there was a trend for reduced pericardial effusion among patients with abdominal obesity (3.6% vs 4.7%, p=0.053), with significantly less cardiac tamponade as a consequence (2.5% vs 3.5%, p=0.049).

Conclusion: Abdominal obesity as indicated by waist circumference was associated with a greater burden of concomitant diseases and an independent risk factor for long-term AF recurrence following catheter ablation but had no effects on total peri-procedural complications. Overall, waist circumference may provide a useful, simple marker for clinical risk stratification to guide clinical-decision making in patients undergoing AF ablation. ❑

Figure: Kaplan-Meier curve for long-term AF recurrence following ablation



Oral Abstracts – Arrhythmia Mechanisms

24/Factors affecting pacing induced left ventricular dysfunction; A retrospective case-control study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr24

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Introduction: Chronic high burden of right ventricular (RV) pacing is well known to cause deleterious effects on the left ventricular (LV) systolic function. However, there is variation in this effect with LV systolic function being maintained in some patients and worsening in others. We investigated characteristics amongst a cohort of patients with RV pacing burden greater than 40% to establish any specific risk factors associated with this effect.

Methods: We retrospectively examined records of 152 consecutive patients with RV pacing > 40% who underwent generator change (GC) or cardiac resynchronisation therapy (CRT) upgrade between July 2016 and July 2019 at Barts Heart Centre. All patients had LV assessment prior to initial pacing procedure and prior to GC or CRT upgrade with echocardiography. Case group included patients who underwent CRT upgrade (81 patients) with LV systolic dysfunction (ejection fraction EF ≤45%) and the controls were patients with preserved LV function who underwent only generator change (71 patients). Patients with underlying cardiomyopathies and complex congenital heart disease were excluded. Within the CRT upgrade group, factors affecting the development of LV systolic dysfunction were examined.

Results: Baseline characteristics are presented in *Table 1*. Primary indication for pacing for both cohorts were similar with principal reason being complete heart block (72%). Median RV pacing % in both cohorts were high, 99% vs 100%. Median time between implant and upgrade or GC were similar (CRT upgrade 8 years vs GC 9 years). Male predominance was significantly higher (p=0.008) in the upgrade cohort compared to the GC cohort. Presence of low pre-implant LV ejection fraction (<55%), history of ischaemic heart disease, presence of atrial fibrillation and chronic kidney disease were more prevalent in upgrade cohort compared to GC cohort (p<0.04). Within the CRT upgrade cohort, the effect of paced QRS duration and age at implant were examined using Spearman's correlation coefficient. There was an inverse correlation between paced QRS duration and LV systolic function prior to upgrade (r= -0.64; p<0.01). A negative correlation was also observed between age at implant and time to diagnosis of LV systolic dysfunction since implant (r= -0.36; p<0.01). There was no statistically significant association between RV lead position (apical vs septum) with paced QRS duration (p=0.58) and LV systolic function (p=0.89).

Table 1: Baseline characteristics between CRT upgrade and generator change cohort

	CRT upgrade group n=81 (%)	GC group n=71 (%)	*P* value
Age	80 (72-86)	84 (73-89)	0.06
Age at implant	73 (63-77)	70 (63-78)	0.86
Gender			0.008
Female	21 (26)	33 (47)	
Male	60 (74)	38 (53)	
Comorbidities			
Diabetes	27 (33)	19 (27)	0.38
Hypertension	43 (53)	41 (58)	0.56
Ischaemic heart disease	34 (42)	12 (17)	0.001
Myocardial infarction prior PPM implant	22 (27)	9 (13)	0.02
Myocardial infarction after PPM implant	12 (15)	3 (4)	0.03
Atrial Fibrillation (AF)	52 (64)	31 (44)	0.01
Valvular heart disease	20 (25)	14 (20)	0.48
Chemotherapy exposure	2 (3)	0 (0)	0.18
Chronic kidney disease	54 (37-74)	65 (48- 83)	0.03
LV systolic function (EF %) at the time of BC	35 (28-39)	58 (56-60)	<0.001
Pre-implant LV function (EF %)			0.04
>55	59 (73)	65 (91)	
51-55	16 (20)	6 (9)	
46-50	6 (7)	0 (0)	
At the time of generator change LV function (EF%)			<0.001
>55	0 (0)	65 (91)	
51-55	0 (0)	6 (9)	
46-50	1 (1)		
41-45	11 (14)	0 (0)	
36-40	18 (22)	0 (0)	
≤ 35	51 (63)	0 (0)	
Indication			
Sicksinus syndrome/tachy brady syndrome	5 (6)	8 (11)	
Mobitz type II (second degree AV block)	7 (8)	3 (4)	
Complete heart block	58 (72)	51 (72)	
Slowly conducted AF	8 (10)	4 (6)	
Congenital complete heart block	0 (0)	3 (4)	
For AV node ablation	3 (4)	2 (3)	

Conclusion: Male gender, pre-implant LV ejection fraction (EF <55%), ischaemic heart disease, atrial fibrillation and chronic kidney disease may be associated with deterioration in LV function in patients who have a high burden of RV pacing. Wider paced QRS duration and age at implant may also be factors which influence development of pacing induced LV dysfunction. Further large prospective randomised studies are needed to determine aetiological factors in these patients. ❑

Oral Abstracts – Arrhythmia Mechanisms

25/His-bundle pacing – are we identifying all eligible patients?

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr25

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Introduction: Pacing-Induced Cardiomyopathy (PICM) can lead to significant morbidity, requiring treatment by device upgrade procedures. The risk of occurrence is directly related to the burden of right ventricular pacing, which can often be reduced by careful device programming. When however frequent ventricular stimulation cannot be avoided, pacing the conduction system may offer an alternative to myocardial pacing and thus reduce the risk of PICM. The most recent international guidelines[1] recommend that His-bundle pacing should be considered among 1) patients with EF 36-50% and expected to require >40% ventricular pacing (Vp>40%) (class IIa); and 2) patients requiring pacing who have block at the level of the AV node (class IIb). This study sought to determine how many patients undergoing bradycardia pacing would have fulfilled those criteria.

Methods: This was a single-centre retrospective study over a 5-year period to the end of April 2020. Demographic and clinical details of patients receiving device implants were obtained from the Pacing Service Database, along with the indication for pacing, electrocardiographic and echocardiographic data. A cardiology consultant with a special interest in pacing reviewed each case with regards to the likelihood of requiring >40% ventricular pacing. Heart block at the level of the AV node was considered present if patients presented with a narrow QRS in conjunction with second or third degree heart block.

Results: A total of 1,265 patients underwent pacemaker implantation for bradycardia during the study period, 890 for conduction system disease (198 with second degree block, 333 with complete heart block), 349 for sinus node disease and 26 for other indication. *Figure 1* shows a flowsheet of those expected to require Vp>40%. In total, 175 patients had a class IIa indication for His-bundle pacing. After excluding those who did not have an echocardiogram, this equates to up to 30% of those with expected Vp>40% and up to 18.6% of the total pacemaker population. Some 237 patients had block at the level of the AV node - 35 of these patients also fulfilled the class IIa criteria for His-bundle pacing; 202 patients (16% of the total) had a sole class IIb indication for His-bundle pacing.

Figure 1. Flowsheet showing indication for pacing and subsequent identification of possible Class IIa indication candidates for His-bundle pacing

RVp – right ventricular pacing, EF – ejection fraction.

Conclusion: Up to 35% of patients receiving pacemaker implantation for bradycardia may be considered for His-bundle pacing. This has significant implications for training and service delivery initially, but likely beneficial health economics in the longer term. ❑

Reference:

1. Kusumoto FM, Schoenfeld MH, Barrett C, et al. 2018 ACC/AHA/HRS Guideline on the evaluation and management of patients with bradycardia and cardiac conduction delay. *J Am Coll Cardiol.* 2019;74:e51–156.

Oral Abstracts – Arrhythmia Mechanisms

26/Body surface potential mapping is no more sensitive than 12-lead ECG for measuring ventricular repolarisation in obese individuals

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr26

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Background: Obesity is associated with pro-arrhythmic electrocardiographic (ECG) abnormalities, such as corrected QT (QTc) prolongation and increased QT dispersion (QTd), which confer a greater risk of ventricular arrhythmia and sudden cardiac death. Few studies have assessed specific measures of repolarisation (T-peak-to-T-end interval (Tpe) or the Tpe/QT, Tpe/QTc, Tpe/JT or Tpe/JTc ratios) in obesity. Owing to greater thoracic coverage, body surface potential mapping (BSPM) may provide greater sensitivity than 12-lead ECG to assess repolarisation abnormalities associated with obesity.

Aims: We aimed to assess differences in measures of ventricular repolarisation and its dispersion between obese and normal-weight individuals using 12-lead ECG. Secondly, we aimed to perform BSPM at rest and during recovery from exercise to assess whether BSPM is more sensitive than 12-lead ECG for detecting differences in ventricular repolarisation between obese and normal-weight individuals.

Methods: 12-lead ECGs from 22 obese (BMI-35.6±6.7) and 44 age-sex matched normal-weight (BMI-22.5±1.6) individuals were analysed. 252-lead BSPM was performed in 6 obese (BMI-39.8±9.1) and 6 age-sex matched normal-weight (BMI-23.8±0.9) individuals at rest and 2 minutes following exercise. QTd was defined as the standard deviation of QT intervals (QTstd).

Results: Obese individuals had significantly prolonged QT (380±25 vs 367±26, p<0.05), QTc (404±24 vs 379±21, p<0.0001) and JTc (304±23 vs 285±22, p<0.001) intervals at rest compared to normal-weight individuals. There were no differences in the JT or Tpe intervals or the Tpe/QT, Tpe/QTc, Tpe/JT and Tpe/JTc ratios between the groups. There were no differences in the QTstd between obese and normal-weight individuals using 12-lead ECG (19±4.3 vs 19±4.2, p>0.05) or 252-lead BSPM (20±5.7 vs 19±3.8, p>0.05). QTc prolongation was no more pronounced following exercise in obese compared to normal-weight individuals.

Conclusion: Obesity is associated with delayed ventricular repolarisation reflected by QTc and JTc interval prolongation. BSPM does not provide greater sensitivity than 12-lead ECG for measuring differences in ventricular repolarisation in obese individuals. Recovery from exercise does not unmask abnormalities of ventricular repolarisation in obese individuals which are not present at rest. ❑

Oral Abstracts – Arrhythmia Mechanisms

27/A comprehensive assessment of atrial arrhythmogenesis in ASD patients

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr27

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Background: Uncorrected atrial septal defects (ASD) are associated with atrial arrhythmias however the bi-atrial arrhythmia substrate, and a result, rhythm management strategies, are ill-defined in this cohort. Timely ASD closure may reduce AA prevalence, but the effect of percutaneous ASD closure on AAs has not been systematically evaluated. We aimed to investigate the effects of percutaneous ASD closure on AA prevalence and further sought to define the arrhythmia substrate in ASD patients with and without AAs, hypothesising that electrical and structural remodelling and ectopic foci would predominate in the right atrium and would be related to age and shunt fraction. Methods: Meta-analysis was performed to determine the effects of percutaneous ASD closure on AA prevalence. Atrial EP studies were undertaken at percutaneous ASD closure with assessment of bi-atrial voltage, effective refractory periods (ERP) and conduction velocity (CV) and their restitution properties. Atrial late gadolinium enhancement cardiac MRI (CMR) was performed prior to ASD closure to quantify bi-atrial fibrosis. Triggers for AF were assessed using an isoprenaline ectopy provocation protocol and through assessment of ambulatory atrial ectopy on Holter monitoring. Comparison was made to non-congenital heart disease PAF patients who underwent the same protocol prior to and during first time ablation.

Results:

Effects of Percutaneous ASD Closure

Meta-analysis of 25 studies demonstrated no reduction in atrial arrhythmia prevalence post percutaneous ASD closure in adult patients (OR 0.855, 95% CI 0.672 to 1.087, P=0.201).

Invasive Electrical Assessment

In 21 ASD and 21 control patients areas of right atrial low voltage (<0.5 mV) and scar (<0.05 mV) were greater in ASD than control patients (P=0.02 and P=0.039) with a greater degree of low voltage and scar in right than the left atrium in ASD patients (P=0.002 and P=0.010, respectively). In both atria steeper ERP (RA; P=0.004, LA; P=0.009) and CV restitution (RA; P≤0.001, LA; P=0.007) was seen in ASD than control patients.

CMR Assessment

36 ASD and 36 control patients underwent bi-atrial CMR imaging. Right and left atrial fibrosis were significantly greater in ASD patients than

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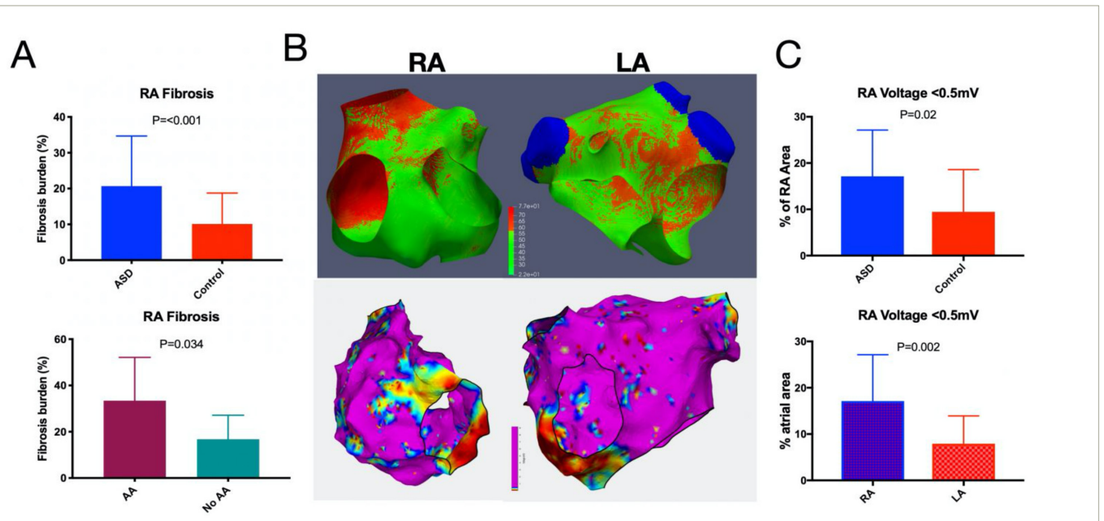
Figure 1



A; RA fibrosis assessed by LGE CMR was greater in ASD vs control patients (top) and was greater in ASD patients with vs without AAs (bottom). **B**: RA and LA maps generated from LGE-CMR imaging (top) and invasive voltage mapping (bottom) in an ASD patient. High signal intensity areas are represented in red on LGE-CMR fibrosis maps and low voltage by coloured (non-pink) areas on voltage maps. **C**: RA low voltage areas were greater in ASD vs controls (top) and in ASD patients the RA was the predominant site of low voltage areas (bottom). RA=right atrium, LA=left atrium, AA= atrial arrhythmia. ASD= atrial septal defect

Oral Abstracts – Arrhythmia Mechanisms

27/A comprehensive assessment of atrial arrhythmogenesis in ASD patients (*continued*)

control patients (P<0.001). Right atrial fibrosis burden was greater in ASD patients with atrial arrhythmias than those without (P=0.034).

Arrhythmia Triggers

During isoprenaline infusion and on non-invasive assessment on Holter monitoring a non-significant trend towards a greater degree of provoked or ambulatory right-atrial ectopy was seen in ASD vs control patients.

Relationship Between Remodelling and Magnitude of Exposure to Shunt

No relationship was seen between the degree of structural and electrical remodelling and patient age or shunt fraction in the ASD group.

Conclusion: Changes of electrical and structural remodelling predominate in the right atrium in ASD patients and are not related to exposure to the shunt. Right atrial fibrosis is associated with AAs and may be of greater relevance to arrhythmogenesis than ectopic triggers suggesting a role for CMR in non-invasive risk assessment in this cohort. Differences in ERP and CV restitution between ASD and control patient may offer additional mechanistic insight into AAs. As percutaneous ASD closure alone is unlikely to be sufficient to treat AAs, strategies of adjunctive ablation at time of closure, including right-sided ablation, in patients with AAs, warrant investigation in a randomised controlled trial. ❑

Oral Abstracts – Arrhythmia Mechanisms

28/Adipose tissue depots demonstrate variation in adipokine profile: a method to investigate the mechanisms underpinning arrhythmogenesis in obesity

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr28

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Introduction: Obesity which is characterised by excess adipose tissue (AT) has been associated with increased risk of arrhythmia. AT functions as an endocrine organ and secretes adipokines which may induce a proarrhythmic substrate. Specifically, epicardial AT (EAT) has been associated with increased arrhythmic risk and a greater proinflammatory adipokine profile than subcutaneous AT (SAT). Culture of rat ventricular slices in EAT- and SAT- conditioned media containing adipokines may identify the mechanisms underpinning adverse electrophysiological remodelling associated with obesity. This requires culture of fresh AT to generate AT-conditioned media. However, the incubation time of AT in culture that yields maximum adipokine secretion, and whether adipokine protein expression varies temporally, remain unknown.

Aims: To determine if there is a temporal variation in adipokine protein expression in human EAT and SAT culture, and thereby identify the incubation time yielding maximal adipokine concentrations. Additionally, to compare adipokine profiles between EAT and SAT.

Methods: Paired samples of EAT and SAT were harvested from eleven patients undergoing elective coronary artery bypass graft or valve repair surgery. Samples were cultured for 24, 48, 72, or 96 hours, and adipokine protein expression in EAT- and SAT-conditioned media were analysed.

Results: 12 pro- and anti-inflammatory adipokines were detected in EAT- and SAT-conditioned media. Expression of monocyte chemoattractant protein-1 (MCP-1) was significantly lower at 96 hours of SAT culture (669 ± 79 arbitrary units, au) compared with 24 hours (2459 ± 2037 au, p=0.0199) and 48 hours (2425 ± 2087 au, p=0.0448). When comparing adipokine profiles between EAT and SAT, resistin expression was significantly higher in EAT vs SAT at 24 hours (EAT: 4386 ± 1565 au vs SAT: 2561 ± 1053 au, p=0.0312). No other significant differences in adipokine expression were observed temporally during culture, or between EAT and SAT.

Conclusion: EAT and SAT exhibited similar pro-inflammatory adipokine profiles in tissue culture over a 96-hour period. However, MCP-1 expression demonstrated temporal variation in SAT culture, and at 24 hours resistin was significantly higher in EAT vs SAT. Our findings suggest EAT and SAT cultured for 24 hours yields maximal adipokine concentrations, that can be utilised for co-culture with rat ventricular slices, to study the effect of AT on pro-arrhythmic myocardial remodelling. ❑

Figure:

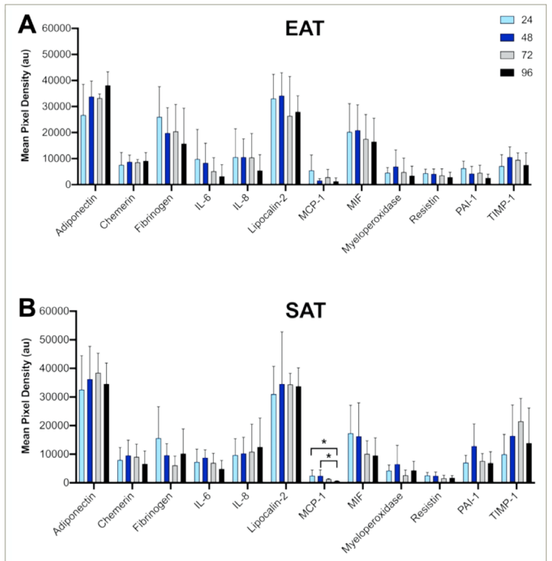

Figure : Temporal variation in the adipokine profiles of non-matched subjects between 24, 48, 72 and 96 hours, for paired samples of EAT (**A**) and SAT (**B**). Levels of 12 pro- and anti-inflammatory adipokines measured with ELISA using human adipokine multi-array kit. Values expressed as mean pixel density (arbitrary units) with SD. Error bars represent SD. 24 hours (light blue, n=6); 48 (dark blue, n=5); 72 (grey, n=4); 96 (black, n=4). IL, Interleukin; MCP-1, Monocyte Chemoattractant Protein-1; MIF, Macrophage Migration Inhibitory Factor; PAI-1, Plasminogen Activator Inhibitor-1; TIMP-1, Tissue Inhibitor of Metalloproteinase-1.
*Indicates p<0.05. Kruskal-Wallis with post-hoc Dunn's test.

Oral Abstracts – Arrhythmia Mechanisms

29/Machine learning can be used to identify cellular uncoupling from the contact electrogram in intact human and porcine hearts

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr29

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Background: Freedom from AF following ablation remains at around 60% even with the addition of electrogram guided procedures alongside pulmonary vein isolation. Gap junctional (GJ) connexin proteins have been established as being deterministic in the development of atrial fibrillation (AF), therefore identifying areas of GJ abnormality (cellular uncoupling) may provide a target to guide ablation strategy. The contact electrogram (EGM) contains electrophysiological information beyond what is currently interpreted clinically. More effective utilisation of subtle changes in EGM morphology caused by cellular uncoupling could lead to improved treatments. The Langendorff system enables EGMs from intact human and porcine hearts to be recorded ex-vivo, where cellular uncoupling can be pharmacologically induced in a controlled manner. We aimed to train a machine learning model that would be capable of identifying the presence of GJ uncoupling in the myocardium from the EGM morphology.

Methods: Unipolar EGMs were recorded on the left atrial and left ventricular epicardium of ex vivo human (n=3) and porcine (n=8) hearts using a Langendorff system and high-density grid catheter (Abbot Medical). All hearts were paced at cycle lengths (CL) between 300-1500ms and administered 1mM carbenoxolone (CBX) via bolus to induce cellular uncoupling. EGM recordings were sequentially mapped at the same sites before and after CBX administration. Nineteen morphological features were extracted from each EGM using automated algorithms. A random forest machine learning algorithm was trained on 80% of the EGMs (n=378132), selected at random by site and CL. Prediction accuracy of classifying between baseline (BL) and CBX recordings was assessed using the remaining unseen 20% of the EGMs (n=94533)

Results: The average prediction accuracy on the validation dataset was found to be 92%, with BL accuracy at 94% and CBX at 88%. Precision was 92% BL, 95% CBX and recall was 96% BL, 81% CBX. Of the features chosen by the machine learning algorithm, the group percentage changes from BL to CBX were RS interval -60.2%, R point Amplitude -5.9%, QS Interval -56.5%, EGM Duration -52.6%, Amplitude +10.0%, QR Interval -49.8%, Q Point Amplitude -23.7%, S Point Amplitude -24.1%, RS Gradient -120%, QR Gradient -5.9%, S-Endpoint Gradient +33.8%, Fractionation Index +60.5%, RS Ratio +10.5%, stimulus to $(-dV/dt)_{max}$ Interval +20.3%.

Conclusion: Machine learning can be used to accurately and automatically detect reduced cellular coupling from the EGM morphology of intact ex vivo hearts. The methodology used enables interpretation of the EGMs beyond the current clinical binary classification of simple/complex or early/late. Using the Langendorff to pharmacologically induce other channelopathies in the ex vivo hearts would enable a machine learning model to be trained, which could predict a more diverse array of abnormalities from the EGMs, that, if translated to the clinic, could be of further benefit to guide ablation procedures. ❑

Oral Abstracts 3 – Devices

30/Implantable cardioverter defibrillator outcomes in patients with hypertrophic cardiomyopathy at a tertiary centre

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr30

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Introduction: Hypertrophic cardiomyopathy (HCM) is the commonest inherited heart disease. Implantable cardioverter defibrillators (ICDs) are routinely implanted to protect against risk of sudden cardiac death (SCD) in those patients (pts) who meet criteria. Whilst the consequence of not having an ICD when needed is clear, the implantation of cardiac devices is not without short and long-term risks to the patient. We sought to report the ICD complication rate in HCM patients and place them in context with the frequency of appropriate therapies delivered.

Methods: We retrospectively assessed consecutive patients who underwent ICD implantation between July 2016 and October 2018 and were coded as hypertrophic cardiomyopathy in the device database (Mediconnect™). HCM diagnosis was confirmed by reviewing implant referral and procedure notes, with only new device implants included. Complications were described according to timing, with acute considered in the same admission and late being post-discharge.

Results: Between July 2016 and October 2018, 136 HCM patients underwent ICD implantation, 127 (93%) for primary prevention of SCD. Over a mean follow-up of 1.9 ± 0.7 years, there were 3 deaths, 2 from cardiac cause (myocardial infarction). 8 pts (5.9%) received appropriate therapies. 7 pts had both an appropriate shock and anti-tachycardic pacing (ATP), and one pt had ATP alone. 6 pts (4.4%) received an inappropriate shock. There were 4 procedural complications (2.9%), including a pericardial effusion / tamponade, torn cephalic vein after difficult access, right atrial lead displacement/loss of function requiring revision, and finally high lead impedance with a new lead required. 6 pts (4.4%) experienced a late complication, including right ventricular lead displacement with loss of function requiring revision (2 pts), atrial lead displacement (2 pts), superficial wound infection requiring antibiotics (1 pts), and high shock impedance at follow-up (1pt). Adverse ICD events (inappropriate shocks and / or device complications) were seen in 16 pts (12%).

Conclusions/implications: Over a short follow-up period, occurrence of appropriate device therapy and adverse event rate was in line with published data, with infection rate extremely low. The occurrence of inappropriate shocks suggests this may be an important potential complication to include in pre-implant discussion with patients. ❑

Oral Abstracts 3 – Devices

31/Long-term adverse sequelae of left ventricular leads in the context of cardiac resynchronisation therapy

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr31

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Background: Cardiac resynchronisation therapy (CRT) confers symptomatic and survival benefits in chronic heart failure with reduced ejection fraction (HFrEF). However, there remains a paucity of data on long-term performance of left ventricular pacing leads, including adverse sequelae.

Methods: Adult patients receiving CRT for HFrEF between 2008 and 2014 were identified retrospectively from an outpatient electronic database at a large tertiary centre (Leeds Teaching Hospitals NHS Trust). Procedural and clinical notes were accessed from individual patient records and used to ascertain post-procedural complications. Acute lead failure was defined as macro-displacement within 24 hours of index procedure. Chronic lead failure was defined as elevated pacing thresholds >24 hours post-procedure due to micro/macro displacement, premature battery depletion, lead failure, lead insulation failure or intractable phrenic nerve stimulation (PNS). Details on device-related infections were also collated.

Results: 280 patients were included, with mean (±SD) age of 74.2 years (±9.0) and 34% (96/280) receiving CRT-D. Median follow-up of patients was 7.6 years (IQR 4-9). Acute lead failure occurred in 0.71% (2/280). Chronic lead failure occurred in 1.79% (5/280). Of these, there were 4 cases of lead macro-displacement, with a median time to dislocation of 45 days, and one case of intractable PNS. Device-related infection occurred in 1.43% (4/280). All cases arose >12 months post-implant, with the identified pathogen *Staphylococcus aureus* in three instances and *Staphylococcus epidermis* in one case. All underwent successful full device explant and subsequent re-implantation.

Conclusions: In the context of CRT, left ventricular pacing leads appear to be associated with low incidence of long-term adverse sequelae over prolonged follow-up. ❑

Oral Abstracts 3 – Devices

32/CRT optimisation: A study comparing nominal versus individualised programming modes

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr32

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Introduction: Not all patients respond favourably to CRT. Electrical programming may improve CRT response, but a universal programming strategy may be ineffective as patient specific factors can influence electrical timing within the heart. Moreover, there is little guidance for CRT programming, hence CRT devices are often left at suboptimal settings.[1] Two emerging technologies, fusion pacing (e.g SyncAV) and multipoint pacing (MPP), have been shown to narrow QRS and give acute benefit. It seems intuitive that combining technologies may augment the benefit but there is little evidence available to support this. This study compared five programming strategies to determine which produced the narrowest QRS.

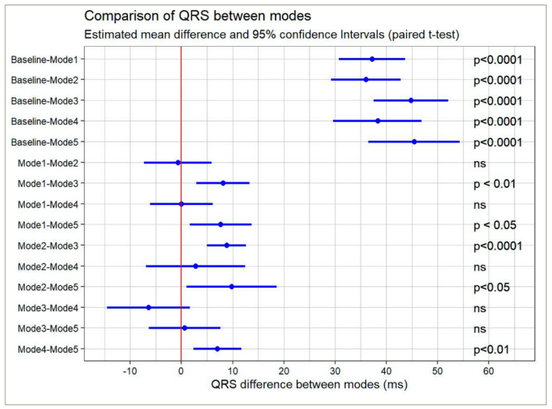
Methods: This was an observational study of current clinical practice at a single study centre. 27 patients (with intact AV conduction) were implanted with an Abbott CRT for standard CRT indications. Baseline QRS duration was measured on the operating table. Immediately following CRT implantation, five different programming strategies were temporarily applied aiming for narrowest QRS:

- Mode 1. Best single point BiV pacing using QuickOpt
- Mode 2. Best single point BiV pacing with nominal SyncAV
- Mode 3. Best single point BiV pacing with individualised SyncAV
- Mode 4. BiV pacing using QuickOpt and MPP
- Mode 5. BiV pacing with MPP and individualised SyncAV

In each case, abbreviated global QRS duration (QRSd) was measured on the device programmer using digital calipers in leads I, II, III, aVF and V5 and 50 mm/sec sweep speed. QRSd was verified by a second independent operator.

Results: Data were collected on 27 patients until suspension of enrolment in March 2020 due to COVID-19. Several significant differences were identified, as shown in the graph below. As expected, all paced modes achieved highly significant reductions in QRSd ($p<0.0001$) compared to baseline. The largest mean reductions in QRSd compared to baseline were obtained with Mode 3 (individualised SyncAV) and Mode 5 (MPP and individualised SyncAV). Mode 3 showed reduction in QRSd when compared to Mode 1 ($p<0.01$) and Mode 2 ($p<0.0001$). Mode 5 also showed significant reduction in QRSd when compared to Modes 1 ($p<0.05$), 2 ($p<0.05$) and 4 ($p<0.01$).

Figure:



Discussion: This study supports the view that individualised CRT programming (Mode 3 and 5) can produce maximal QRS narrowing. These were the only two programming strategies to show significant superiority over best single point BiV pacing (Mode 1). The combination of MPP with individualised SyncAV (Mode 5) was associated with some of the best individual improvements. Clinically, MPP is not suitable for all patients due twitch or myocardial viability, and in this situation, individualised SyncAV (Mode 3) is equally effective in selected patients. From this data, individualised SyncAV appears more influential than MPP, in reducing QRSd but further research is needed in this area. ❑

References

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Oral Abstracts 3 – Devices

33/First UK experience of cardiac contractility modulation therapy in patients with heart failure and reduced ejection fraction

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr33

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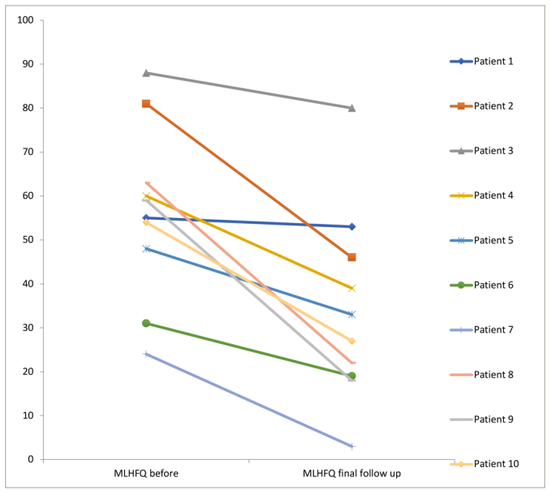
Background: Cardiac Contractility Modulation therapy is a novel device-based technology, which may be used in selected heart failure patients. CCM therapy involves applying biphasic, high-voltage (≈7.5 V) and long-duration (≈20 milliseconds) electric signals to the right ventricular septal wall during the absolute myocardial refractory period, which invokes biochemical and cellular changes in the failing myocardium thus improving contractility. The aim of this study is to report the outcomes in the first ten patients implanted with a CCM device in the United Kingdom.

Methods: This was a retrospective study. 10 patients who met the inclusion criteria (EF 25-45%, NYHA class 3 or 4 and QRS duration less than 130 ms) were implanted with a CCM device in 2018. As part of their follow-up they underwent regular review by the heart failure team. We report the changes in ejection fraction, NYHA class and The Minnesota Living with Heart Failure Questionnaire (MLHFQ) scores over the follow-up period.

Results: The mean age of the patients was 68.3 ± 7.8. Six of the patients were male and the majority of patients (90 %) had an ischaemic cardiomyopathy. The average follow-up in months was 21.30 ± 2.2. Overall, the ejection fraction improved from 26.2% ± 4.4% to 31.8% ± 3.6% at final follow-up ($p=0.40$) and quality of life as measured by the MLHFQ improved significantly from 56.3 ± 19.6 to 34.0 ± 21.8 ($p\leq0.01$). (*Figure 1*) All patients improved at least one NYHA class. Overall, the NYHA class improved from 2.80 ± 0.92 to 1.7 ± 0.68 ($p=0.77$).

Figure 1: MLHFQ change from baseline to final follow up in all patients



Conclusion: CCM therapy resulted in an improvement in ejection fraction and quality of life in this patient cohort, which is consistent with previous clinical trial data. CCM therapy provides a potential new treatment option for these patients who would not be eligible for cardiac resynchronisation therapy. ❑

Oral Abstracts 3 – Devices

34/A retrospective study comparing the clinical outcomes of left vs right sided ventricular pacing in patients undergoing transcatheter aortic valve implantation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr34

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Background: Transcatheter aortic valve implantation (TAVI) is a minimally invasive procedure to treat abnormal narrowing of the aortic valve in non-surgical candidates. Rapid ventricular pacing often facilitates optimal positioning of the TAVI valve. Traditionally, this has been
Methods: The study was a retrospective service evaluation in sequential patients treated before and after the change from routine RV pacing to LV pacing in patients implanted with a variety of valves at Leeds Teaching Hospital NHS Trust (LTHT). Data was collected from all patients clinically eligible for a TAVI procedure between May 2018 and June 2019. Clinical and procedural data were obtained from Trust clinical databases with safety data and clinical outcomes including procedural complications evaluated.
Results: A total of 323 TAVI procedures were performed during this study period. 60 patients were excluded for having a permanent pacemaker in situ (n=57), unsuccessful valve deployment (n=1) and incomplete clinical data (n=2). 263 (81.4%) patients with a mean age of 80 ± 7.2 years were included in the analysis. Patients were grouped according to the pacing technique adopted; 151 patients received LV pacing; 112 patients received RV pacing. Patients were implanted with one of five different valves (Sapien 3, Evolut, Portico, Accurate Neo and Lotus). Procedural characteristics showed a significant reduction in procedure duration for the LV group (63.5 ± 16.78 mins vs 69.4 ± 22.55 mins; p=0.04) and screen time (15.3 ± 6.0 mins vs 18.6 ± 8.19 mins; p≤0.01) compared to the RV group. Effective pacing stimulation was similar in the LV and RV groups (96.7% versus 99.1%; p=0.16%) as was duration of inpatient stay (2.90 ± 2.29 days vs 3.06 ± 2.68 days; p=0.62). Patients undergoing RV pacing were significantly more likely to have the temporary wire left in post procedure (56.3% vs 21.8%; p≤0.01) and required a post procedure permanent pacemaker (PPM) (22.32% vs 12.58%; p=0.04). MACE (major adverse cardiac events) occurred in 13% for the LV group and 14.3% in the RV group (p=0.06). Lastly, conduction abnormalities, namely new third degree AV block, were more frequent in self expanding valves (12%) versus balloon expanding valves (1.9%; p=0.04) as were requirements for post procedural PPM insertion (21% vs 5.8% respectively; p=0.02).
Conclusion: This is the largest reported retrospective study within the UK comparing RV and LV pacing strategies in a real-world unselected population using a range of valve types. LV pacing can successfully achieve consistent pacing, reduced procedure duration and lower radiation screen time when compared with RV pacing. In addition, this study has confirmed the non-inferiority of LV pacing in terms of complication rates as defined by MACE criteria. However, it should be noted that in patients with pre-existing conduction abnormalities, RV pacing and balloon expandable valves should still be utilised due to the increased incidence of new conduction abnormalities and post procedure PPM. ❑

Oral Abstracts 3 – Devices

35/Patient and implant procedure characteristics of the Micra™ transcatheter pacemaker in the United Kingdom: Experience from a real-world registry

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr35

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Introduction: The Micra post-approval registry (PAR) and Micra Acute Performance regional cohort (MAP; conducted in Europe, Middle East, and Africa [EMEA]) are ongoing prospective registries designed to evaluate safety and performance of the Micra transcatheter pacing system in the post-market real-world setting. The patient profile and implant characteristics of patients undergoing Micra implant in the UK were compared with the rest of the EMEA region.
Methods: Patients undergoing Micra implant attempt and enrolled in the Micra PAR or MAP cohorts in the EMEA region were included in the analysis. Baseline characteristics and procedural outcomes were compared between those patients in the UK and the rest of the EMEA region.
Results: In the UK a total of 207 of 1,987 (10.4%) patients underwent Micra implant attempt at 13 centers between September 2015 and January 2020. The Micra device was successfully implanted in 206 of the 207 patients (99.5%), similar to the 99.6% implant success rate in the EMEA region. There were comparable sex distributions with males 68.6% (142) in the UK and 62.2% (1,170) in the EMEA. Patients in the UK tended to be significantly younger than patients from other EMEA countries } (68.3 ± 17.8 vs 76.7 ± 12.8, p<0.001) and age was no bar to implantation with similar ranges (18–95 vs 13–102). UK patients were less likely to have a history of hypertension, diabetes, or renal dysfunction (all p<0.05; *Table*). Similar to the rest of EMEA, the most common primary pacing indication in the UK was bradyarrhythmia with atrial fibrillation; however, syncope was a more common primary pacing indication in the UK (23.3% vs 13.0%). The majority of implants in UK patients (92.8%) required ≤3 deployments (EMEA 92.1%). Average pacing thresholds among UK patients at implant were 0.6 ± 0.4 V at 0.24 ms, comparable to the EMEA pacing thresholds at implant (0.6 ± 0.5 V at 0.24 ms).
Conclusion: Micra patients from the UK were younger, had fewer comorbidities, and differing primary pacing indications than those of patients from the rest of EMEA. Importantly, the Micra transcatheter pacemaker was implanted with a high rate of success among patients from both the UK and the rest of EMEA despite these differences in patient baseline characteristics. ❑

Table:

Subject Characteristics	UNITED KINGDOM (N = 207)	EMEA (N = 1780)	Total (N = 1987)	p-value
HTN	44.9% (93)	62.8% (1118)	60.9% (1211)	<0.001
Diabetes	18.8% (39)	27.3% (486)	26.4% (525)	0.010
Renal Dysfunction	15.9% (33)	23.9% (425)	23.0% (458)	0.011
Dialysis	6.3% (13)	7.4% (132)	7.3% (145)	0.67
Prior CIED	22.2% (46)	17.3% (308)	17.8% (354)	0.08
Condition that precludes the use of TV-PPM	21.3% (44)	30.8% (547)	29.8% (591)	0.005
Pacing Indication	**UNITED KINGDOM (N = 202)**	**EMEA (N = 1777)**	**Total (N = 1979)**	
Bradyarrhythmia with AF	54.0% (109)	58.3% (1036)	57.9% (1145)	<0.001
SN Dysfunction/ AV Block	6.9% (14) / 10.4% (21)	9.3% (165) / 16.7% (297)	9.0% (179)/ 16.1% (318)	
Syncope	23.3% (47)	13.0% (231)	14.0% (278)	

Oral Abstracts 3 – Mapping and Ablation

36/Assessment of the optimal bipolar endocardial voltage cut off for VT substrate characterization

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr36

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Background: Voltage thresholds for ventricular scar definition are based on historic data collected using catheters with widely spaced bipoles. Modern multipolar mapping catheters employ smaller electrodes and interelectrode spacing that theoretically allows for mapping with increased resolution and reduced far-field electrogram (EGM) component. Despite the advancement in technology, historic cutoffs of <0.5 mV for dense scar and 0.5-1.5 mV for scar borderzone continue to be used in contemporary electrophysiology. We aimed to assess the optimal voltage cutoffs for substrate characterization using the HD Grid (Abbott, Inc, USA) multipolar mapping catheter.

Methods: Three patients who underwent VT ablation for implantable cardioverter defibrillator (ICD) shocks, had substrate mapping performed using the HD Grid and pre-procedure cardiac magnetic resonance imaging (CMR). The HD Grid is a multipolar mapping catheter containing 16x1 mm electrodes in a 4x4 grid layout with equal spacing of 3 mm. Bipolar voltage maps were collected using HD wave mapping technology, whereby orthogonal bipolar wavefronts are analysed by the system and the better of the two signals is used to negate the effect of wavefront directionality. Also, the system uses the best duplicate algorithm, whereby the highest amplitude signal in a collected region is displayed on the map. Gadolinium-enhanced CMR data was analysed using the ADAS software (Galgo Medical), which segments the myocardial scar density, and was co-registered with the electroanatomical map on the Precision software platform (Abbott, Inc, USA). Voltages in CMR scar were assessed to characterize the most accurate settings for endocardial scar (*Figure 1A*).

Results: 1,028 voltage points in dense CMR scar were analysed. The median bipolar voltage for regions of dense CMR scar was 0.21 mV (IQR 0.11-0.33). 1,174 voltage points from ADAS scar borderzone were analysed, with a median bipolar voltage of 0.73 (IQR 0.49-1.1). The 80th centile for dense scar was 0.37 mV and for scar borderzone was 1.24 mV. ROC analysis AOC 90% suggested the optimal cutoff for endocardial dense scar was 0.45 mV, (Sensitivity 86%, Specificity 81%) (*Figure 1B*). ROC analysis AOC 91% suggested the optimal cutoff for endocardial scar borderzone was 1.4 mV, (Sensitivity 83%, Specificity 83%).

Conclusion: Ventricular substrate characterization with newer mapping technology, suggests that traditional voltage cutoffs may need revision for delineation of scar characteristics. This has important implications for mapping VT and characterizing channels in order to identify VT circuits. Further analysis involving more patients would help validate these values. ❑

Figure 1:

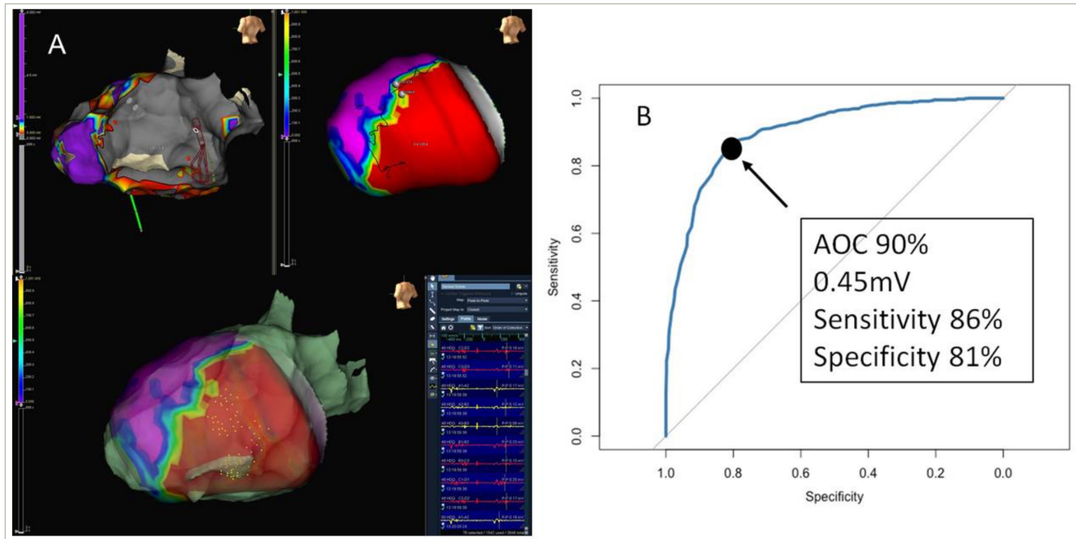

Figure 1. **(A)** Bipolar voltage map 0.4-1.5mV *(upper left)* and segmented CMR for endocardial scar *(upper right)*, were merged *(bottom)* to assess voltage characteristics within CMR scar area. **(B)** Receiver operating characteristic curve suggesting optimal bipolar voltage cutoff for dense scar on CMR.

Oral Abstracts 3 – Mapping and Ablation

37/Procedural complications: Lessons learned from over 5,000 ablations at Barts Heart Centre

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr37

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Introduction: The Barts Heart Centre was established in May 2015. Trends in EP procedural workflow and complications were examined as part of continuous audit.

Methods: Procedural data were extracted from an internal database of all electrophysiology procedures (EP studies and ablations) performed between 1st January 2016 and 1st January 2020. Procedure reports and clinical records were examined for patient parameters, intraprocedural variables, and the incidence of acute and long-term complications.

Results: 23 consultant operators performed 5,514 procedures of which 1,278 (23%) were re-do procedures. Procedural output was as follows: Left atrial ablation (n=2,762, 50%), typical flutter (n=908, 17%), AVNRT/AVRT (n=701, 13%), diagnostic EP study (n=467, 8%), VT (n=422, 8%), AV node (n=252, 4%). There were 159 complications (2.88%) with a non-significant increase in complications over time (2016: 2.42%, 2017: 2.82%, 2018: 3.1%, 2019: 3.32%, p=0.28). The most frequent complications were cardiac tamponade (n=78, 1.4%), vascular access (n=23, 0.4%), phrenic nerve injury (temporary or permanent; n=13, 0.2%) and unintended AV block requiring pacing (n=7, 0.13%). 3 patients (0.05%) died during, or as a result of complications from, the procedure, and a further 6 (0.1%) died in hospital within 30 days of the procedure from congestive cardiac failure. Multivariate logistic regression analysis identified the following significant predictors of complications – patient parameters: age (OR 1.03 (1.01-1.04), p<0.001); ischaemic heart disease (OR 2.37 (1.5-3.7), p<0.001); procedure type: any re-do procedure (OR 1.57 (1.32-2.14), p=0.003); VT ablation (OR 3.97 (2.29-6.87); p<0.001); re-do AF ablation (OR 1.87 (1.13-3.09), p=0.015); and intraprocedural variables: transseptal puncture performed (OR 1.56 (1.04-2.36), p=0.026); epicardial access (OR 2.2 (1.05-4.82) p=0.032); procedure time of over 2 hours (OR 1.46 (1.06-2.03), p=0.022). Emergency presentation (OR 1.03, (0.4-2.68), p=0.95), congenital heart disease (OR 0.66 (0.26-1.70), p=0.37) or zero fluoroscopy use (OR 0.56 (0.29-1.07), p=0.062) were not associated with an increased risk of complications. Variation in complication rates between operators (range 0.81-5.1%) became non-significant when adjusting for procedural complexity and patient demographics.

Conclusions: Ablation complication rates across a broad range of procedures at a high-volume EP centre are low and similar between operators when adjusting for procedural risk. Important predictors of complications have been identified which will be incorporated into future clinical decision making and consent. Prospective validation of a pre-procedural risk score is ongoing. ❑

Oral Abstracts 3 – Mapping and Ablation

38/Atrial signal clarity and rhythm specificity are critical when using artificial intelligence (AI) to distinguish atrial fibrillation (AF) from rhythms that mimic AF

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr38

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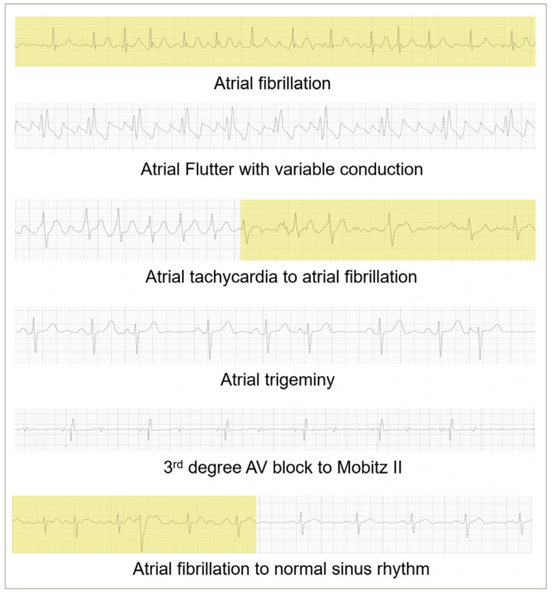
Background: The identification of atrial fibrillation (AF) using artificial intelligence (AI), either with medically prescribed ECG monitors or non-prescription devices such as watches, is not to be taken lightly. Little focus has been placed on the cost, anxiety and potential therapeutic consequences of a false positive diagnosis. The potential value of AI in AF diagnostics is not debated here, but if it is to be used, the ECG used to determine the truth set should be capable of sorting AF from its various mimickers. Many current methods are limited by the duration of the ECG and the fidelity of the P-wave as well as by the validation process details. These limitations can lead to misdiagnosis of other arrhythmias with RR interval variability as AF by the AI engine.
Objective: Our objective was to build an AI to detect AF with better than 90% sensitivity and 90% specificity capable of identifying the onset and offset of episodic AF events, without conflating other atrial (or ventricular) arrhythmias that mimic AF with RR interval variability.
Methods: For this work, we built a convolutional neural network (CNN) that would analyze Carnation Ambulatory Monitor (CAM™) (Bardy Diagnostics, Inc., Seattle, WA) ECG and its associated RR interval data to produce an AF yes/no output for every half-second of ECG data. Training of the CNN was done with CAM ECG recordings from 1,227 patients, 474 with paroxysmal or persistent AF, and 753 without AF. Included in the 753 patients were 148 patients with dense atrial or ventricular ectopy, and both atrial flutter (AFL) and sustained atrial tachycardia (AT) with variable conduction. This distinction is pertinent to the diagnostic and therapeutic medical and procedural management, and stroke risk should these disorders be diagnosed as AF. Our validation was comprised of two-hour excerpts of CAM ECG data chosen at random from 50 AF-positive patients and 50 AF-negative patients (200 hours total). AF was diagnosed if variable p-wave morphology was present for at least 30 seconds. AF presence and duration were confirmed by a team of experienced cardiac electrophysiology clinicians. Disagreements between the three validating electrophysiology clinicians were adjudicated at weekly review meetings.
Results: The AI differentiates AF not only from normal sinus rhythm, but also from other conditions such as atrial ectopy, ventricular ectopy, atrial flutter and atrial tachycardia with variable conduction. Our results were 96.82% sensitive and 99.86% specific with a positive predictivity of 99.79% for detecting 30 seconds of AF or longer.
Conclusions: Our P-wave centric continuous ECG monitoring technology allows our neural network, or AI, to differentiate between AF and a host of rhythms that mimic AF. AI systems that do not make these distinctions may mislead both patients and clinicians. ❑

Figure:



Oral Abstracts 3 – Mapping and Ablation

39/Optimising co-registration of voltage and magnetic resonance imaging derived scar to guide ablation of ventricular arrhythmias in patients with cardiac implantable electronic devices

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr39

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Aims: Scar evaluation by late gadolinium enhancement cardiovascular magnetic resonance (LGE-CMR) can assist ventricular tachycardia (VT) ablation, but co-registration with electro-anatomical maps (EAMs) and imaging artefact from implantable cardioverter defibrillators (ICDs) limit accuracy. We assessed the feasibility of using personalised co-registration algorithms to correlate low-voltage zones (LVZ) with optimised LGE-CMR scar imaging in patients with ICDs.
Methods: 10 patients planned for VT ablation underwent pre-procedural LGE-CMR using wideband imaging. Scar was segmented from CMR pixel signal intensity (PSI) maps using commercial software with new bespoke tools and compared to detailed EAMs. Spatial smoothing was applied to reduce noise in both PSI and voltage maps. Co-registration of EP and imaging derived scar was performed using the aorta as a fiducial marker and the impact of co-registration was determined using a test-retest strategy, and in simulations by shifting and rotating co-registered maps.
Results: PSI localized low-voltage zones (V <1.5 mV) with area under the ROC curve AUC=0.84 (0.80–0.88), sensitivity=79% (74–81%) and specificity=80% (74–85%) and it moderately correlated with bipolar voltage, r=-0.62 (-0.71 – -0.43) [Median (1st–3rd quartile) across patients]. In simulations, small random shifts and rotations significantly worsened LVZ localization in at least some cases, but the use of the full aortic geometry ensured high intra and inter-operator reproducibility of LVZ localization (r >0.86 for AUC). Results for LVZ with V <0.5 mV were similar.
Conclusion: In patients with CIEDs, novel wideband CMR sequences and personalised co-registration strategies can localize LVZ with good accuracy and may assist VT ablation procedures. ❑

Oral Abstracts 3 – Mapping and Ablation

40/Impact of MultiPolAr mapping catheters on long-term outcomes for ventricular tachycardia ablation (IMPACT-VT study)

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr40

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Background: Ventricular Tachycardia (VT) mapping strategies for scar-dependent monomorphic VT have traditionally involved entrainment and pace mapping. The increasing importance of substrate mapping has emerged with several methods described to target the VT site of origin and diastolic conduction channels (CCs), such as, low amplitude ventricular activity (LAVA) potential and decrementing evoked potential (DEEP) mapping. Furthermore, recent state-of-the-art multipolar mapping catheters have been developed to enhance mapping capabilities.

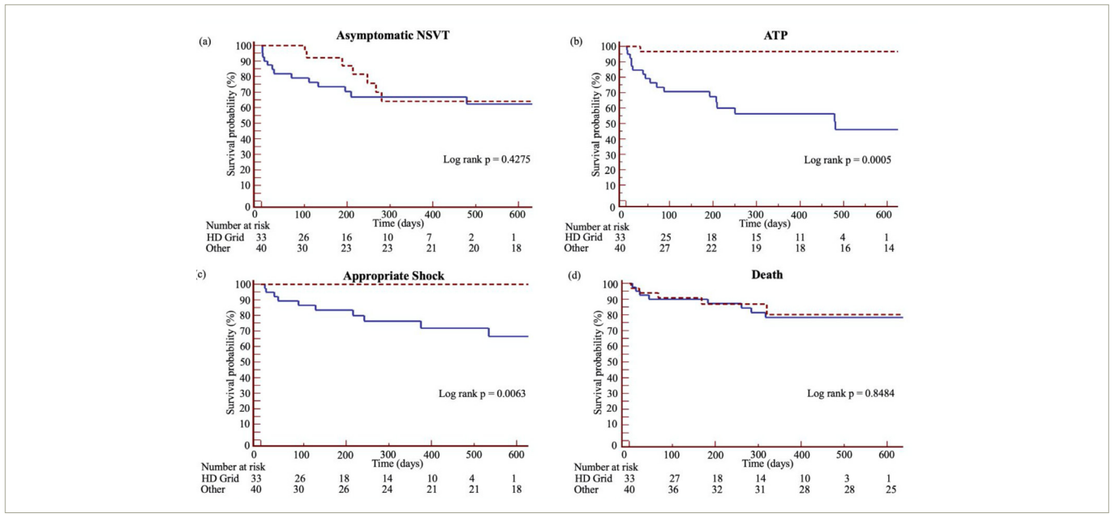
Objective: The purpose of this study was to investigate whether VT ablation long-term outcome was improved with the use of high-density mapping catheters combining complementary mapping strategies into a strict mapping and ablation workflow.

Methods: Structural heart VT ablation patients underwent a strict procedural workflow combining substrate, entrainment, pace mapping and contemporary activation mapping methodologies. Substrate mapping included the identification of CCs with ripple mapping, voltage scanning and DEEP potential mapping. Mapping catheters compared included the HD Grid, Pentaray, Livewire Duodeca and point-by-point RF catheters. Primary endpoints were recurrent ATP, appropriate shock, asymptomatic non-sustained VT (NSVT) or all-cause death and the primary analysis compared long term outcomes in the HD Grid mapping group to all other mapping catheters.

Results: A total of 73 structural heart VT ablation procedures were performed with 33 HD Grid mapping cases and 40 non-HD Grid cases with no significant difference in baseline characteristics. Substrate mapping was performed in 97% (71/73) of cases and activation maps used to guide ablation were successfully generated in 82% of HD Grid cases, 64% of Pentaray cases, 92% Duodeca cases and 33% of RF mapping cases (p=0.025) with a similar trend observed with entrainment and pace mapping (HD Grid 58%; Pentaray 45%, Duodeca 83%, RF 17%; p=0.039). A greater number of VTs were mapped with multipolar catheters and thereafter ablated. Complete elimination of clinical and non-clinical VTs which was achieved in 79% of HD Grid cases, 55% of Pentaray cases, 83% Duodeca and 33% of RF mapping cases (p=0.04). Survival curve analysis showed a significantly higher end-point free survival for both ATP and appropriate shock in the HD Grid group compared to other mapping catheters. With a mean follow-up of 372 ± 234 days, 97% and 100% of HD Grid patients were free of recurrent ATP and shock, respectively, compared to 64% and 82% in the Pentaray group; 58% and 83% in the Duodeca group; 33% and 33% in the RF mapping group.

Conclusions: A wide variety of mapping catheters can be used with an armamentarium of strategies to define VT ablation targets. We have shown a step-wise improvement in survival free from ICD therapies as the density of mapping capability increases. By using high density mapping catheters and combining complementary mapping strategies in a strict procedural workflow, long-term clinical outcomes are improved. ❑

Figure 1:



Oral Abstracts 3 – Mapping and Ablation

41/Power, lesion size index and oesophageal temperature alerts during atrial fibrillation ablation (PiLOT-AF study): a randomised study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr41

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Background: Low radiofrequency (RF) powers are commonly used on the posterior wall of the left atrium (LA) for atrial fibrillation (AF) ablation to prevent oesophageal damage. Compared with higher powers, they require longer ablation durations to achieve a target lesion size index (LSI). Oesophageal heating during ablation is the result of a time-dependent process of conductive heating produced by nearby RF delivery. This randomized study was conducted to compare risk of oesophageal heating and acute procedure success of different LSI-guided ablation protocols combining higher or lower RF power and different target LSI values.

Methods: Eighty consecutive patients were prospectively enrolled and randomised to one of 4 combinations of RF power and target LSI for ablation on the LA posterior wall (20W/LSI 4, 20W/LSI 5, 40W/LSI 4 and 40W/LSI 5). The primary endpoint of the study was the occurrence and number of oesophageal temperature alerts (OTAs) per patient during ablation. Acute indicators of procedure success were considered as secondary end-points. Long term follow-up data were also collected for all patients.

Results: Oesophageal temperature alerts (OTAs) occurred in a similar proportion of patients in all groups (*Figure 1*). Significantly shorter RF durations were required to achieve the target LSI in the 40W groups. Less than 50% of the RF lesions reached the target LSI of 5 when using 20W despite a longer RF duration. A lower rate of first-pass Pulmonary Vein Isolation and a higher rate of acute Pulmonary Vein Reconnection were recorded in the group 20W/LSI 5. A lower AF recurrence rate was observed in the 40W groups compared to the 20W groups at 29 months follow-up (p=0.015; *Figure 2*). An LSI of at least 5 on the LA posterior wall was associated with better long-term outcomes (p=0.004; *Figure 3*).

Conclusions: When guided by LSI, posterior wall ablation with 40W is associated with a similar rate of oesophageal temperature alerts and a lower AF recurrence rate at follow-up if compared to 20W. These data will provide a basis to plan future randomised trials. ❑

Figure 1:

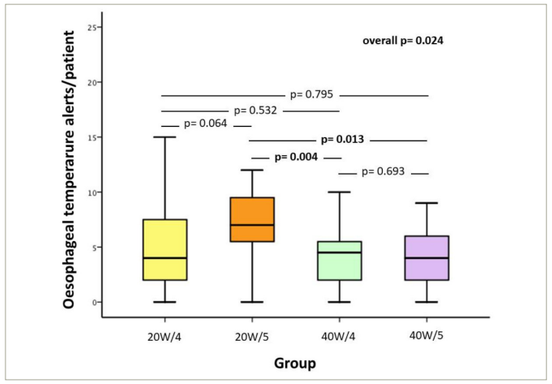


Figure 2:

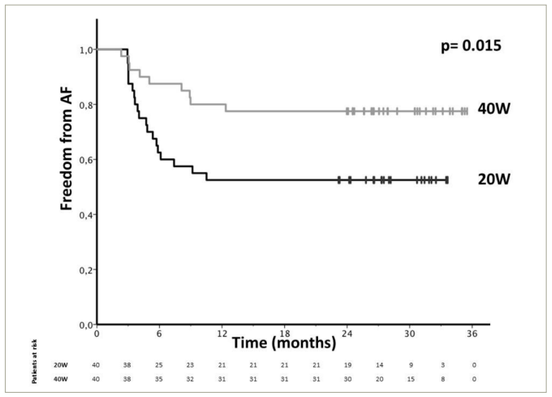
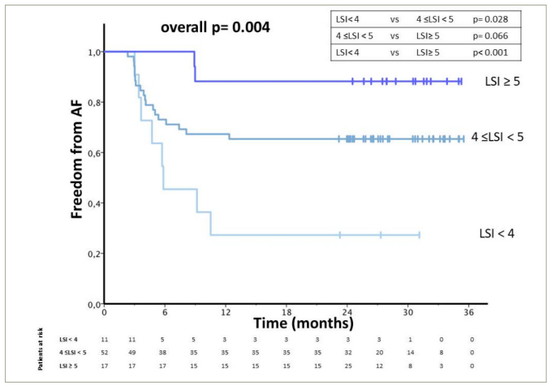


Figure 3:



Best Poster

42/A case control study comparing long term outcomes of devices implanted via femoral vs conventional superior access

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr42

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Background: The conventional route to insert cardiac implantable electronic devices (CIED) is not always possible. Devices implanted via the femoral route (F-CIED) remain an alternative option despite the advent of leadless and subcutaneous devices. However, the long-term outcomes of F-CIED, in particular complex F-CIED (implantable cardioverter defibrillators (ICD) and cardiac resynchronisation therapy (CRT) devices)), are not known. Furthermore, the feasibility and safety of extracting chronic femoral leads has not been reported.

Methods: All patients with F-CIED implanted between 2002-2019 at two high volume tertiary centres were included in the study. A total of 31 F-CIED (10 complex - ICD and CRT - and 21 simple - single and dual chamber pacemakers) were compared 1:3 to 93 matched controls of conventional devices implanted via superior venous access (C-CIED). Complications requiring intervention were classified as early (<30 days) and late (>30 days) following implant.

Results: Early complications were similar between F-CIED and C-CIED (6% vs 5%; p=0.85) and between complex F-CIED and simple F-CIED sub-groups (10% vs 5%; p=0.58). Late complications at 7.5 ± 4.9 years follow-up were higher with F-CIED compared to C-CIED (29% vs 11.6%; p<0.01) and greater with the complex F-CIED subgroup compared to simple F-CIED and complex C-CIED (60% vs 14% vs 7%; p<0.01). Eight of 12 late complications with F-CIED were related to the generator site including six generator erosions, one generator migration and one lead erosion. Eight femoral generators and 14 chronic leads (mean duration in situ 8.1 ± 2.1 years) were extracted without complication.

Conclusion: The early complication rate of F-CIED is similar to devices implanted by the conventional approach but there is an increased risk of late complications, particularly with complex femoral devices. Extraction of chronic femoral leads by expert operators in experienced centres is feasible and safe. ❑

Best Poster

43/Cardiac resynchronisation therapy (CRT) and optimal drug therapy normalises lifespan in octogenarians

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr43

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Background: CRT improves prognosis in selected patients with systolic heart failure (HF). There is a paucity of data regarding longer-term outcomes in octogenarians who receive CRT.

Purpose: To evaluate long-term morbidity, mortality and guideline-based HF treatment in an octogenarian cohort of CRT recipients.

Methods: Retrospective analysis of 30 patients aged ≥80 years old who underwent CRT insertion January 2014 - December 2016 at a district hospital. Mortality was compared to patients <80 years old who underwent CRT implantation during this period (n=71) as well as against the UK national mortality census. HF medication was reviewed over the follow-up period. Hospital admissions and changes in LVEF and NYHA heart failure symptoms were reviewed.

Results: The average age of the octogenarian cohort was 86.3 years old. Over a mean follow-up period of 4.8 years, survival was 63% in the octogenarian group compared to 73% in those aged <80 years (Chi^2 analysis, P=0.319468; no significant difference in survival). The survival data is similar to census data for the general healthy ≥80 years population. 11 patients died; 5 were related to heart ± renal failure (2 were related to HF, 2 cardio-renal failure, 1 end-stage renal failure). Mean time between CRT implant and death in ≥80 years was 3.1 years, compared to 1.93 years in those <80 years. On average, there were 0.58 admissions/patient/year; 26% admissions directly related to cardiac pathology and 17% related to renal pathology. 5% of admissions related to drug titration. Mean number of HF medications increased from 2 to 2.5 post implant. Improvement in LVEF was noted in 67% of patients who had follow up echocardiograms. Modal NYHA class improved from Class III at implantation to Class II post implantation. HF medications prescription was similar to UK national audit data (NICOR, *Table 1*).

Conclusion: Octogenarians, with CRT, have excellent survival over a mean period of 4.8 years alongside improvement in HF symptoms. Post CRT, they tolerate HF medication titration, have low rates of hospitalisation and normalisation of life expectancy. ❑

Table 1: Heart failure treatment post CRT-P insertion with comparison to NICOR data for 2017/18

Drug	% Patients	NICOR data 2017/2018 (%)
Beta blocker	90	89
Mineralocorticoid receptor antagonist	46.7	53
ACE inhibitor / Angiotensin receptor blocker / Angiotensin receptor neprilysin inhibitor	53.3	84
Isosorbide mononitrate	43.3	N/A
Hydralazine	10.0	N/A
Ivabradine	3.3	N/A
≥3 Drugs	53.3	N/A

Best Poster

44/Acute conduction recovery post cardiac surgery in patients with high grade atrioventricular block

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr44

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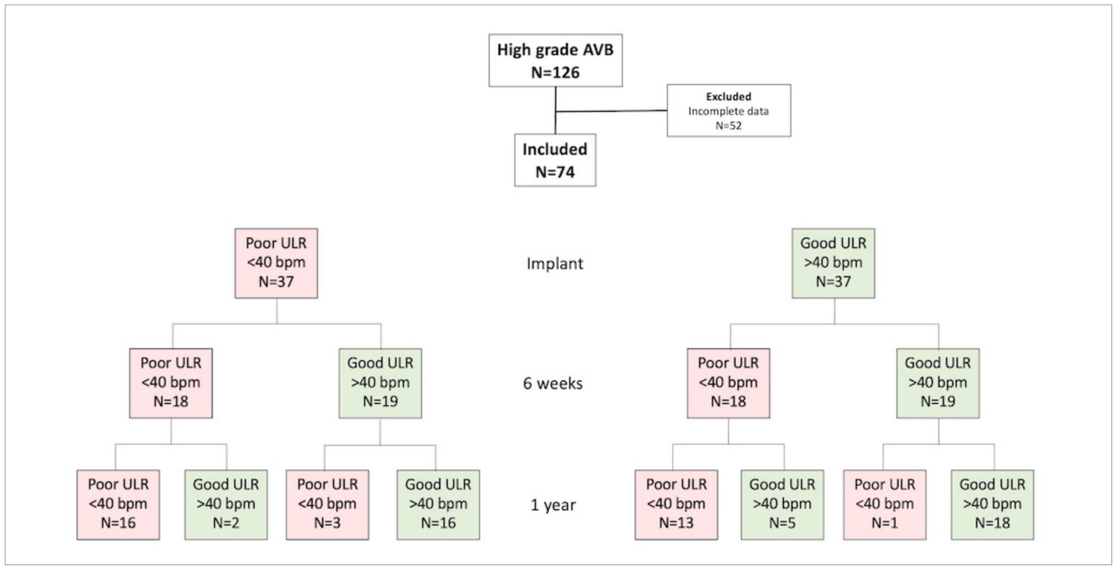
Introduction: Conduction tissue damage during cardiac surgery necessitates permanent pacemaker (PPM) implantation in approximately 4% of patients. Studies have demonstrated late recovery of conduction in 16-42% of patients, but the time course is unknown. It is also unclear whether the presence of an underlying rhythm (ULR) at the time of implant predicts late recovery. We sought to assess the ULR at implant, 6 weeks and 1 year in patients undergoing cardiac device implantation post cardiac surgery and whether ULR at implant and 6 weeks was predictive of late conduction recovery.

Methods: 193 consecutive patients underwent cardiac device implantation post cardiac surgery between August 2015 – December 2018 at Liverpool Heart & Chest Hospital. Data were extracted from hospital administrative records and electronic medical records. The presence of an ULR was recorded at implant, 6 weeks and 1 year follow-up (>40 bpm = good ULR, below 40 bpm = poor ULR). Only patients with high grade atrioventricular block (AVB, defined as complete or second degree non-Mobitz type 1) and complete follow-up data were included. Sensitivity and specificity of ULR at implant and 6 weeks for predicting poor ULR at 1 year were determined. Group differences (good ULR vs poor ULR at 1 year) were assessed using Chi-squared or Mann Whitney tests. P<0.05 was statistically significant.

Results: 74 patients were included (median age 72 years, 62% male, 93% PPM). Reasons for exclusion included non-AVB (n=67) and incomplete data (n=52). Surgery included aortic valve replacement (n=45 [61%]), mitral valve repair or replacement (n=21 [28%]), combined aortic and mitral valve (n=7 [10%]) and coronary artery bypass graft (n=28 [38%], non-exclusive). Median time to implant from surgery was 5 days (lower quartile 7, upper quartile 9). *Figure 1* demonstrates ULR at implant, 6 weeks and 1 year. ULR at 6 weeks was predictive of ULR at 1 year (sensitivity 100%, specificity 89%), whilst ULR at implant was not (sensitivity 33%, specificity 70%). Aortic valve surgery (p=0.001) was significantly associated with poor ULR at 1 year, however age, gender, pre-operative conduction disease and rate limiting medications were not.

Conclusion: The present data suggests that conduction recovery (when present) predominantly occurs early post cardiac surgery. In our cohort of patients, the ULR at 6 weeks post implant was more predictive of late conduction recovery, compared to the ULR at time of implant. Future study is warranted to assess whether programming interventions at 6 weeks may help reduce ventricular pacing requirements in patients with signs of early conduction recovery. ❑

Figure 1. Flow diagram showing the underlying rhythm (ULR) of patients undergoing permanent pacemaker implantation for high grade atrioventricular (AVB) post cardiac surgery at time of implant, 6 weeks and 1 year follow-up



Best Poster

45/Implantable loop recorders rarely alter the management of young patients with presyncope or syncope

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr45

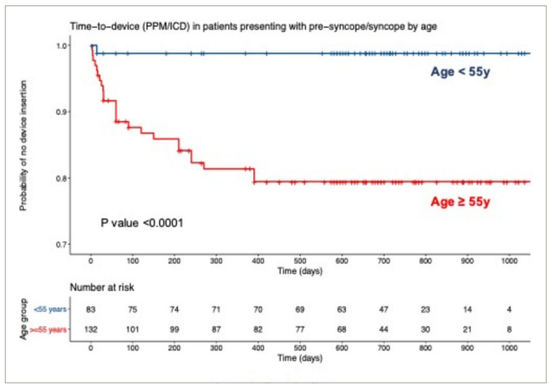
MM Sanghvi (Presenting Author) - Barts Heart Centre, London; DM Jones - Barts Heart Centre, London; C Monkhouse - Barts Heart Centre, London; V Kanthasamy - Barts Heart Centre, London; R Providencia - Barts Heart Centre, London; S Sporton - Barts Heart Centre, London; MJ Earley - Barts Heart Centre, London; M Finlay - Barts Heart Centre, London

Introduction: Implantable Loop Recorder (ILR) procedures are now done by allied health professionals in outpatients; however, it is expensive with a single device costing £3,878. This is in spite of limited evidence regarding the diagnostic utility of ILR so we performed a detailed examination of its performance in the real-world.

Methods: The detailed clinical records of all consecutive individuals who underwent ILR insertion at Barts Heart Centre, London between May 2017 and October 2018 were examined to determine indication for insertion and their clinical outcomes.

Results: There were 325 patients, (54% female; mean age of 59 ± 18). The median follow-up was 575 days (IQR = 323-791). A diagnosis that altered management was made in 86 (26%) patients, at a median time of 90 days (range = 1-775). Indications for ILR implantation were pre-syncope/syncope (64%), palpitations (18%) and AF detection (13%). Only a single patient under the age of 55 who presented with syncope or presyncope underwent a pacemaker implant, this patient had suffered severe injury following syncope, and was diagnosed with sinus pauses on day 14 post-implant. Data concerning PPM/ICD implantation in those undergoing ILR insertion for pre-syncope/syncope by age group are presented in *Figure 1*. No patient undergoing implant for the indication of "palpitations" was implanted with a pacemaker or ICD. The highest diagnostic yield (≈40%) for ILR was in AF detection for patients with cryptogenic stroke.

Figure 1:



Conclusion: Management-altering diagnoses provided by ILR are rare in younger patients, particularly in syncope, presyncope or palpitations. A focus on the medical history, in addition to consumer non-invasive monitoring devices for symptom-arrhythmia correlation, is preferable in younger patients. ❑

Best Poster

46/Transvenous lead extraction in a low volume extraction centre; is cardiac surgery on standby necessary?

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr46

CU Peter (Presenting Author) - Nottingham University Hospitals, Nottingham; M Hall - Nottingham University Hospitals, Nottingham; J Chuen - Nottingham University Hospitals, Nottingham; AD Staniforth - Nottingham University Hospitals, Nottingham; T Robinson - Nottingham University Hospitals, Nottingham

Introduction: The ELECTRa registry indicated lower success rates and higher complication rates in low volume centres performing <30 transvenous lead extractions (TLE) per year. The UK lead extraction group met in 2018 to produce standards for lead extraction classifying procedures as low, medium or high risk. It recommended having a cardiac surgical team present for high risk cases and advised that high quality centres should have a successful lead extraction rate of >94%, procedural mortality rate of <0.8% and major complication rate of <1.7%. We present our TLE success and complication rates; overall, and according to procedural risk.

Methods: All TLE cases performed Nottingham University Hospitals from October 2010 (when our current electronic recording system was implemented) to March 2020 were audited with respect to patient and lead characteristics, indication, procedural details and outcomes. Cases were classified as "low", "medium" and "high" risk according to the UK lead extractors consensus document.

Results: 139 TLE procedures were performed over 9.25 years (15 cases per annum) by 3 operators. Baseline characteristics: male 113 (81%); mean age 62 ± 17 years; BMI 24.8 ± 5.6 Kg/m^2; severe left ventricular impairment 34 (24%); diabetic 20 (14%); cerebrovascular disease 11 (8%). Indication for extraction were non-infectious in 51 (37%); device erosion/pocket infection in 49 (35%) and systemic infection in 39 (28%). 260 leads were attempted, range 1–4, mean 1.87 per case. See *Table 1* for lead and device characteristics. 47.5% of cases were classified as high risk, 45.3% medium risk and 7.2% low risk. Simple traction alone was used in 17 patients (12.2%), locking stylets in 26 (18.7%), mechanical sheaths in 78 (56.1%) and snares in 18 (12.9%). Overall clinical success rate was 97.8% (complete removal in 88.5%, fragment left in 9.4%), major complication rate 2.9%, minor complication rate 10.8%. There were 4 major complications – 3 cardiac tamponades (2 needing pericardiocentesis, 1 emergency sternotomy) and 1 failure to extract requiring semi-elective surgical input. There were no peri-procedural deaths. 7 patients died within 30 days of TLE; 6 of whom had TLE for systemic infection (relative risk 15.4, p=0.002). Major complication rates increased according to procedural risk group (0% low, 1.6% medium, 4.5% high) but success rate did not differ significantly (100% low, 98% medium, 97% high).

Table 1. Lead and device characteristics

Leads, *N* (%)	260
Active fixation	156 (60)
Passive Fixation	104 (40)
Mean lead dwell time ± SD, *months*	88.4 ± 17.5
Range, *months*	4 - 332
Pacemakers, N (%)	69 (49.6)
Single chamber / Dual chamber / Biventricular	13 / 52 / 4
Implantable cardioverter defibrillators, *N* (%)	70 (50.4)
Single chamber / Dual chamber / Biventricular	32 / 17 / 21
Dual coil	33

Conclusion: Nottingham University Hospitals is a low volume TLE centre. Despite this, our clinical success rate is higher than the expected standard (98 vs 94%). Our rate of major complications is higher than the expected standard (2.9 vs 1.7%) and may be a reflection of the large proportion of high-risk cases undertaken. Of our 66 high risk patients only 1 required an emergency sternotomy raising the question whether cardiac surgical team presence for all high-risk cases is an appropriate use of resources. ❑

Best Poster

47/Reduced radiation exposure in accessory pathway ablations guided by electro-anatomical mapping: a single centre experience

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr47

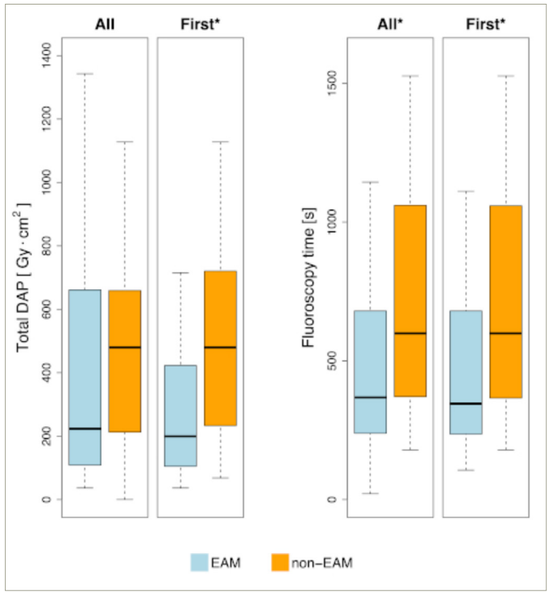
SK Musiol (Presenting Author) - Bristol Heart Institute, Bristol; K Mansfield - Bristol Heart Institute, Bristol; K Maciver - Bristol Heart Institute, Bristol; R Marriott - Bristol Heart Institute, Bristol; P Barman - Bristol Heart Institute, Bristol

Introduction: Catheter ablation is the treatment of choice for accessory pathways (APs). Currently, it is unclear whether the use of electro-anatomical mapping (EAM) systems results in better outcomes of radiofrequency (RF) AP ablations. To help answer this question we present a retrospective observational analysis of a modern single centre cohort.

Methods: Clinical and electrophysiological data were extracted from patient records for all AP ablations performed in our centre between May 2018 and December 2019. Outcome data were compared between EAM and non-EAM cases. Continuous variables are given as median [interquartile range]. Group comparisons were performed using the Mann-Whitney U test (continuous variables) or Fisher's exact test (categorical variables).

Results: A total of 82 patients underwent 85 RF ablation procedures (66 first and 19 repeat). EAM was used in 57 cases while 28 were in the non-EAM group. The median age was 35 [26–47], 27 patients were female, 5 had congenital heart disease, 15 had co-existing atrial fibrillation, 38 had a documented tachyarrhythmia, and 58 had manifest pre-excitation on ECG. The presenting symptoms were palpitations in 69 patients, syncope in 6, cardiac arrest in 2, others in 4, and 4 cases were diagnosed incidentally. Pathway location was left in 41, right in 11, and septal in 33. The success rate was 95% (81/85) acutely, and 91% (77/85) at 3 months. The re-do rate was 7% (6/85), and the overall significant complication rate was 4% (3/85): 1 tamponade, 1 myocardial infarction, and 1 vascular access complication (haematoma not requiring any intervention). There were no statistically significant differences in terms of these outcomes between EAM and non-EAM cases. Fluoroscopy time was shorter in EAM cases (368.0 s [239.0–680.0] vs 599.0 s [371.0–1060.5], p<0.01), but the difference in dose area product (DAP) did not reach statistical significance (223.1 Gy·cm^2 [109.2–646.9] vs 479.7 Gy·cm^2 [213.0–659.3], p=0.15). Procedure time was longer in EAM cases (158.0 min [126.0–180.0] vs 123.0 min [112.5–147.5], p<0.01). Among first procedures there was a statistically significant difference in fluoroscopy time (345.5 s [236.2–663.8] vs 599.0 s [366.0–1059.0], p<0.01) and DAP (199.3 Gy·cm^2 [105.1–423.0] vs 479.7 Gy·cm^2 [233.1–720.6], p=0.02) and no significant difference in procedure time (144.0 min [121.5–168.5] vs 123.0 min [112.0–146.0], p=0.06) in EAM vs non-EAM cases respectively.

Figure 1: Procedure parameters for EAM vs non-EAM cases for all, as well as first procedures only. Extreme outliers were omitted for clarity but included in analysis



Conclusions: EAM use correlates with reduced radiation exposure in patients undergoing AP ablation with at most a modest increase in procedure time and no difference in clinical outcomes. The reduction is particularly pronounced in first procedures. This finding provides an argument for more liberal use of EAM, as well as a rationale for further research. ❑

Posters

48/The 1st shock efficacy of the recommended Zoll protocol for cardioverting atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr48

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Our trust recently replaced our defibrillators with the Zoll R Series Plus. This has a rectilinear biphasic waveform. Compared with traditional energies used with monophasic waveforms, the Zoll literature recommends lower energies for synchronised DC cardioversion of arrhythmias, starting at 75J (75J, 120J, 150J, 200J), based upon the results of clinical trials; the recommendations are to use 120J if the BMI is significantly elevated. When we switched across to the new defibrillators using the recommended protocol, we noticed a lack of first shock efficacy, and sought to compare the efficacy of the recommended protocol with a simpler protocol of up to 3 200J synchronised shocks using the same device by undertaking a service evaluation.

18 consecutive patients who underwent DCCV of atrial fibrillation using the Zoll Protocol (75J or 120J initial shock) were compared with 18 consecutive patients using the New Protocol (200J initial shock).

The demographics were as per Table 1. Patients undergoing the New Protocol were significantly more likely to have had more than one previous cardioversion, but otherwise the groups were well matched. 16 patients started at 75J in the Zoll Protocol group and 2 at 120J. Overall, 17/18 had a successful cardioversion using the Zoll Protocol and 18/18 had a successful cardioversion using the New Protocol (p=ns). There were on average 2.0 shocks per patient in the Zoll Protocol group (36 in total) vs 1.2 shocks per patient in the New Protocol group (21 in total). The first shock efficacy was significantly lower in the Zoll Protocol group (8/18 vs 16/18, p=0.005, *Table 1*). There were no safety issues

Table 1

	Zoll Protocol	New Protocol	p
Number	18	18	1.0
Age (± SD, years)	66.7 ± 7.8	62.1 ± 7.6	0.20
Sex (no. of men)	13	13	1.0
Body Mass Index (± SD, Kg/m^2)	29.0 ± 5.2	29.3 ± 7.0	0.87
Left Ventricular Function			
Normal	6	11	
Mild-moderate impairment	4	4	
Severely impaired	8	3	0.15
Left atrial size (± SD, mm)	44.8 ± 10.8	45.4 ± 26.2	0.94
1st cardioversion	15	7	0.006
Average duration of AF (± SD, days)	100.4 ± 61.5	83.4 ± 42.6	0.34
Previous ablations (n, %)	1 (5.6%)	3 (16.7%)	0.29
On amiodarone? (n, %)	7 (38.9%)	7 (38.9%)	1.0
1st shock successful? (n, %)	8 (44.4%)	16 (88.9%)	0.005

In conclusion, using a higher initial starting energy rather than the recommended settings reduces the number of shocks delivered to patients to achieve cardioversion, and made running a cardioversion list more efficient. No safety issues were encountered. ❑

Posters

49/Thromboprophylaxis in elderly atrial fibrillation patients with recent thromboembolism and at high bleeding risk: a report from the ChiOTEAF Registry

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr49

Y Guo (Presenting Author) - Medical School of Chinese PLA, Department of Cardiology, Chinese PLA General Hospital, Beijing, China; Liverpool Centre for Cardiovascular Sciences, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool, United Kingdom; Y Wang - Chinese PLA General Hospital, Beijing; GYH Lip - Medical School of Chinese PLA, Department of Cardiology, Chinese PLA General; Hospital, Beijing, China; Liverpool Centre for Cardiovascular Sciences, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool, United Kingdom; Aalborg Thrombosis Research Unit, Department of Clinical Medicine, Aalborg University, Aalborg, Denmark

Background: Elderly patients with atrial fibrillation (AF) may present with acute thromboembolic events, often in combination with high bleeding risk. There are limited data on such high-risk patients from China, as well as the benefits and harms of oral anticoagulants (OAC).

Objective: To investigate the impacts on death, thromboembolism (TE), and acute coronary artery syndrome (ACS) of different antithrombotic treatment strategies in elderly patients with AF with recent acute thromboembolism and at high risk for bleeding.

Methods: Chinese Optimal Thrombophylaxis in the Elderly patients with Atrial Fibrillation (ChiOTEAF Registry) was a prospectively, real-world registry from 44 research centres across China between Oct 2014 to Dec 2018. A Cox proportional hazard model analysis was performed for the outcomes related to antithrombotic therapy.

Results: There were 1141 patients (mean age 77 (SD 9) years; 42.3% female) presenting with acute thromboembolism (521 ischaemic stroke, 86 systemic thromboembolism, 664 ACS; of these, 1018 sustained single TE, 116 dual TE events, and 7 triple TE) at enrolment, with follow-up (mean ± SD) of 369 (54) days. CHA2DS2-VASc and HAS-BLED scores (mean ± SD) were 4.5 ± 1.6, and 2.8 ± 1.1 in this population, respectively. Among these, there were 786 (68.9%) AF patients with bleeding events or receiving invasive procedure/ surgery during hospitalization. During one-year follow-up, there were 57 (5.0%) deaths, 31 (2.7%) thromboembolism, and 14 (1.2%) ACS, while there were 4 (0.4%) intracranial haemorrhage and 15 (1.3%) extracranial haemorrhage. The usage (n, %) of oral anticoagulants (OACs), parenteral anticoagulant, and antiplatelet at discharge were 434 (38.0%), 80 (7.0%), and 707 (62.0%), respectively. After adjusting for age, gender, heart failure, hypertension, diabetes mellitus, prior myocardial infarction, chronic renal dysfunction, liver dysfunction, OACs at discharge reduced the risk for all-cause death, thromboembolism, and ACS (hazard ratio, HR, 95% confidence interval, CI) for the whole cohort (HR, 95% CI, 0.43, 0.19-0.95, p=0.04 on warfarin; 0.42, 0.20-0.87, p=0.02 on non-vitamin K antagonist OACs, NOAC, respectively). Subgroup analyses showed that the decreased risks for all-cause death, thromboembolism, and ACS of OACs were in AF patients with acute ischaemic stroke (all p<0.05), but not in AF patients with ACS. For AF patients with bleeding events, or receiving invasive procedure/surgery during hospitalization, NOAC at discharge decreased the risk for all-cause death, thromboembolism, and ACS (HR, 95% CI, 0.28, 0.10-0.78, p= 0.01).

Conclusion: Elderly atrial fibrillation patients with recent thromboembolism and at high bleeding risk derive benefits from OACs at discharge, especially amongst those with recent ischaemic stroke and with NOAC use. ❑

Figure.

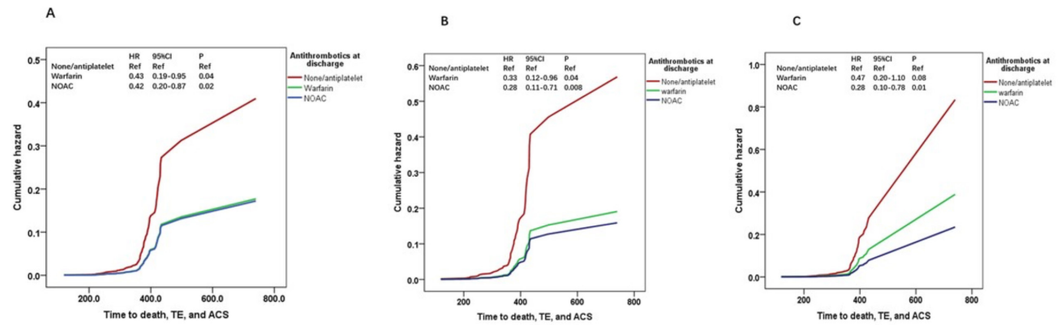


Figure Hazard ratios of anticoagulants for the composite endpoints of death, TE, and ACS.
1 AF patients with acute TE at admission (n=1141). 1 AF patients with acute stroke at admission (n=521). 1 AF patients with acute TE, bleeding events, or receiving invasive procedure/surgery during hospitalization (n=786)

Posters

50/Major adverse cardiovascular events with renal failure in atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr50

WY Ding (Presenting Author) - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool; GYH Lip - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool; D Pastori - Department of Clinical, Internal Medicine, Anesthesiologic and Cardiovascular Sciences, Sapienza University of Rome, Rome; A Shantsila - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool

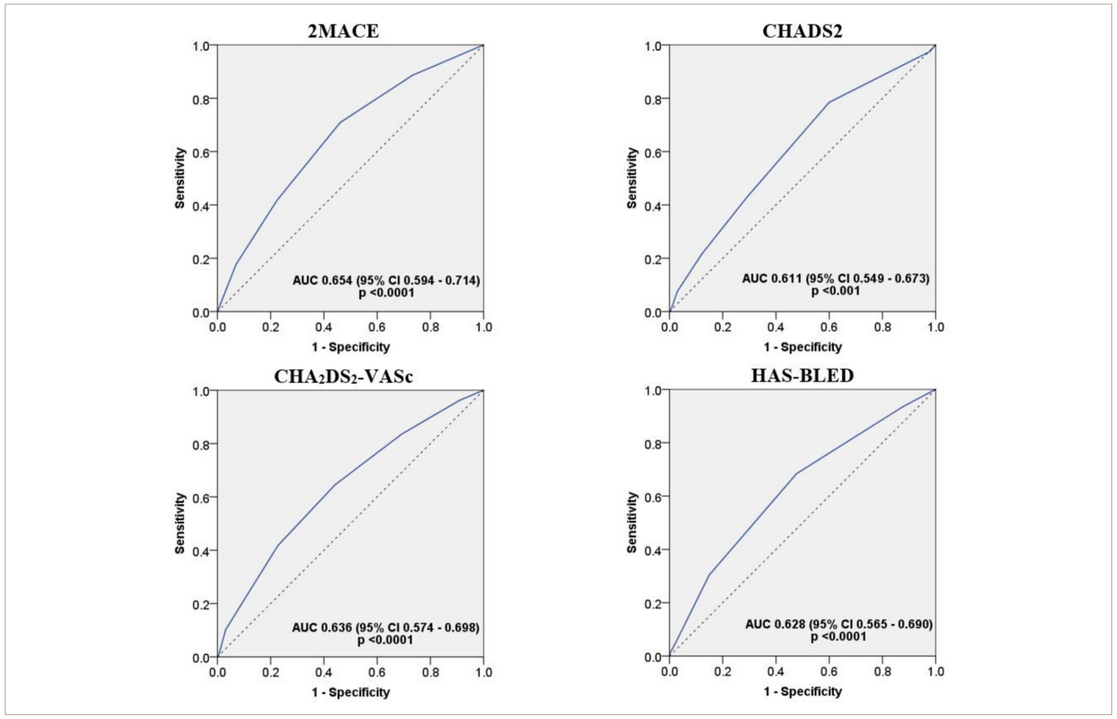
Background: Atrial fibrillation (AF) and chronic kidney disease (CKD) are closely related conditions that are both associated with a significant increase in major adverse cardiovascular events (MACE). The objectives of this study were to evaluate the impact of CKD on MACE in patients with AF and the predictive value of the 2MACE score.

Methods: We performed a post-hoc analysis of the AMADEUS trial. Chronic kidney disease was defined as an eGFR <60 ml/min/1.73 m^2 (based on the Chronic Kidney Disease Epidemiology Collaboration equation). The primary endpoint was MACE (composite of myocardial infarction, cardiac revascularisation and cardiovascular mortality). Secondary endpoints included the composite of stroke, major bleeding and non-cardiovascular mortality, and each of the aforementioned outcomes separately. The 2MACE score was determined by assigning 2 points for metabolic syndrome and age ≥75 years, and 1 point for previous myocardial infarction or cardiac revascularization, ejection fraction <40% and prior thromboembolism.

Results: Of the 4,554 patients, 1,526 (33.5%) were females and the median age was 71 (IQR 64 - 77) years. There were 3,838 (84.3%) non-CKD and 716 (15.7%) CKD patients. The latter group had a higher prevalence of hypertension and diabetes mellitus ($p < 0.001$). After a median (IQR) follow-up of 346 (185 - 457) days, there were 79 (1.7%) MACE which occurred at a rate of 1.94% per 100 patient-years. The incidences of cardiovascular and non-cardiovascular mortality were 1.41% and 2.44% per 100 patient-years, respectively. There were no significant differences in the crude primary or secondary study endpoints between the groups ($p > 0.05$). Multivariable regression analysis found no association between CKD and MACE (HR 1.03 [95% CI 0.45 - 2.34]). The c-index of the 2MACE score for predicting MACE was 0.65 (95% CI 0.59 - 0.71, $p < 0.001$). Overall, the 2MACE score performed better than the CHA_2DS_2-VASc, CHADS2 and HAS-BLED scores in this regard (*Figure*). However, in the presence of CKD, each additional point of the 2MACE score contributed to a greater risk of MACE compared to the non-CKD group (HR 3.17 [95% CI 1.28 - 7.85] vs 1.48 [95% CI 1.17 - 1.87]).

Conclusion: The 2MACE score may be a useful tool for clinical risk stratification of high-risk AF patients with CKD. Those at high MACE risk could be targeted for more intensive cardiovascular prevention strategies. The presence of CKD was not found to be independently associated with MACE in AF patients. ❑

Figure. Receiver-operating characteristic curves comparison for MACE (composite of myocardial infarction, cardiac revascularisation and cardiovascular mortality) with the 2MACE, CHA_2DS_2-VASc, CHADS2 and HAS-BLED scores



Posters

51/Incidence and outcomes of iatrogenic pneumothorax secondary to cardiac pacemaker implantation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr51

AJ Bull (Presenting Author) - Liverpool Heart and Chest, Liverpool; F Frost - Liverpool Heart and Chest, Liverpool; D Nazareth - Liverpool Heart and Chest, Liverpool; D J Wright - Liverpool Heart and Chest, Liverpool

Background: Pneumothorax is an important early complication of cardiac pacemaker implantation however little is known about the modern incidence and outcomes. Current guidelines do not distinguish between causes of iatrogenic pneumothorax and so procedure specific data is needed to help guide cardiologists and respiratory clinicians alike.

Method: Retrospective analysis of patients who developed a pneumothorax as a result of cardiac pacing from January 2015 to September 2019 was undertaken. Cases were identified from data linkage of the cardiac devices database and pneumothorax medical code. Clinical and procedural characteristics were recorded and outcomes of interest included incidence of pneumothorax and subsequent management outcomes.

Results: During the study period, 6643 cardiac devices were implanted at our large tertiary cardiothoracic centre. Pneumothorax occurred in 43/6643 (0.65%). Those suffering from pneumothorax had an average age of 74.2 years, 24/43 (56%) were male, 9/43 (20.9%) had previously known lung disease. Vascular access was obtained via subclavian vein 25/43, axillary 16/43, cephalic 1/43, revision 1/43. Of the devices inserted 18/43 were pacemakers, 12/43 CRT, 13/43 were ICD. First operator was a consultant in 20/43 cases and registrar or fellow in 23/43. Conservative management was adopted in 34/43 (79.1%), with chest drain inserted in the remainder. Only 8 patients managed conservatively required subsequent pleural intervention, giving a success rate of 76.5% for primary conservative management. Mean ±SD length of stay was 3.9±6.7 for primary conservative management and 7.1±6.1 for primary chest drain insertion. The respiratory specialists (5/9) or thoracic surgical specialists (4/9) inserted all chest drains where that was opted as the primary management strategy. For those managed initially conservatively the cardiologists managed this alone 9/34, advise was sought from the thoracic surgical specialists 2/34, telephone advice from the respiratory specialists 7/34 and respiratory specialist review 16/34. Respiratory specialists were involved with all 8 patients initially managed conservatively who subsequently went on to have a chest drain inserted.

Discussion: Pneumothorax incidence is rare but not negligible following cardiac pacemaker implantation. The majority of cases can be safely managed with conservative management. Where chest drain insertion is indicated, specialist advice from respiratory or thoracic surgical team should be obtained. ❑

Posters

52/First-in-man use of fusion-based multisite left ventricular pacing utilising a leadless endocardial cardiac resynchronisation therapy system (WISE-CRT)

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr52

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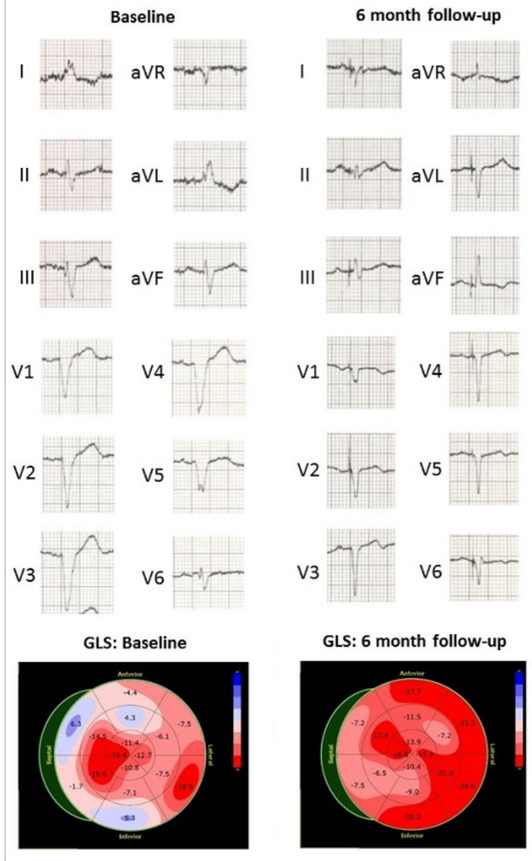
Background: Delivery of cardiac resynchronisation therapy (CRT) using conventional systems can be limited by sub-optimal venous anatomy. The WiSE-CRT (EBR Systems, Sunnyvale, CA, USA) has been approved for use with existing right-sided systems. We report the case of a CRT recipient with a left ventricular (LV) lead in the middle cardiac vein (MCV) and who subsequently developed right ventricular (RV) lead failure.
Objective: To describe the first-ever use of multisite LV pacing in a patient with the WiSE-CRT system.
Results: A 73-year old male with ischemic heart failure had received CRT-D using a bipolar LV lead in the MCV. The RV lead developed loss of sensing and capture 3 years on, leading to LV-only pacing. The patient deteriorated and echocardiography showed an LV ejection fraction (EF) of 17%. A venogram showed an occluded subclavian vein. Options were discussed and consent for a change to CRT-P combined with a WiSE-CRT implant was obtained. Day 1 involved the implant of the WiSE-CRT system transmitter under general anesthesia. The CRT-D generator was replaced with a CRT-P, the RV ICD lead pins were capped and both atrial and LV lead parameters were tested and satisfactory. On day 2, under conscious sedation, the receiver electrode was inserted using a retrograde transaortic approach and deployed on the endocardial aspect of the basal anterolateral LV wall. The existing LV lead was used to trigger the WiSE-CRT system, providing simultaneous LV and RV pacing. The AV delay was optimized to 150 ms to allow fusion with intrinsic cardiac conduction, with negative AV hysteresis programmed on (delta -20ms). The patient was seen in the research clinic 10 days and 6 months later, as per protocol. An acute QRS narrowing from 160ms (baseline) to 117ms (paced) was noted at implant. At 6 months, further improvement was noted with a QRS duration of 70ms; a reduction in LV end-systolic volume of 49%; an increase in EF to 41%; and an improvement in global longitudinal strain from -8.8% to -14.9%.
Conclusion: This report on the first-in-man use of fusion-based multisite LV pacing using a leadless endocardial pacing system demonstrates it is possible to synchronise the WiSE-CRT system with an LV lead, providing CRT to patients with sub-optimal coronary vein anatomy. ❑

Fig. 1: Parameter improvement, comparison between baseline and 6-month follow-up. Top panel: table describing absolute ECG and echocardiography parameters; Middle panel: change in QRS morphology on 12 lead ECG; Bottom panel: change in mechanical dyssynchrony.

Measurements	Baseline	6 month follow-up
QRS duration (ms)	160	70
End-diastolic volume (mL)	186	133 (-28%)
End-systolic volume (mL)	154	78 (-49%)
Ejection fraction (%)	17	41
Global longitudinal strain (%)	-8.8	-14.9



Posters

53/Clot structure in patients with non-valvular atrial fibrillation and sinus rhythm

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr53

C Voukalis (Presenting Author) - Institute of Cardiovascular Sciences, University of Birmingham, Birmingham; E Shantsila - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool; GYH Lip - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool

Introduction: Changes in a haemostatic state related in atrial fibrillation (AF) are insufficiently understood. The aim of this study is to investigate differences in the haemostatic mechanisms between patients with AF and sinus rhythm (SR) and second, to ascertain abnormalities in clot structure, which may reflect higher risk of thromboembolism.
Methods: We compared clot structure characteristics and thrombosis related biomarkers in a group of AF patients (n=47) against a "disease control" group in SR and ischaemic heart disease (IHD, n=39). Patients in both groups were receiving a single antiplatelet drug (aspirin or clopidogrel). Haemostasis was investigated by a viscoelastic technique performed in whole blood (thromboelastography; TEG), a "microplate-reader based" technique in citrated plasma (microplate assay; MPA), immunoassays to determine plasma concentrations of plasminogen activator inhibitor-1 (PAI-1), tissue-plasminogen activator and D-dimer, and flow cytometry for enumeration of apoptotic or platelet derived microparticles.
Results: Whole blood analysis by TEG revealed no differences between the two conditions regarding the generation and lysis of fibrin clot. Assessment of plasma, exogenous induced thrombogenesis and fibrinolysis by MPA, demonstrated faster generation of the fibrin polymer [Rate of clot formation (p=0.027)], more dense clot [Maximum amplitude (p<0.001)] and slower fibrin structure lysis [Rate of clot dissolution (p=0.005)] in patients with AF compared with the control group. PAI-1 levels were raised in the SR and IHD (p=0.008) in contrast with the apoptotic microparticles which were raised in the AF group (p=0.02).
Conclusions: Clot structure in AF appears to have enhanced prothrombotic characteristics compared with SR. Apoptotic microparticles may contribute to impaired haemostasis in AF. ❑

Table 1. Haemostatic parameters in patients with atrial fibrillation (AF) and sinus rhythm (SR)

Method	Indices/Biomarkers	AF	SR	p value
Microplate assay	Lag time (sec)	320 (250-351)	310 (250-340)	0.84
	Rate of clot formation (units/sec)	37 (20-43)	30 (23-34)	0.03
	Max optical density (units)	0.48 (0.42-0.56)	0.38 (0.33-0.45)	<0.001
	Rate of clot dissolution (units/sec)	33 (22-42)	42 (33-47)	0.005
	Time 50% lysed (sec)	224 (81)	212 (42)	0.42
Enzyme-linked immunosorbent assay	D-dimers (ng/ml)	7.82 (4.19-13.61)	7.74 (4.38-11.76)	0.87
	Tissue plasminogen activator (ng/ml)	0.48 (0.42-0.62)	0.54 (0.46-0.62)	0.34
	Plasminogen activator inhibitor 1 (pg/ml)	0.16 (0.12-0.23)	0.20 (0.14-0.41)	0.008
Microparticles	Platelet derived microparticles (10^3/ml)	20 (5-71)	7 (3-47)	0.28
	Apoptotic microparticles (10^3/ml)	480 (290-1191)	144 (54-933)	0.02

Posters

54/Prevalence of atrial fibrillation and outcomes in older long-term care residents: a systematic review

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr54

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Introduction: Atrial fibrillation (AF) disproportionately affects older people and the incidence of previously undiagnosed AF in long-term care (LTC) residents is high (approximately 14%). Prescription of oral anticoagulation (OAC) is integral to stroke prevention for AF but there is evidence of under-treatment in older people in LTC, likely due to clinicians' concerns of iatrogenic harm and doubt over the net clinical benefit of pharmacological intervention. This systematic review reviews the prevalence and the net risk-benefit of OAC in the older population living in LTC.

Methods: Observational studies investigating the prevalence or outcomes of AF in LTC were identified from searching electronic databases (Ovid Medline, CINAHL, PsycINFO, Scopus, Web of Science) from inception to 31st October 2019. The OpenGrey repository was searched for unpublished literature/dissertations, complemented by hand-searching of two geriatric cardiology journals and Google Scholar. International Scientific Indexing conference proceedings were searched for conference abstracts and bibliographies of identified articles were reviewed for any additional relevant studies. Two authors independently identified relevant articles, performed data extraction and assessed the quality and risk of bias using the Newcastle Ottawa Scale. Disagreements were resolved by discussion with another reviewer. The protocol was registered with PROSPERO (CRD42020164963).

Results: After full-text review, 21 studies were identified which reported AF prevalence in LTC residents, ranging from 7.1%-38% (n=3 reported an AF prevalence <10%, n=13 a prevalence of 10-15%, and n=5 a prevalence >15%). There was no association between mean/median resident age (years) and prevalence of AF. The median resident age was 85 years [IQR 77-89] for the highest prevalence of AF (38%) and the mean resident age was 87.7 years [SD 6.5] for the lowest prevalence of AF (7.1%). Two studies reported on outcomes based on the prescription of OAC or not; one reported a reduction in ischaemic stroke event rate associated with OAC prescription (2.84 per 100 person years, 95% Confidence Interval (CI) 1.98-7.25 vs. 3.95, 95% CI 2.85-10.08, but a higher intracranial haemorrhage rate (0.71 per 100 person years, 95% CI 0.29-2.15 vs. 0.65, 95% CI 0.29-1.93). The second study reported a 76% lower chance of ischaemic stroke with OAC prescription after adjustment and a low incidence of bleeding (n=4 events) in residents on OAC. No studies examined the effect OAC type on outcomes.

Conclusions: Estimates of AF prevalence were inconsistent and varied extensively; this likely reflects heterogeneity in the methods of AF diagnosis, resident characteristics and type of LTC facility. The limited number of studies examining adverse outcomes of LTC residents prevents the drawing of any definitive conclusions. Whilst this observational data does provide some insight, in the absence of more rigorous study designs the risk-treatment paradox still needs addressing in this often-neglected population who are at high-risk of AF and adverse AF-related outcomes. We recommend more rigorous study designs augmented with routinely collected health and social care data. ❑

Posters

55/Atrial fibrillation in the United Kingdom: predicting costs of an emerging epidemic

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr55

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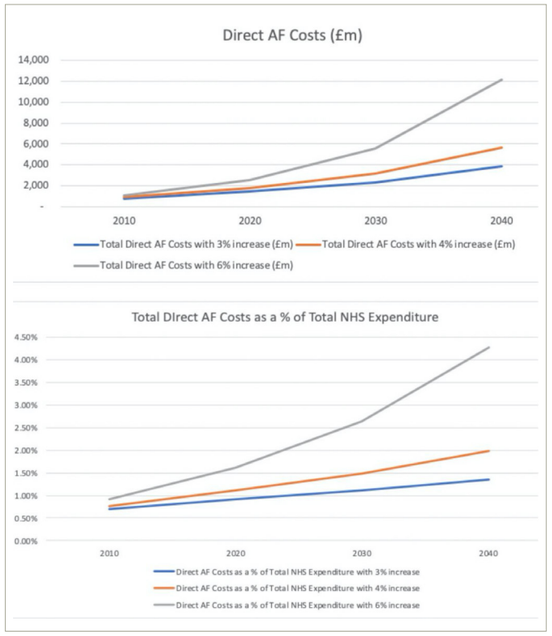
Background: Atrial fibrillation (AF) is the most common sustained heart arrhythmia and a major preventable cause of stroke, heart failure and dementia. AF already accounts for a significant amount of NHS funding, and over the coming years is highly likely to impose a growing cost on NHS budgets and the wider UK health care system. Predicting the likely healthcare costs of this increasingly common arrhythmia over the next decade would help with NHS resource planning.

Methods: Based on prior published data, we initially calculated the cost of AF for 1995, and then again for 2000 which was calculated from a combination of contemporary and extrapolated data from that time. These data have been used as the basis for forecasting AF costs in the UK and as a share of total NHS expenditure. Sensitivity modelling of 3%, 4% and 6% annual increase in AF prevalence amongst the population was applied to the starting point of the year 2000. From 2020 onwards, forecast assumptions used: (i) NHS expenditure from 2020 onwards assumed to increase at annual rate of 3%/year; and (ii) the UK inflation rate to increase by 2% annually.

Results (*see Figures*): The estimated direct and proportion of NHS expenditure of AF in 2020 for each of the assumed increases of 3%, 4% and 6% would be £1,435m (0.91%), £1,741m (1.11%) and £2,548m (1.62%) respectively. For 2030, the modelling would mean that the direct costs of AF and proportion of NHS expenditure would be £2,351m (1.1%), £3,141m (1.48%), £5,562m (2.63%), respectively. For 2040 the modelling shows that the direct costs of AF and proportion of NHS expenditure would be £3,851m (1.35%), £5,668m (1.99%), £12,143m (4.27%), respectively. The major component of this expenditure is forecast to be primary admissions (accounting for nearly 60% of the total direct costs of AF). The full cost of AF related hospitalisations may still be underestimated, due to the other admissions associated with a secondary coding of AF, which in 2020 are forecast to be between £2,269m and £4,030m, depending on the annual population increase of AF prevalence.

Conclusions: Focussing on 2020 AF is predicted to cost the NHS a total of a minimum of £1,435m and a maximum of £2,548m (subject to the rate of increase in AF prevalence), between 1.1-1.6% of NHS expenditure. The latter would increase to 1.35-4.27% of NHS expenditure, over the next 2 decades, mostly from primary admissions. Improved strategies to reduce the NHS healthcare cost burden of AF are urgently needed. ❑

Figures:



Posters

56/Short-term apixaban for documented left atrial appendage thrombus in high risk atrial fibrillation patients undergoing left atrial appendage occlusion

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr56

WYD Ding (Presenting Author) - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool; GYH Lip - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool; TB Fairbairn - Liverpool Heart & Chest Hospital, Liverpool; SB Binukrishnan - Liverpool Heart & Chest Hospital, Liverpool; AK Khalatbari - Liverpool Heart & Chest Hospital, Liverpool; PV Velavan - Liverpool Heart & Chest Hospital, Liverpool; DG Gupta - Liverpool Centre for Cardiovascular Science, University of Liverpool and Liverpool Heart & Chest Hospital, Liverpool

Background: The presence of left atrial appendage (LAA) thrombus precludes endocardial LAA occlusion, but there are scant data on the management of these very high-risk atrial fibrillation (AF) patients. Our aim was to evaluate the efficacy and safety of short-term apixaban treatment for LAA thrombi detected prior to planned LAA occlusion in patients with contraindications to long-term oral anticoagulant (OAC) therapy.

Methods: We report the short- and long-term outcomes on AF patients who had LAA thrombi documented on pre-procedural imaging prior to their LAA occlusion procedure.

Results: Among 87 patients who underwent workup for LAA occlusion, LAA thrombi were documented in 11 patients on pre-procedural imaging (nine on trans-oesophageal echocardiography and two on cardiac computed tomographic angiography). They comprised of seven (63.6%) males with a mean age of 76.9 (±6.9) years. Every patient had permanent AF. The median CHA_2DS_2-VASc and HAS-BLED scores were 4.0 (3.0 - 5.0) and 2.0 (2.0 - 3.0) respectively. Contraindications to long-term OAC were prior intracranial haemorrhage while on OAC (n=4) and despite no OAC (n=2), prior gastrointestinal haemorrhage while on OAC (n=2) and despite no OAC (n=1), severe unexplained anaemia on dabigatran (n=1), and failed OAC (n=1). Before enrolment, none of the patients were receiving OAC and four (36.4%) patients were on an antiplatelet agent. Appropriate dose-adjusted apixaban was prescribed for each patient and repeat imaging scheduled at 6-8-week intervals. Complete resolution of LAA thrombus was observed in 10 (90.9%) patients after 94 (IQR 44 - 126) days, all of whom underwent LAA occlusion safely with no peri-procedural complications. During treatment with apixaban, one patient had severe gastrointestinal bleeding requiring blood transfusion and one patient suffered an ischaemic stroke with subsequent full recovery. One patient had persistent LAA thrombus on repeated imaging and a patient-centred decision was taken for long-term apixaban therapy; no bleeding complications were observed over a follow-up of 25 weeks. Among the 10 patients who received LAA occlusion, no device-related thrombus was observed on follow-up imaging (eight by trans-oesophageal echocardiography and two by cardiac computed tomographic angiography). Over a median follow-up of 129 (33 - 169) weeks, one patient had a transient ischaemic attack and one patient had an episode of severe epistaxis despite not being on antiplatelet or OAC therapy. Four (40%) patients died.

Conclusion: Short-term treatment with apixaban appears to be effective and relatively safe for high-risk AF patients with documented LAA thrombi who are ineligible for long-term OAC therapy. This allows the LAA occlusion procedure to be undertaken safely. ❑

Posters

57/Accuracy of Kodex–EPD system in confirming pulmonary vein occlusion during cryoballoon ablation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr57

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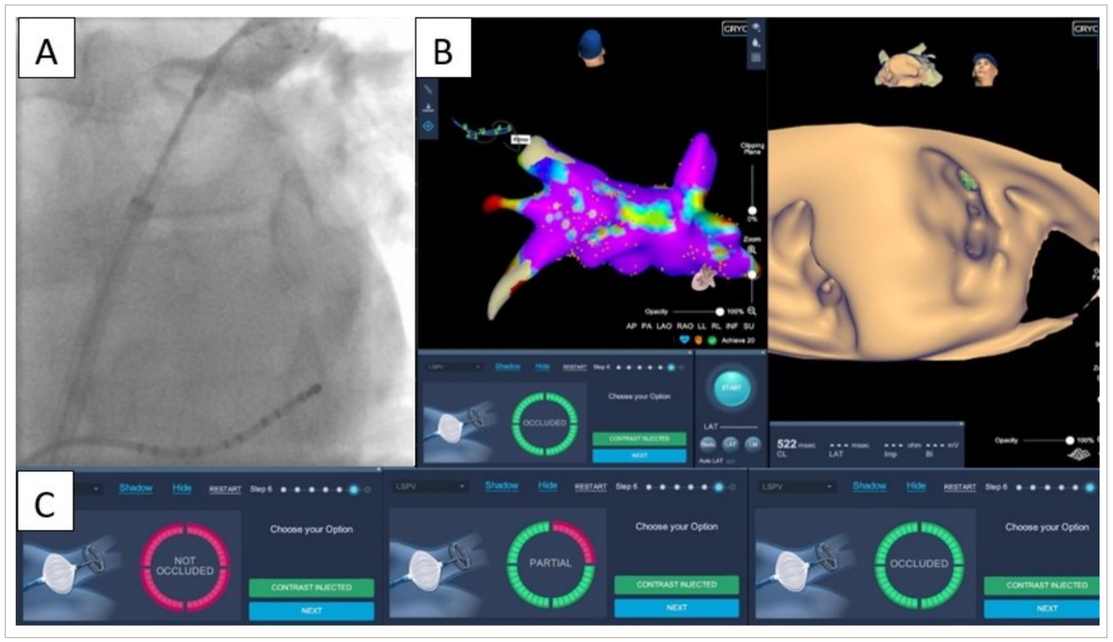
Introduction: Cryoballoon is an effective treatment for atrial fibrillation and is conventionally guided by fluoroscopy with contrast venography to confirm pulmonary vein (PV) occlusion. The Kodex-EDP system (EDP Solutions, Philips) is a novel non-contact navigation and mapping system using the unique dielectric properties of biological tissue. The system measures the varying potentials induced on standard catheter electrodes as it moves within an electrical field generated by body surface patches. Marked gradients in the electrical field occur near endocardial structures meaning the system can accurately delineate cardiac anatomy. The system does not require tissue contact to construct anatomy. The system also includes a PV occlusion tool which measures the change in dialectic properties from baseline (balloon not in tissue contact) to when circumferential tissue contact is achieved, thereby indicating the degree of PV occlusion. This tool has the potential to markedly reduce procedural fluoroscopy exposure if accurate enough to replace contrast venography. This pilot study aimed to assess the diagnostic accuracy of the occlusion tool.

Methods: A retrospective blinded review of contrast venograms was performed and compared with the results of the occlusion tool. Contrast venography was classified on a graded scale from 1 (negligible occlusion with rapid outflow from the PV) to 4 (total occlusion with complete contrast retention). Grades 3 and 4 were considered indicative of satisfactory PV occlusion. The Kodex-EPD system displays the PV as 4 quadrants. All 4 quadrant displays reading green indicates complete PV occlusion (*Figure 1*). The first case was performed with software version 1.4.6 with the remaining 5 cases using version 1.4.6a.

Results: Six patients (5 (83%) male, mean age 60.2±14.1 years) had cryoballoon ablation assisted by the Kodex–EPD system. Fifty-eight PV occlusions were verified with both contrast venography and the Kodex–EPD system. Thirty-seven of the 52 PVs indicated as occluded on the PV occlusion tool were satisfactorily occluded on contrast venography. Three of the 6 PVs displayed as not occluded on the PV occlusion tool were satisfactorily occluded on contrast venography. The sensitivity and specificity of the occlusion tool for PV occlusion as defined by contrast venography were 92.5% and 16.7% respectively. The positive and negative predictive values of the occlusion tool were 71.2% and 50% respectively. Four PVs had grade 4 occlusion on contrast venography and all were identified as occluded with the occlusion tool.

Conclusion: In this study, the PV occlusion tool of the Kodex–EDP system had a high sensitivity and moderate positive predictive value but low specificity for PV occlusion as determined by contrast venography. Therefore, while the tool has the potential to substantially reduce fluoroscopy exposure, the current software version may not currently have sufficient diagnostic accuracy to replace contrast venography. ❑

Figure 1: Example of PV Occlusion tool – A) Contrast venogram with the cryoballoon occluding the left upper pulmonary vein. B) Kodex-EDP maps - PA view of left atrium on the left and AP panoramic view (left atrium opened out) on the right. The PV occlusion tool indicates that left upper vein is occluded. C) The 4 quadrants of the PV occlusion tool are all red at baseline and progressively turn green with balloon engagement. All 4 quadrants turning green indicates complete PV occlusion.



Posters

58/Jet ventilation or intermittent positive pressure ventilation during contact force-guided pulmonary vein isolation: comparative analysis of ablation lesion creation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr58

YR Hill (Presenting Author) - University of Exeter, Exeter; DR Tomlinson - University Hospitals Plymouth NHS Trust, Plymouth

Introduction: Successful pulmonary vein isolation (PVI) requires the creation of continuous and durable transmural ablation lesions encircling the pulmonary veins (PV). During contact force (CF) radiofrequency (RF) delivery, catheter stability is clearly an important determinant of lesion creation. However, the precise extent to which cardiac and respiratory motion influence site-specific RF effects is presently unknown. Therefore, we aim to determine whether the mode of ventilation - volume-controlled intermittent positive pressure (IPPV) versus high frequency jet ventilation (HFJV) - influences RF lesion creation during PVI.

Methods: Consecutive, unselected adult patients underwent single-operator CF PVI using CARTO® and VISITAG Module guidance (Biosense Webster). IPPV was at 6-8ml/kg, 14-16 breaths/minute guided by end-tidal CO_2. During HFJV, GA was induced and maintained with total intravenous anaesthesia using depth of anaesthesia monitoring (BISTM, Medtronic Inc.). A Monsoon III ventilator (Acutronic Medical Systems AG) delivered jet ventilation at 150jets/min using 60% inspired oxygen concentration (titrated to maintain saturations 95%); driving pressure 1.0 bar, 1:1 inspiration to expiration ratio. RF was delivered using Agilis sheath support and during coronary sinus pacing at 600ms; force-over-time 100% min 1g and 2mm position stability (ACCURESP off). 30W was delivered to all sites during IPPV, whereas 20W was delivered to left-sided left atrial posterior wall (LAPW) sites during HFJV. Time to pure R unipolar electrogram (UE) morphology change and impedance drop (ImpD - both total and maximum rate) were measured at the first-ablated LAPW sites using exported VISITAG Module data.

Results: 25 and 22 patients were ventilated using IPPV and HFJV respectively. During IPPV and using 30W, time to pure R UE morphology change was significantly shorter at left-sided sites (*p=0.01*). However, during HFJV there was no significant difference between left (20W) and right-sided (30W) LAPW sites. There was no significant difference in time to pure R between IPPV and JV when comparing left and right-sided LAPW sites (*Table*). There was a significant difference (*p=0.003*) in rate of impedance drop between IPPV and HFJV in only LAPW sites, with a greater rate of impedance drop when using IPPV. The rate of impedance drop was also greater in LAPW sites than right-sided sites during IPPV (p = 0.0004), but there was no significant difference in rate of impedance drop at LAPW and right-sided sites during HFJV.

Conclusions: Extending the findings of previous studies, we have demonstrated a significantly greater rate of impedance drop at left versus right-sided LAPW sites during CF PVI under GA. However, compared to IPPV, HFJV was without effect on the rate of impedance drop at right-sided LAPW sites, indicating that cardiac contraction-induced motion is the main determinant of catheter-tissue instability at right-sided sites under these conditions. Finally, as the rate of impedance drop did not differ between left-sided (at 20W) and right-sided (at 30W) LAPW sites during HFJV, this approach may be used to achieve equivalent RF effects using a fixed RF duration protocol. ❑

Table:

	IPPV (n=25)			HFJV (n=22)			IPPV vs HFJV	
	Left-sided (30W)	Right-sided (30W)	p	Left-sided (20W)	Right-sided (30W)	p	Left-sided p	Right-sided p
Time to pure R (s)	4.36	6.74	0.01	4.88	5.9	NS	NS	NS
Max rate of mpD (ohms/s)	1.19	0.69	0.0004	0.77	0.64	NS	0.003	NS

Posters

59/Long term outcomes of percutaneous and thoracoscopic surgical ablation for atrial fibrillation in patients with continuous beat-to-beat monitoring

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr59

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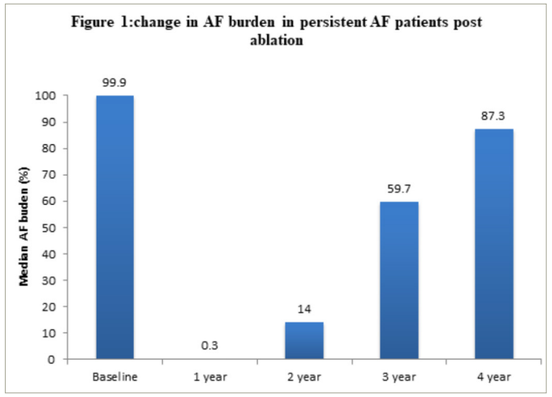
Introduction: Catheter ablation has been shown to be safe and effective in reducing atrial fibrillation (AF) burden and symptoms. However, there is limited long term data using continuous monitoring to assess the actual success of catheter ablation. This study assessed the long-term outcome of AF ablation in patients with implantable cardiac devices allowing beat-to-beat analysis of arrhythmia outcomes.

Methods: 223 patients (mean age 75.9 ± 7.4, 50.9% men) who underwent catheter or thoracopic surgical ablation for symptomatic AF were studied. The techniques used were PVAC ablation (51.6%), cryoablation (16.1%), point by point (13.0%), nMARQ (12.1%) and surgical ablation (7.2%). All patients had a cardiac implantable device (109 pacemaker and 114 implantable loop recorder), and were followed up for a mean period of 735.2 ± 338.0 days, post ablation.

Results: 146 (65.5%) patients had paroxysmal AF (PAF) and 77 (34.5%) patients had persistent AF. After first ablation there was a significant reduction in AF burden (relative risk 0.91, *95% CI* 0.89 to 0.94; P = <0.01). Median AF burden in PAF patients reduced from (interquartile range [IQR], 0.1%-8.08%) to 0.10% ([IQR], 0%-2.44%) at one year and this was maintained up to four-year follow up. In persistent AF patients AF burden reduced from 99.9% ([IQR], 51.53%-100%) to 0.30% ([IQR], 0%-77.25%) at one year however increased to 87.3% ([IQR], 4.25%-100%) at four years follow up (*Figure 1*). At first ablation there was no significant difference in AF burden reduction between the different techniques used (p=0.32). At second ablation point by point ablation was associated with greater reduction in AF burden (relative risk, 0.77 [95% CI, 0.65–0.91]; *P* = <0.01).

Figure:



Conclusion: Ablation results in significant reductions in AF burden both acutely and over the long term when assessed using continuous device derived beat-to-beat monitoring. When second ablation was required the point-by-point technique was associated with greater reductions in AF burden than "single shot" technologies. In persistent AF, burden increased two years after ablation to near pre ablation levels by year 4 suggesting a different mechanism from PAF patients where this increase was not demonstrated. ❑

Posters

60/Improving the long-term management of new-onset atrial fibrillation on the intensive care unit: an audit and quality improvement project

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr60

K Saleh (Presenting Author) - Frimley Park Hospital, Frimley; L Watts - Frimley Park Hospital, Frimley; E Hipwell - Frimley Park Hospital, Frimley; M Faircloth - Frimley Park Hospital, Frimley

Introduction: Atrial fibrillation (AF) is a common arrhythmia in the intensive care setting. Observational studies of patients who develop new-onset AF during critical illness have demonstrated an increased risk of recurrence and increased morbidity and mortality, in both the short and long term, related to thromboembolic stroke and heart failure.

Patients with new-onset AF on the intensive care unit (ICU) were identified to determine if clinicians made decisions regarding long term anticoagulation and made robust follow-up plans on discharge. This prompted a further quality improvement project to address deficiencies identified in the patient pathway.

Methods: A retrospective audit of patients on the ICU was performed spanning a 6-month period. Patients who triggered an arrhythmia alert on the PICIS software were identified and cross-checked with patient records to identify instances of new-onset AF (n=14). Clinical records, discharge summaries and echocardiogram requests were reviewed. Analysis revealed the following:

1. Only 64% of patients who survived to discharge had documentation of new-onset AF on their ICU discharge summary; and in patients whose arrhythmia had resolved prior to discharge (79%), none had documentation of new-onset AF.
2. Only 57% of patients had new-onset AF recorded on their hospital discharge summaries.
3. Long term anticoagulation was commenced by the discharging team in only 29% of patients despite having a high stroke risk (CHA_2DS_2-VASc score ≥ 2).
4. Only one patient had documentation of a stroke and bleeding risk assessment during their entire hospital stay and no patients had reassessments of bleeding risk post discharge from ICU.

CONTINUED

Figure:

New-onset Atrial Fibrillation/Flutter Proforma

NHS Frimley Health NHS Foundation Trust

First Name: _____
Surname: _____
Date of birth: ____/____/____
Hospital Number: _____

Doctor completing form:
Name (PRINT): _____
Date: ____/____/____ Time: _____

Please complete this form and file into the patient's notes as a record of a new-onset or first detection of atrial fibrillation or flutter.

INTENSIVE CARE TEAM to complete

Please tick as appropriate:

1. Rhythm: Atrial Fibrillation ☐ Atrial Flutter ☐
2. Onset: Date: __/__/__ Time: _____
3. Has the rhythm resolved?
   Yes ☐ Date: __/__/__ Time: _____ Longest duration: _____
   No ☐
4. Calculate stroke and bleeding risk and consider anticoagulation
   CHA_2DS_2-VASc score ____ HAS-BLED score ____ *Refer to scoring parameters overleaf*
5. Is anticoagulation currently indicated?
   Yes ☐ No ☐
   Please provide rationale: _____
   Will this decision need review prior to discharge from ITU? _____
6. Ensure new-onset AF is clearly documented onto ITU discharge summary

RECEIVING SPECIALTY TEAM to complete

Please tick as appropriate:

1. Re-calculate stroke and bleeding risk and consider anticoagulation
   CHA_2DS_2-VASc score ____ HAS-BLED score ____ *Refer to scoring parameters overleaf*
2. Is anticoagulation indicated on discharge from hospital? *Consider weight, age and renal function if using a DOAC*
   Yes ☐ No ☐
   If anticoagulation is commenced, please organise follow up on discharge with anticoagulation clinic at fhft.anticoagulant.clinic@nhs.net
3. Request routine outpatient echocardiogram (clinical investigations form)
4. Refer to arrhythmia nurse specialist on discharge by emailing andrea.lavous@nhs.net

CHA_2DS_2-VASc score

Congestive heart failure / LV dysfunction history	1
Hypertension	1
Age 65-74 years	1
Age ⩾ 75 years	2
Diabetes history	1
Stroke / TIA history	2
Vascular disease history	1
Female sex*	1

*Note female sex alone is not an indication for anticoagulation

HAS-BLED score

Hypertension (>160mmHg systolic)	1
Abnormal renal function (Creatinine > 200, dialysis, transplant)	1
Abnormal liver function (cirrhosis, bilirubin >2x normal, ALT/AST/ALP >3x normal)	1
Stroke history	1
Prior major bleeding history or predisposition to bleeding	1
Labile INR (unstable/high INRs, time in therapeutic range <60%)	1
Age > 65 years	1
Drugs predisposing to bleeding (aspirin, clopidogrel, NSAIDs etc)	1
Alcohol ⩾ 8 drinks per week	1

For any queries, please consult the cardiology team or cardiology consultant of the week (x3724)

Posters

60/Improving the long-term management of new-onset atrial fibrillation on the intensive care unit: an audit and quality improvement project (*continued*)

5. No patients had follow up arranged on discharge with a cardiologist, arrhythmia nurse or their GP.
6. No patients were booked an outpatient echocardiogram by the discharging team, where these had not already occurred during their inpatient stay.

A multi-faceted approach was devised using quality improvement (QI) methodology, aimed at improving communication and care continuity. This consisted of implementation of a "new-onset AF proforma", amendment of the ICU discharge summary template to include a specific entry for new-onset AF and educational initiatives for doctors and nursing staff. A repeat PDSA cycle refined the proforma to promote repeat assessment of stroke and bleeding risk post discharge from ICU and the incorporation of a routine pathway for triage and follow up via the arrhythmia nurse specialist.

Results: Patients with new-onset AF who survived to discharge were captured over a 3-month period (n=8). Improvement was noted in documentation of new-onset AF on the ICU and hospital discharge summaries (100% and 88% respectively). All patients captured on the "new-onset AF proforma" were risk assessed in terms of stroke and bleeding risk. Long term anticoagulation was commenced in 88% of patients in whom the discharging team deemed it appropriate (according to stroke and bleeding risk). All patients had echocardiograms while in hospital for non-AF pathologies, precluding the need for an outpatient echocardiogram.

Conclusion: This QI project has successfully improved the long-term management of patients with new-onset AF on ICU, in particular enhancing rates of anticoagulation prescribing on discharge. This cohort of patients are frequently overlooked as they transition from ICU to the ward to the community and these simple interventions have the potential to improve patient outcomes and continuity of care. ❑

Posters

61/Iatrogenic cardiac perforation following pacemaker and defibrillator implantation; presentation, management and outcomes

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr61

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Aims: Cardiac perforations caused by pacemaker and implantable-cardioverter defibrillator (ICD) leads are serious events. Due in part to their infrequency, management options and outcomes are unclear.
Methods: A single-centre retrospective study was conducted at a high-volume tertiary centre to identify patients in whom cardiac perforation occurred due to lead implantation or intervention. The search included all lead procedures spanning 3 years from 2016-2019. 6 months follow-up was assessed in all patients with perforation.
Results: Of 4619 procedures 32 patients were diagnosed with lead related cardiac perforation (involving 33 leads), mean age 74±15 years, 20 (63%) female, mean left ventricular ejection fraction 51% (±11). 9 devices were implanted at other centres; therefore, the institutional rate of perforation was 0.5% (n=23 patients, 24 leads). 9 (39%) were identified acutely (<24 hours), median time to diagnosis was 32 (±49) days in sub-acute/chronic perforation. All but one leads were active fixation models; 25/32 (78%) had abnormal electrical parameters at device interrogation. 6/33 (18%) were ICD leads. 27/33 (82%) leads perforated the right ventricle (RV) in the apex or anterior apical region, 3 (9%) mid anterior RV and 2 (6%) lateral right atrium. Management was trans-venous in 31/32 (97%) patients with lead extraction or repositioning; pericardial drainage was required in 10/32 (31%), sternotomy with surgical repair was required in 1 (3%). 1 (3%) patient was deceased within 30 days, all other patients made a full recovery and were well at 6 months follow-up.
Conclusion: Although infrequent (0.5%), perforation occurred predominantly in the RV apex. No clear patient factors were identified as risk factors. Trans-venous lead extraction was safe and effective with surgical intervention rarely required. ❑

Posters

62/Surgical ablation for atrial fibrillation - single centre experience and outcomes

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr62

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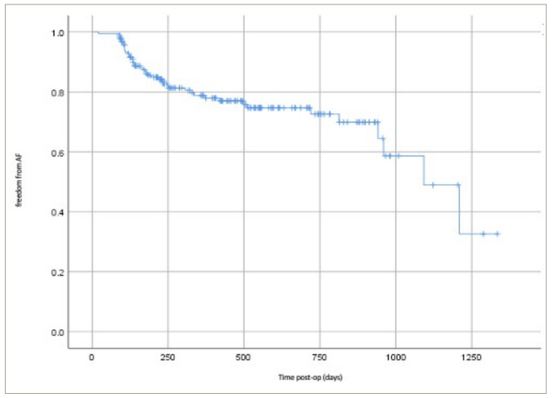
Introduction: Surgical "Maze" was first performed in 1987, although techniques have evolved since then. The most recent 2017 Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation (AF) recommends concomitant ablation for symptomatic AF alongside other cardiac surgery (Class I/IIa) and standalone ablation (Class IIa) for persistent and long-standing persistent AF. We sought to evaluate the contemporary performance of surgical ablation at our centre.
Methods: Retrospective electronic database and case note review at a single tertiary centre, including all operations involving surgical AF ablation between January 2016 to December 2018. A 90 day "blanking period" was allowed post op. Of 278 patients initially identified, 94 were excluded as there was no follow up after initial clinic visit 90 days post-surgery. Follow up was for minimum 6 months, median 12 months. Cardiac rhythm was determined on 12 lead ECG pre-op and during post op follow up by Holter monitor and/or 12 lead ECG.
Results: Of 184 patients studied 115 were male (63%), with a mean age of 71 ± 11 years. 144 (78%) had persistent AF. 82 patients had hypertension, 21 had diabetes, 14 had chronic pulmonary disease, 19 patients had a previous myocardial infarction. 161 had a left ventricular ejection fraction (LVEF) of > 50%, 21 had LVEF 30-50% and 2 had LVEF < 30%. Mean left atrial size was 57 ± 15mm. 66 patients had mitral valve disease, 29 had aortic valve disease, 41 had disease of > 2 valves. Ablation performed ranged from pulmonary vein isolation only to Cox Maze IV. 33 patients had standalone AF surgery; in 116 ablation was combined with valve surgery, in 15 with CABG, in 20 with CABG and valve surgery. The left atrial appendage was treated by excision or clip device in the majority.
140 (76.1%) patients remained free of AF at last follow up. *Figure 1* shows

Figure:



Kaplan-Meier curve for AF recurrence. Recurrence of AF in 44 patients occurred at a median of 212 days post op (range 91-1092). 7 patients underwent further catheter-based ablation. 30-day mortality was 3.6% and overall survival was 96%.
Conclusions: These data confirm excellent "real world" outcomes from surgical ablation in a cohort of mainly persistent AF patients, despite advanced atrial myopathy based on left atrial size, coexistent valve disease and comorbidity. The limitations are in its retrospective nature, involving a heterogeneous population and surgical lesion sets, with inconsistent use of Holter monitoring during follow up. ❑

Posters

63/10-Year experience of transvenous lead extraction in the University Hospital of Birmingham NHS Trust

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr63

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Introduction: Transvenous lead extraction (TLE) of cardiac implantable devices has been established as a safe and effective practice. Despite the advancement of methods and techniques, there is still a wide variation amongst centres. We present our own experience from 10 years of TLE procedures at the University Hospital of Birmingham.

Methods: We retrospectively analysed the records from 371 patients undergoing a TLE procedure in our hospital between November 2010 and May 2020. Data was collected using our electronic database, clinical records and operation notes. The EHRA and HRS proposed definitions were adopted in our analysis. Multiple regression analysis using IBM SPSS 23 was performed to identify predictors of adverse outcomes and procedural success.

Results: Patient characteristics are summarised in *Figure 1*. Mean age was 67 years with a mean BMI of 27.9. Explants accounted for 14.2% of all cases. 20.9% of all devices extracted were defibrillators and 30.5% were Cardiac Resynchronization Therapy systems. In total, 833 leads were extracted with a mean of 2.2 leads per patient, out of which 20.5% were defibrillator leads and 12.7% left ventricular leads. 95.2% of cases were undertaken under local anaesthesia and conscious sedation. In 8.3% of procedures, the femoral approach was used in combination with or instead of a superior access. Laser powered mechanical sheaths were used in 45.8% of procedures. Complete lead removal was achieved in 93.3% of cases. The prevalence of procedure related major complications was 2.9%. The peri-procedural mortality was 0.5%, whilst in-hospital mortality was 2.9%. Use of laser sheath was more commonly associated with peri-procedural complications (OR 13.7, CI 95%, p = 0.038). Incomplete lead removal was statistically higher in cases where the femoral route was used (OR 12.2, CI 95%, p= 0.00) and in patients with higher number of leads that required extraction (OR 2.6, CI 95%, p = 0.003). There were no statistically important independent factors associated with peri-procedural or in-hospital mortality in our case analysis.

Conclusions: The outcomes and safety of TLE practice in our centre are in keeping with international published data. Our observational findings demonstrate that lead extraction can be done safely and effectively under local anaesthesia and conscious sedation. Laser lead extraction is an efficient tool, which can be associated with an increase in peri-procedural complication, but no effect on mortality. ❑

Figure 1 – Patients' characteristics

		Number of pts	Percentage (%)
Gender	Female	73	19.7
	Male	298	80.3
Underlying heart disease	None	159	42.6
	Ischaemic cardiomyopathy	111	29.8
	Non ischaemic DCM	64	17.1
	Hypertrophic cardiomyopathy	13	3.5
	Congenital heart disease	12	3.2
	Heart transplant	5	1.3
	LV non compaction	2	0.5
	Other [channelopathy etc]	5	1.3
LV function	Normal	177	47.7
	Mild impairment	28	7.5
	Moderate impairment	36	9.7
	Severe impairment	130	35
Valves	Native	341	91.4
	Bioprosthetic	12	3.2
	Mechanical	14	3.8
	Repair	6	1.6
Previous sternotomy	Yes	82	22
	No	291	78
Chronic kidney disease	Yes	107	28.7
	No	266	71.3
Indication for extraction	Isolated pocket infection	153	41
	Isolated pocket erosion	73	19.6
	Bacteraemia	6	1.6
	Pocket infection with bacteraemia	9	2.4
	Pocket infection with endocarditis	49	13.1
	Device related endocarditis without pocket infection	22	5.9
	Lead dysfunction	42	11.3
	Lead related complications	6	1.6
	Chronic pain	7	1.9
	Venous access issues	1	0.3
	Other	5	1.3
Original implant indication	AV node disease	97	26
	Sinus node disease	92	24.7
	Primary prevention	69	18.5
	Secondary indication	58	15.5
	CRT indication	52	13.9
	Unclear / unknown	5	1.3
Pathogen cultured	None	290	77.8
	Staph aureus	50	13.4
	Staph epidermidis	7	1.9
	Streptococcus	7	1.9
	Other	17	5
Leads extracted	Active fixation atrial lead	180	21.7
	Passive fixation atrial lead	112	13.4
	Active fixation ventricular lead	95	11.4
	Passive fixation ventricular lead	169	20.3
	Single coil ICD lead	92	11
	Dual coil ICD lead	79	9.5
	Bipolar LV lead	61	7.3
	Quadripolar LV lead	36	4.3
	Starfix LV lead	6	0.7
	Other active fixation LV lead	3	0.4
Method of extraction	Simple traction	371	100
	Locking stylets	237	63.9
	Mechanical non-powered telescopic sheaths	153	41.2
	Laser sheaths	170	45.8
	Snares	27	7.3
	Baskets	1	0.3
	Lead extenders	1	0.3
	Occlusion balloons	1	0.3
Complications	None	330	88.5
	Minor	16	4.3
	Major non-procedural related	16	4.3
	Major procedural related	11	2.9

Pts – patients, DCM – dilated cardiomyopathy, LV – left ventricle, CRT- cardiac resynchronization therapy, ICD – Implantable Cardiodefibrilator leads.

Posters

64/Improving disconnected remote monitor rates during the COVID-19 pandemic

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr64

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Background: Remote monitoring (RM) for implanted cardiac devices has been increasing nationally. At a large tertiary cardiac centre with more than 5,000 patients enrolled on RM, a significant problem is disconnected RM. Disconnected RM can be detrimental, resulting in undetected arrhythmia, battery depletion or lead failure, all of which can result in deterioration in health or mortality. This issue has been exaggerated during the COVID-19 pandemic, as virtual follow ups increased to minimise exposure to the virus. We anticipated that as the increase in RM, would also increase the rate of disconnected RM. Therefore, we approached company representatives (reps) to form a collaborative working relationship to reduce the number of patients with disconnected RM.

Method: We contacted reps from three device companies, approximately 70% of our RM population, three platforms agreed to participate. Limitations for all manufacturers included different GDPR restrictions. One platform wasn't contacted, as high compliance didn't require their support. Two companies were allowed read-only access to RM platforms to allow contact with patients, as telephone numbers were documented on all platforms. The third company was provided spread sheets with patients' name, device, and phone number. All companies received data that was practicable and adhered to GDPR compliance. Prior to reps troubleshooting, Cardiac Scientists ensured data fields were complete and patients were active within the clinic. Reps then called patients to assist with reconnection. If this was not achieved, the issue was reported with discussions had with patients. New transmitters were distributed if required and/or letters and information guides.

Results: The proportion of disconnected RM across two platforms decreased marginally (1 & 2) and one (3) significantly (*Table 1*).

Discussion: The small proportion reduction of disconnected RM patients on 1 and 2 can been attributed to the high volumes of patients enrolled during the pandemic. The 3rd platform only consists of ILR patients. For that reason, few RM were provided during the audit period, resulting in a significant decrease in disconnected RM proportion. Whilst triaging for platform 3, we discovered 124 patients' devices had reached end of service, been removed and had not been removed from the platform. This highlighted a gap in communication, which we have now resolved. Following discussions with reps, a few simple troubleshooting approaches solved the majority issues. Including: pressing status or reset button to re-establish connection, moving the monitor closer to a window for improved signal or switching the 4G dongle port. Some patients were unaware that RM needed to be plugged in constantly. Maintaining a low burden of disconnected RM is necessary to allow future RM only follow-up. There is therefore a need to improve Cardiac Scientist training to alleviate the disconnected RM burden to continue this project to achieve a disconnected rate of 0%. In conclusion, reducing disconnected RM during the COVID-19 pandemic has been a success. Demonstrating that collaboration with RM platforms could be achieved to decrease the disconnected RM burden. We would like to thank the representatives at Boston Scientific, Abbott and FocusOn for their help and support during this project. ❑

Table 1:

	Platform 1	Platform 2	Platform 3
Disconnected Monitors Pre (%)	16	9.7	22
Disconnected Monitors Post (%)	15.9	8.4	11.7
Number of Patients Reconnected	160	120	26

Posters

65/Ablation index technology and esophageal protection during AF ablation: further outcomes from the IMPACT study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr65

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Background: The IMPACT study established the role of esophageal temperature control in preventing esophageal injury during radiofrequency (RF) ablation for atrial fibrillation (AF). The procedures were performed using Ablation Index (AI) technology.
Objective: To determine the effect of esophageal cooling on the formation of RF lesions and the characteristics of RF lesions associated with esophageal injury.
Methods: Participants in the IMPACT trial underwent AF ablation guided by AI (30W at 350-400 AI posteriorly, 40W at ≥450 AI anteriorly). A blinded 1:1 randomisation assigned patients to the use of the ensoETM® device to keep esophageal temperature at 4°C during ablation or standard practice using a single-sensor temperature probe. Endoscopic evaluation occurred 7 days post ablation. Ablation parameters and short-term outcomes were analysed.
Results: We recruited 188 patients. Procedure and fluoroscopy times were similar, and all pulmonary veins were isolated. First pass pulmonary vein isolation and reconnection at the end of the waiting period were similar in both randomized groups (51/64 vs 51/68; p=0.54 and 5/64 vs 7/68; p=0.76, respectively). Posterior wall isolation was also similar: 24/33 vs 27/38; p=0.88. Ablation effect on tissue, measured in impedance drop, was no different between the 2 randomized groups: 8.6Ω (IQR: 6-11.8) vs 8.76Ω (IQR: 6-12.2) p=0.25. Thermal injury was significantly less common in the randomized group receiving oesophageal protection (p<0.008). Ablation characteristics of cases with thermal injury were similar to those without thermal injury, with no difference in RF duration, maximum power or impedance drop (p=0.08-0.69). A smaller proportion of ablation index values >500 was located at posterior left atrial sites compared to cases with no thermal injury (32.3% vs 78.4%; p<0.001). Arrhythmia recurrence was similar at the 6-month follow up (4.5% vs 6.1%; p=0.75).
Conclusions: Esophageal cooling has been shown to be effective in reducing ablation-related thermal injury during RF ablation. AI data confirm that this protection does not make it any more difficult to achieve standard procedural endpoints, or to obtain clinical success in the short term. ❑

Posters

66/Lesion Size Index (LSI) – guided catheter ablation for atrial fibrillation: can tissue impedance drop help identifying desirable ablation settings and target indices?

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr66

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Background: Reliable creation of durable transmural lesions is the key for successful catheter ablation procedures. Tissue impedance drop during radiofrequency delivery has been traditionally used as an indicator of lesion formation and size. More recently, Lesion Size Index (LSI) has become available in clinical settings as marker of lesion formation. In animal studies LSI correlates with lesion size regardless of the power used, meaning that it is theoretically possible to achieve the same lesion size with different powers by modifying contact force and ablation time accordingly. However previous data also suggest that ablation lesions reach maturity after 20-30 sec of energy delivery and no further increase of lesion size is observed thereafter despite more prolonged ablation. We assessed the relationship between ablation parameters and tissue impedance drop, as surrogate marker of lesion size, to help establishing ideal ablation settings and target indices for atrial RF catheter ablation.
Methods: Consecutive patients undergoing their first left atrial catheter ablation for atrial fibrillation were enrolled. Point-by-point ablation was performed for all study ablations, using RF powers of 20, 30 or 40 W. Tissue impedance, contact force, RF power and LSI values were continuously recorded during ablation and sampled at 100 Hz. An STL filter was used to process the impedance data and remove noise. The mean contact force was calculated for every lesion. The effect of contact force and power on impedance drop was assessed. The variation of impedance drop over time and LSI were also investigated. The maximum percentage impedance drop for every interval was calculated relative to the starting impedance.
Results: A total of 3337 RF lesions, delivered in 44 patients, were included in the analysis. The maximum impedance drop achieved during RF delivery was progressively higher with use of higher RF powers (*Figure 1*). No correlation was observed between contact force and maximum percentage impedance drop (*Figure 2*) in each power group. The incremental time analysis also showed progressively shorter ablation times required to reach the plateau of impedance drop with use of higher power (*Figure 3*). The LSI value required to reach maximum percentage impedance drop was progressively higher with higher power (*Figure 4*).
Conclusions: Regardless of the contact force used and despite more prolonged ablation durations, lower powers produce lower maximum percentage impedance drops. This could mean smaller lesion sizes achievable with lower powers. Higher LSI values could be needed with higher RF powers to reach the maximum achievable lesion size. ❑

Figure 1:

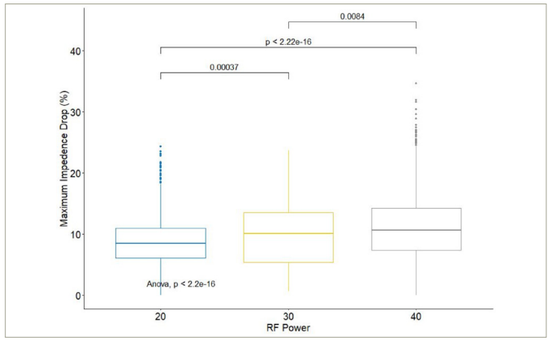
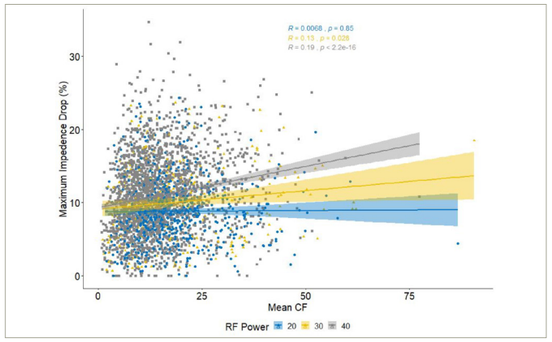


Figure 2:



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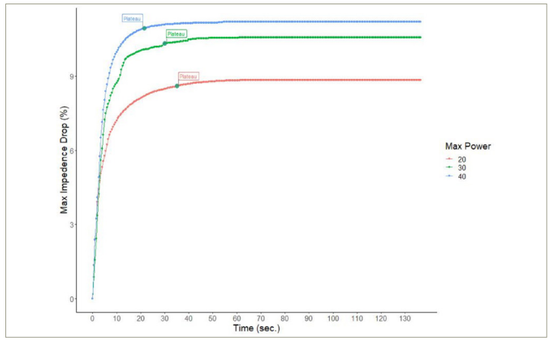
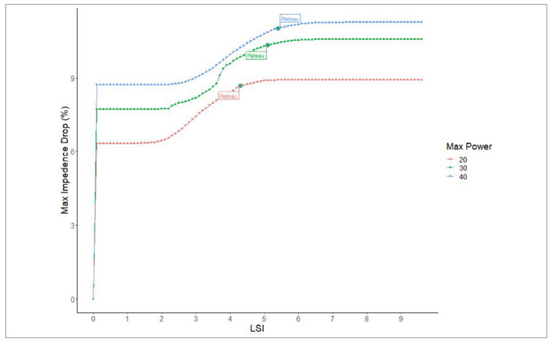


Figure 4:



Posters

67/Predicting high ventricular pacing burden among patients receiving device therapy for bradycardia – how good is operator opinion?

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr67

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Introduction: Current guidelines indicate that pacing methods that maintain physiologic ventricular activation (biventricular pacing or His-bundle pacing) should be chosen over right ventricular pacing among patients with EF 36-50% who are expected to require ventricular pacing >40% of the time. There are no guidelines to help predict which patients will receive a high burden of ventricular pacing and this is left to operator opinion. We sought to ascertain whether operator opinion is an accurate predictor of high burden of ventricular pacing.

Methods: This was a single-centre single-blinded observational study of patients who received pacemaker implant for treatment of bradycardia over the 4-year period to the end of April 2019 and had at least 12-month follow-up data on record. Patients' demographic, clinical, electrocardiographic and echocardiographic data were reviewed in a blinded fashion by a senior implanting physician, who estimated whether the percentage right ventricle pacing at 12 months would exceed 40%. At 12 months the percentage of pacing was then identified from the pacing records and compared with the prediction.

Results: Some 982 patients underwent pacemaker implantation during the study period, 698 for conduction system disease (CSD), 267 for sinus node disease (SND) and 17 for other conditions. Overall, 856 had valid follow-up data. Of these, 543 (63.4%) were predicted to ventricular pace >40% of the time and 527(61.6%) were documented as actually having paced >40%. The sensitivity and specificity of operator prediction were 93.2% and 84.2% respectively, with positive and negative predictive values of 90.4% and 88.5%. Table 1 illustrates the above analysis and further sub-group analysis of different populations by clinical parameter. In the sub-group analysis, clinical heart block and PR>300 conferred a significant predictive factor for accurate prediction of >40% RV pacing, but that clinical features such as syncope or non-syncope were less useful

Conclusion: In this single-centre study, in patients receiving pacemaker implant for treatment of bradycardia, operator prediction of the burden of RV pacing >40% has an acceptable degree of accuracy. Patients with sinus node disease ventricular pacing more than 40%, and those with conduction disease ventricular pacing less than 40% were harder to pick up. Sub-group analysis alludes to the fact that certain clinical parameters may make this prediction easier. Assessing for easily obtainable clinical, electrocardiographic or echocardiographic parameters to such an end, may lead to greater accuracy of prediction. ❑

Table 1. Comparison of operator opinion across different sub-categories of pacing indication

	SND	CSD	CHB	SND+PR <160	PR >300	Syncope	Non-Syncope
n	698	267	216	84	60	409	344
Sens	44.4%	97.7%	100%	6.3%	100%	86.4%	87.9%
Spec	98.3%	62.0%	45.2%	97.1%	0%**	89.9%	79.6%
PPV	87.0%	90.6%	91.6%	33.3%	98.3%	94.2%	92.5%
NPV	87.9%	87.9%	100%	81.5%	-	77.6%	70.5%

*** only 1 patient did not RV pace >40% - this was not predicted. SND – sinus node disease; CSD – conduction system disease; CHB – complete heart block, PPV – positive predictive value; NPV – negative predictive value.*

Posters

68/Fusion pacing optimization with MultiPoint pacing in cardiac resynchronization therapy improves dyssynchrony of myocardial activation, an electrocardiographic imaging assessment

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr68

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Background: Cardiac resynchronization therapy (CRT) with MultiPoint Pacing (MPP) can improve electrical resynchronization of the left ventricle (LV) compared to conventional CRT. The SyncAV™ algorithm dynamically combines intrinsic atrioventricular (AV) conduction with pacing, improving electrical synchrony. The study objectives included assessment of the change in electrical synchrony with SyncAV and MPP, using non-invasive mapping with electrocardiographic imaging (ECGi).

Methods: Patients with LBBB (QRSd ≥150 ms), in sinus rhythm, scheduled for CRT device (MPP enabled CRT P/D, quadripolar LV lead) implantation underwent ECGi acutely. Mapping was done during intrinsic rhythm, nominal AV delay (140/110ms paced/sensed) and optimized SyncAV (individualized SyncAV offset minimizing QRSd) during: biventricular (BiV) and MultiPoint pacing (MPP). BiV activation time (AT) duration and AT dispersion on the LV (LVED=coefficient of variation of AT) were calculated.

Results: ECGi mapping was completed in 10 patients (80% male, mean age 66.4±16 years, 60% ischaemic, LVEF 30±6%, intrinsic QRSd 167±15ms) following SyncAV optimization. Compared to intrinsic conduction (AT: 136.1±15.8ms, LVED: 22.4±3.6%), AT duration was reduced using BiV SyncAV (104.2±20.4ms, p=0.027), MPP nominal (105.1±17.1ms, p=0.023) and MPP SyncAV (96.7±20.2ms, p=0.001); LVED was reduced only by MPP SyncAV (12.1±4.4ms, p=0.008). With respect to BiV nominal (119.0±31.2ms) MPP SyncAV reduced both AT duration (p=0.049) and LVED (12.1±4.4ms, p=0.049).

Conclusions: The duration and dispersion of LV activation may be reduced incrementally by SyncAV and MPP, whereas the combination of MPP and SyncAV achieved significant improvements in the dyssynchrony of activation.

Posters

69/Outcome of atrioventricular nodal ablation and pacemaker insertion for symptomatic atrial fibrillation: a real world data from a large tertiary center

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr69

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Background: Atrial fibrillation (AF) is the most common sustained arrhythmia in adult population with increased prevalence particularly in elderly. AV node ablation and pacemaker insertion (ablate and pace) is a widely accepted strategy for heart rate control in patients with symptomatic AF when rhythm control strategy fails or is deemed inappropriate. Patients usually receive a right ventricular pacing only type of pacemaker unless they got severe left ventricular systolic dysfunction. RV pacing is known to cause LV dysfunction in pacing dependent patients and might have adverse clinical effects on long term follow up. In this study, we aim to review the short and intermediate outcomes of patients who received ablate and pace strategy at University hospitals of Leicester between 2014 and 2019.

Methods: A retrospective analysis of clinical data of symptomatic atrial fibrillation patients treated with AVNA between 2014 and 2019 was conducted. Inclusion criteria were: 1. Symptomatic AF inappropriately controlled with other measures. Exclusion criteria: 1. Patients undergoing follow up in different hospitals where they were referred to our center for the AVNA only. 2. Patients lost to follow up. 3. Patients with incomplete data. Initial sample size was 262 patients; thirty patients were excluded due to the above reasons. Final sample size was 206 patients. The outcomes assessed by our study were annual mortality rate, hospitalizations due to heart failure and the need for upgrade to biventricular pacing system.

Results: Two hundred and six patients met the inclusion criteria, eighty-five (41.3%) were males and 121 females (58.7%); mean age was 74.01, SD ± 7.93 years. Median follow up was 35.6 ± 24.4 months. All patients had uncomplicated procedures with no prolonged hospitalization. Thirty-one patients (15.04%) died during follow up till present. Twenty-seven patients (13.1%) were hospitalized, at least once, due to worsening heart failure symptoms. Twelve patients (5.8%) had multiple admissions for decompensated heart failure post ablation. One hundred and eight patients (52.4%) had right ventricular pacing only while 98 patients (47.6%) received a biventricular pacemaker/defibrillator. Sixteen patients of the former (14.8%) had to undergo upgrade from PPM to CRT as a result of worsening heart failure symptoms. Additional twelve patients (11.1%) required hospitalization due to heart failure decompensation. The incidence for heart failure hospitalization or deterioration in NYHA class was (25.9%) in patients with RV pacing group versus (17.3%) in CRT group (P=0.02). There was no significant mortality difference between both groups.

Conclusion: Significant adverse outcomes were observed following ablate and pace strategy including mortality and worsening heart failure particularly in patients with right ventricular only pacing. Further prospective studies are needed to assess whether a physiological pacing like His bundle pacing might improve the outcome. ❑

Posters

70/HD grid mapping of complex atrial arrhythmias

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr70

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Introduction: Complex atrial tachycardias (AT) are frequently encountered in patients after left atrial catheter abaltions. We aimed to evaluate the HD grid technology for high-resolution mapping of these challenging arrhythmias.

Methods: Prospective observational study including consecutive patients undergoing de novo or redo catheter ablation for AT. Electroanatomical mapping during AT was performed using the Advisor HD grid catheter (HD Wave Solution), and a separate map was created using a conventional bipolar electrode configuration. The total number of collected points and the mean voltage amplitude at the critical isthmus for macro-/micro-reentry AT or at the earliest site of activation for focal AT were recorded and compared in both the maps (i.e. HD Wave Solution vs. standard bipolar configuration). Response to ablation and entrainment was used to confirm the correct location of the critical isthmus (post pacing interval <20ms).

Results: 40 patients (62.6±10.0 years, 70% male) were enrolled and a total of 42 ATs (mean cycle length 323±74ms) were mapped. The mechanism of AT was macro-reentry in 24 cases (57.1%), focal in 16 (38.1%), and micro-reentry in 2 (4.8%). The mean number of electrograms acquired per map was significantly higher for HD wave vs. standard bipolar (23251±12711 vs. 12812±8608, p<0.05). The mean voltage at the critical isthmus/earliest activation point was measured for a total of 22 left-sided ATs and was numerically higher for HD wave vs. standard bipolar (2.60±5.66 vs. 2.18±5.18, p=0.16). After 239±168 days of follow up, 72.5% of patients were free from AT recurrences.

Conclusions: The HD grid is an effective and useful technology for mapping complex AT. This system allows an increased mapping density and resolution compared to conventional bipoles, and as such might optimise the ability to localise critical isthmuses. Success rate of catheter ablation guided by HD grid mapping appears to be high. ❑

Posters

71/DC cardioversion for AF frequently fails to achieve sinus rhythm; temporary amiodarone therapy before first DC cardioversion may reduce the failure rate and the requirement for repeat cardioversion in selected patient populations.

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr71

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Background: DC cardioversion (DCCV) is commonly used to assess the symptomatic benefit of sinus rhythm (SR) when deciding whether to offer further rhythm control therapies such as AF ablation. However, acute failure of DCCV to achieve SR and early reversion to AF are common. This makes assessment of the symptomatic benefit of SR very difficult and many patients undergo repeat DCCV, often while taking amiodarone. We sought to identify factors associated with acute DCCV failure and early reversion to AF, and whether amiodarone therapy before first DCCV could reduce the failure rate in high risk populations

Methods: Retrospective analysis of electronic medical records of patients undergoing DCCV during a 12-month period from Jan-Dec 2017

Results: 239 patients underwent DCCV. Mean age 68 (range 31-89), 68% male. 68% underwent first DCCV, 23% DCCV 2, 7% DCCV 3, and 2% DCCV 4. Follow-up and echocardiographic data was available for 229/239 (96%) patients. 42/229 (18%) achieved SR for <1 week (25/42 acute DCCV failure, 17/42 reversion to AF after <1 week). Factors assessed for association with achieving SR for <1 week were: age >65, documented hypertension, documented obesity, AF duration >12 months, LA dilatation, LV systolic impairment and mitral regurgitation. Only two of these factors were significantly associated with achieving SR for <1 week: the presence of moderate / severe LA dilatation compared to normal sized / mildly dilated LA, and unexpectedly the presence of normal LV systolic function compared to impaired LV systolic function (see *Table 1*). There was no significant difference in the number of patients taking amiodarone within these two groups. 19 patients had previously undergone DCCV 1 and achieved SR for <1 week, who then underwent DCCV 2 while taking amiodarone. 12/19 (63%) of these patients then achieved SR for >1 week. There was no difference in LA dilatation or LV systolic function in this group compared to the general DCCV 1 population.

Conclusion: Achieving <1 week of SR after DCCV was common. It was associated with the presence of LA dilatation and, unexpectedly, normal LV systolic function. The LV function result may have been confounded by difficulty in echocardiographic assessment of LV systolic function in the presence of AF, but does add support to offering rhythm control therapies to selected patients with LV systolic impairment. Among patients who had previously achieved <1 week of SR after DCCV 1 who underwent DCCV 2 on amiodarone, most achieved SR for >1 week. This suggests that temporary amiodarone therapy before DCCV 1 in patients at high risk of early reversion to AF, such as those with LA dilatation, could increase the number who achieve >1 week of SR. This would reduce the requirement for second DCCV and may reduce time to AF ablation in this patient group. ❑

Table 1: Factors associated with achieving SR for <1 week

Factor	Number of patients in SR for <1 week	Number of patients in SR for >1 week	p-value for association
Normal or mild LA dilatation* Moderate or severe LA dilatation*	16 25	106 82	<0.05
Nomal LV systolic function** Impaired LV systolic function**	27 14	88 100	<0.05

**Assessed by LA volume and/or LA diameter*
***Assessed by Simpson's biplane and/or visual assessment*

Posters

72/A survey of current CRT practice within the UK & Ireland

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr72

L Broadhurst (Presenting Author) - Rotherham NHS Foundation Trust, Rotherham

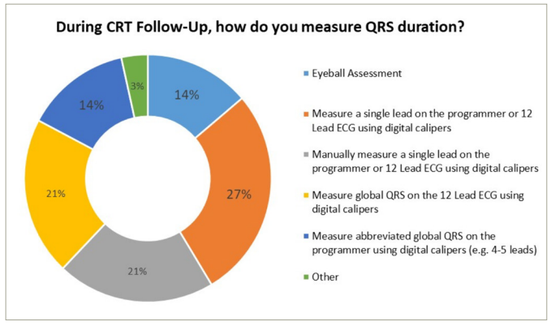
Introduction: It is widely accepted that the methods for optimising CRT vary in clinical practice. Electrical optimisation of CRT is becoming more popular with QRS narrowing and favourable ECG characteristics emerging as markers of success (1). The aim of this survey was to gauge current working practices of CRT within the UK and Ireland, with particular emphasis on the ECG.

Method: Voluntary completion of a short online questionnaire (8 questions) via Survey Monkey. This was circulated widely on two key social media platforms (Facebook & Twitter) and aimed at Cardiac Physiologists & Cardiology Clinicians. The survey remained open between 28/04/2020 and 15/05/2020.

Results: There were 31 responses representing 20 CRT centres within the UK and Ireland with wide geographical spread. 97% agreed that QRS narrowing was important in CRT. 84% measured QRS duration on implant, but only 55% measured QRS duration routinely at follow up. The type of ECG monitoring during CRT Implant varied between centres; 48% used 12 Lead ECG; 29% used limbs leads plus 1-2 chest leads and 19% used limb leads only. There was also variation in the type of ECG monitoring during CRT follow-up; 42% routinely used programmer ECG plus 12 Lead ECG; 16% used 12 Lead ECG only; 16% used programmer ECG only; 26% used programmer ECG with the addition of 12 Lead ECG on an individual basis. Measurement technique for QRS duration varied on implant; 35% measured a single ECG lead using digital calipers; 10% manually measured a single ECG lead; 35% measured global QRS on the 12 Lead ECG using digital calipers; 13% measured abbreviated global QRS on the programmer using digital calipers (e.g 4-5 leads); 3% used eyeball assessment and 3% did not measure QRS duration. Similar variation in the measurement of QRS duration was noted during follow-up (*Figure*).

Discussion: The results highlight wide variation in practice across the UK and Ireland. The optimal electrical characteristics of CRT are best assessed using 12 Lead ECG but this is not universally accepted in clinical practice. QRS duration is considered important during CRT, but there is inconsistency in both the type of ECG monitoring and the methods used to assess QRS narrowing in both implant and follow-up. Studies have shown that QRS duration can vary depending on the measurement technique, with global QRS considered superior to single lead measurement. CRT Optimisation clinics are growing in popularity and it may be beneficial to standardise the type of ECG assessment and also the measurement of QRS duration to ensure quality and consistency. ❑

Figure:



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Posters

73/Single high-dose oral amiodarone for pharmacological cardioversion of atrial fibrillation: A systematic review and meta-analysis

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr73

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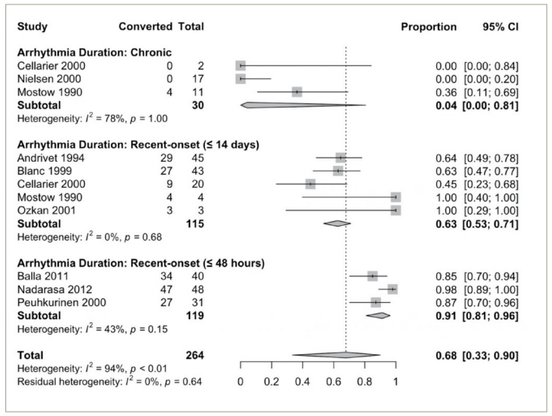
Introduction: Atrial fibrillation (AF) is the most frequently encountered sustained arrhythmia. Electrical cardioversion is incompletely effective yet requires sedation and in-hospital monitoring. A "pill-in-the-pocket" Class IC anti-arrhythmic drug approach is often successful in restoring sinus rhythm but is limited by contraindications and safety concerns. This systematic review assessed the efficacy of single, high-dose oral amiodarone in converting AF within 48 hours of drug administration.

Methods: Studies were identified in MEDLINE and Embase without language restriction from database inception through May 2020. The proportion of patients converted to sinus rhythm after receiving amiodarone was extracted from all studies. Additionally, the risk ratio (RR) of successful cardioversion was extracted from placebo-controlled randomized controlled trials (RCTs). Weighted proportions and RRs were estimated using random effects meta-analysis techniques. A continuity correction was applied to studies with either zero or all events.

Results: Six single-arm observational studies (n = 150) and three clinical trials (n = 114) were included. Patients receiving amiodarone were 63 ± 6 years of age and 57% male. Successful cardioversion was achieved in 91% (95% confidence interval [CI]: 81% to 95%) of patients with acute AF (within 48 hours of onset), 63% (95% CI: 53% to 71%) of patients with recent-onset AF (within two weeks of onset), but only 4% (95% CI: 0% to 81%) of patients with long-standing persistent AF (at least one year). Of the three clinical trials, two were placebo-controlled, single-blind RCTs that compared amiodarone (n = 71) against matching placebo (n = 71) in patients within 48 hours of AF onset. Oral amiodarone significantly increased the likelihood of successful acute AF conversion relative to placebo (RR = 3.32, 95% CI: 1.67 to 6.61, p < 0.01).

Figure:



Conclusions and Implications: A single, oral converting dose of amiodarone was largely effective in achieving sinus rhythm in patients with acute and recent-onset AF, but not long-standing persistent AF. The use of oral amiodarone as first-line therapy for recent-onset AF is appealing due to its convenience, cost-effectiveness, and acute safety profile. However, prior RCTs only included patients within 48 hours of AF onset. A placebo-controlled trial with expanded inclusion and adequate follow-up is warranted to determine the benefit of pill-in-the-pocket amiodarone for management of paroxysmal and acute persistent AF. ❑

Posters

74/Measuring the QRS – How hard can it be?! A method comparison study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr74

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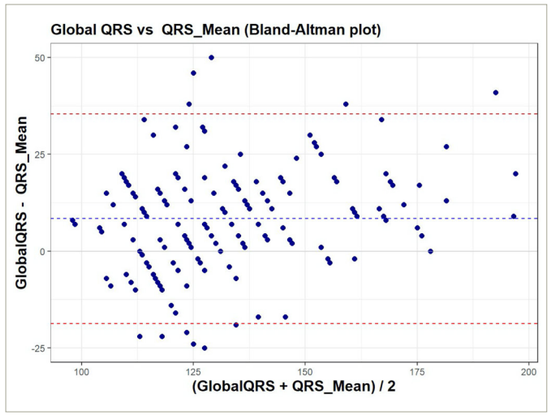
Introduction: Accurate measurement of QRS duration is crucial in CRT to identify eligible patients. Furthermore, QRS narrowing is emerging as a key marker of successful CRT with a growing evidence base of improved response and long-term survival. Despite this, there is no agreed technique to measure QRS duration and different methods are used in clinical practice. Global QRS duration has been shown to have improved accuracy over individual lead measurement. However, global QRS duration is less easily measured without specialist software, hence it is not routinely used in practice. This study compared whether an abbreviated global QRS measurement over 5 leads on the device programmer was comparable to individual lead measurements on the 12 lead ECG.

Methods: Comparison of ECG data for patients undergoing CRT implantation with standard indications. All were implanted with an Abbott CRT device. Individual lead QRS duration from the 12 Lead ECG was compared to abbreviated global QRS duration measured on the Abbott programmer. Up to 6 sets of ECGs were measured per patient. Abbreviated global QRS duration was measured using digital calipers in leads I, II, III, aVF and V5 *'from the earliest onset to the latest offset of the waveform in all leads'*. Individual lead QRS duration in all 12 leads was measured using digital calipers on the 12 Lead ECG via the Phillips haemodynamic system, together with the maximum (QRS_Max) and Mean (QRS_Mean) of the individual leads. 50mm/sec sweep speed was used as standard and gain optimised to improve measurement accuracy. Each measurement technique was applied by a blinded operator and verified by a third independent operator. Bland Altman analysis was used for comparison.

Results: In total, 158 sets of ECG data were compared. Importantly, there was considerable variation in QRS duration between the individual leads on the 12 Lead ECG, likely due to isoelectric segments specific to ECG vector. Compared to GlobalQRS, QRS_Mean averaged 8.4ms shorter with 95% confidence interval for the observed differences ± 21.7ms. This is shown as a Bland-Altman plot (*Figure*). Greater levels of variation were observed between GlobalQRS and individual lead measurements, e.g. GlobalQRS vs Lead I showed an average difference of 14.2ms with 95% confidence interval ± 35.6ms.

Figure:



Discussion: Accurate measurement of QRS duration is critical for electrical optimisation of CRT. This study found substantial variation between different methods of assessing the QRS duration. We recommend further research and development of practical guidelines to standardise clinical practice. Where single lead measurement is used, the target ECG lead should be specified to avoid inaccuracies that may affect device programming. We also recommend consistency of measurement technique between implantation and follow-up. The device programmer is commonly used in both settings and could be used to measure abbreviated global QRS duration to standardise measurement throughout the patient's journey.

References

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Posters

75/Leadless pacemaker implantation: single tertiary centre experience

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr75

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Background: Leadless pacemakers were developed as an alternative pacing modality in patients who cannot undergo transvenous pacing. Early data suggested a good safety and efficacy profile, however real-world data is limited.
Purpose: To report our single tertiary centre experience in leadless pacemaker implantation.
Methodology: All consecutive patients who underwent leadless pacemaker implantation at Liverpool Heart & Chest Hospital between July 2015 and May 2019 were prospectively included. Written informed consent was obtained from each patient. Femoral venous access was obtained using ultrasound guidance. A 27 Fr delivery sheath was inserted via the femoral vein using ultrasound guidance. The Micra™ VR (Medtronic) pacemaker was implanted into the right ventricular septum using fluoroscopy guidance. All procedures were elective and performed under general anaesthesia with planned overnight admission for observation. Clinical Audit & Effectiveness Group (CAEG) approval was obtained and practice in accordance with National Institute of Health & Care Excellence (NICE) guidelines. In total 28 cases were performed of which 71% were male, median age 68 years. Commonest pacing indications included complete heart block (61%), sinus node dysfunction (25%) and second-degree atrioventricular block (Mobitz type 2) (7%).
Commonest reasons for using a leadless pacemaker included previous system extractions (43%), vascular access restrictions precluding transvenous pacing (21%) and patient preference due to psychological concerns (18%).
Pacing check at the time of insertion were as follows:

- Mean threshold 0.56 @ 0.24ms ± 0.23
- Mean R wave measurement 12.2mv ± 5.2
- Mean impedance 747 ohms ± 190 (mean ± SD)

Acute procedural success was 100%. Acute complications included superficial groin haematoma (n=4), fever treated with antibiotics (n=1) and urinary retention requiring urethral catheterisation (n=1). All patients were followed up in pacing clinic with normal pacemaker function. There were no major long-term complications. One patient developed pacemaker syndrome and required a traditional transvenous DDD pacemaker. At one month follow up 25% were >90% paced, 50% were paced less than 3% and battery longevity was >3.01V (>8 yrs). Our real-world data suggests that leadless pacemaker implantation is a safe and effective alternative for patients who cannot undergo transvenous pacing. ❑

Posters

76/Responding to COVID-19: a device clinic perspective

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr76

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Introduction: Coronavirus disease 2019 (COVID-19) has presented unparalled challenges to the management of patients with cardiac implantable electronic devices (CIED). The need to limit exposure to healthcare staff and patients has increased reliance on remote monitoring (RM). This study summarises the change in workload of a device clinic in a Tertiary centre required to completely eliminate all outpatient activity in response to COVID-19.
Methods: In person (IP) follow-ups, RM follow-ups and remote transmissions (RT) received per-month to our device clinic were reviewed from institutional databases and manufacturer remote transmission data. Data was reviewed for the six months before the cessation of outpatient activity in response to COVID-19 (Sept 2019-Feb 2020; pre COVID) and the two months afterwards (April-May 2019; during COVID). Data from March was excluded due to COVID-19 restrictions beginning mid-way through the month. Referrals for procedures from our clinic to other hospitals during COVID were reviewed. Data are expressed as median (range).
Results: Of the 3562 patients (PPM 1828 patients, CRT-P 326, ICD/CRT-D 1408) reviewed annually at our centre, enrolment on RM increased from 97.4% to 97.8% ICD/CRT-D, 16.0% to 19.6% CRT-P and 1.6% to 6.5% PPM pre COVID to during COVID. RM was provided to all patients who required review following CIED procedures or those with hardware or clinical issues. There was a 26.9% reduction in total CIED follow ups (1813 per month (1293-2000) pre COVID to 1326 (1299-1353) during COVID) with a 98.7% reduction in IP follow ups (1335 per month (865-1565) to 15 (13-17)) offset by a 63.9% increase in RM follow ups (800 per month (650-920) vs 1311 (1282-1340)). IP follow ups were only performed for urgent MRIs in patients with CIEDs. PPM follow ups decreased by 77% (661 per month (495-759) to 150 (123-177)) and CRT-P by 53% (105 per month (85-144) to 50 (49-50)) whereas ICD/CRT-D follow ups remained similar to pre COVID levels (922 per month (629-1034) vs 917 (912-922), 0.5% decrease). Remote transmissions increased by 55% (969 per month (586-1010) pre COVID to 1505 (1488-1522) during COVID) with substantial increases for PPMs (19 per month (9-27) to 172 (168-175), 803% increase) and CRT-Ps (10 per month (6-25) to 58 (57-58), 475% increase). ICD/CRT-D transmissions increased by 55.3% (495 per month (586-1010) to 760 (145-536). Twenty patients were referred from our clinic for CIED related procedures at other hospitals (17 generator replacements, two right ventricular lead replacements and 1 right ventricular lead repositioning).
Conclusions: COVID-19 resulted in an immediate increase in CIED follow ups performed via remote monitoring due to the rapid provision of transmitters and the inability to perform IP follow ups. Significant changes to device clinics will be required in the post COVID-19 era including the re-establishment of reduced IP follow ups and an increased utilisation of RM. ❑

Posters

77/The effect of left atrial surface area, pulmonary vein driver density, total fibrosis burden and AF cycle length on PVI outcome: a virtual cohort study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr77

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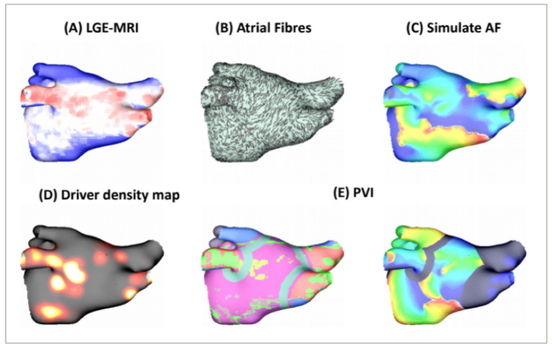
Introduction: Radiofrequency catheter ablation therapy for atrial fibrillation (AF) patients ranges from pulmonary vein isolation (PVI) to more extensive ablation strategies consisting of PVI together with multiple additional lesions. AF patients represent a diverse population requiring a range of different treatment approaches; no single approach is right for all patients, with many patients responding to PVI alone. Identifying these patients is a significant clinical challenge because it is difficult to determine the mechanisms sustaining AF in a specific patient. Virtual patient cohorts allow mechanistic investigation into the individual contribution of the anatomical, electrical and structural substrate to AF ablation. We aimed to construct and utilize a virtual cohort to investigate the effects of anatomy and fibrosis on AF and to predict PVI ablation response.

Methods: Cardiac contrast enhanced magnetic resonance angiogram and late-gadolinium enhancement magnetic resonance imaging (LGE-MRI) data for the left atria of 100 AF patients allowed us to create virtual models. Bifurcations in pulmonary veins (PVs) and the region over the mitral valve were clipped or removed. All the PVs were labelled along with the left atrial appendage. Epicardial and endocardial fibres from a human atrial ex-vivo DTMRI atlas were added to each of the virtual atria through the universal atrial coordinate system. The effects of fibrotic remodelling were included as changes in conduction velocity and ionic properties based on the LGE-MRI intensity distribution. Simulations were then run through the Cardiac Arrythmia Research Package simulator through pre-assigned initial start points. PVI outcome was classified as responder where there is a termination of AF or macro-re-entry, or non-responder where the AF continues. *Figure 1* shows the construction of the virtual cohort and simulation of ablation.

Figure 1:



Results: PVI outcome was 18% termination, 35% macroreentry (either around the junction of the left atrial body with the PV or a single spiral re-entry), and 47% AF (non-responders with multiple spiral re-entries). LA area was significantly smaller in the responder group than non-responder group (99cm^2 vs 117cm^2, p=0.003). Neither the total fibrosis burden (10.4cm^2 vs 7.7cm^2, p=0.1) nor the AF cycle length (206ms vs 206ms, p=0.26) was significantly different in the groups. The number of electrical driver sites in the PVs compared to the entire LA was higher in the responder group (0.34 vs 0.23, p=0.004).

Conclusion: LA surface area and pulmonary vein driver density are significantly higher in responder groups, meaning they are predictive of PVI success. This means smaller left atria and those with driver sites largely in the PVs are more likely to be treated successfully with PVI ablation. Total fibrosis burden and AF cycle length do not affect the success of PVI in AF patients. ❑

Posters

78/Relationship between pulmonary vein sleeve length on 3D anatomical mapping and left atrial size in patients undergoing atrial fibrillation radiofrequency ablation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr78

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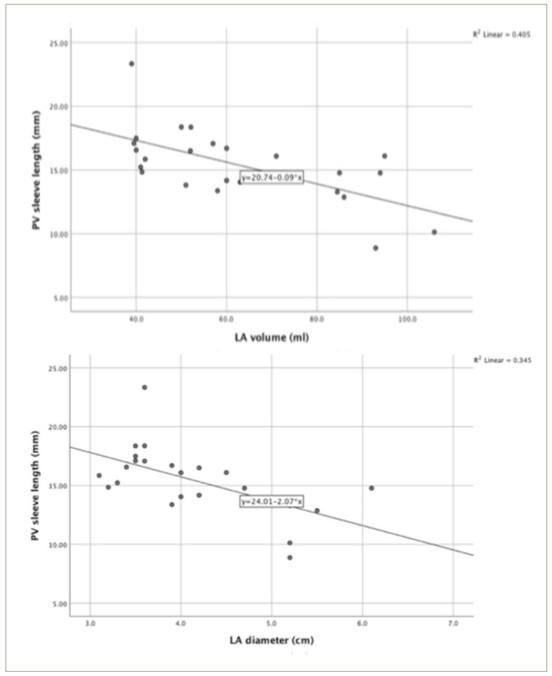
Background/Introduction: The role of pulmonary veins (PVs) in triggering Atrial Fibrillation (AF) is well established. The diameter and morphological features of the PVs in relationship to AF have been studied in animal and human models. The PV sleeve length has not been characterised in vivo in patients undergoing AF ablation. We hypothesised that left atrial (LA) dilatation is associated with shorter PV sleeve length due to atrialisation of the PV myocardium. We aimed to find whether there is a relationship between LA size and PV sleeve length in patients undergoing Radiofrequency (RF) ablation.

Methods: We measured the PV sleeve length in 25 consecutive patients undergoing RF ablation in our department. LA geometry and voltage maps were created using the CARTO 3D electro-anatomical mapping system with distal CS pacing. Persistent AF patients were cardioverted to SR. The bipolar mapping catheter was placed in each PV and the most distal electrical signal was marked on the map. The PV length from the ostium to the marked spot was measured both at the surface of the atrium and endoscopically using a clipping plane view with mean measurements calculated per PV. The left atrial size was measured on transthoracic echocardiography calculating the LA diameter in the long parasternal axis and the LA volume in the 4-chamber window.

Results: Out of the 25 patients (mean age 65 years, 44% female), 11 underwent ablation for persistent and 16 for paroxysmal AF. Mean LA diameter was calculated at 4.1 ± 0.8 cm and mean LA volume at 62.5 ± 21.3 ml. LA volume and diameter were statistically significantly higher in patients with persistent AF (75.9 ml vs 51.5 ml and 4.6 cm vs 3.7 cm respectively). The average sleeve size of each patient's PVs was not statistically different between patients with persistent and paroxysmal AF (14.38 mm vs 16.03 mm respectively, p=0.14). Examining each PV individually, only the right upper PV sleeve was statistically longer in patients with paroxysmal AF (18.8 mm vs 14.9 mm in persistent AF, p=0.014). A simple linear regression was calculated to predict PV sleeve length base on LA size. A significant equation was found (F(1,22)=14.97, p=0.001) with and R^2 of 0.405 for the LA volume and (F(1,21)=11.08, p=0.003) with and R^2 of 0.345 for the LA diameter. PV sleeve length decreased by 0.8 mm for every 10 ml of LA volume increase and similarly by 2 mm for every cm of LA diameter increase.

Figure 1 - Relationship between PV sleeve size and LA size in volume and diameter in AF ablation patients



Conclusion(s): We observed an inverse relationship between PV sleeve length and LA size both by volume and diameter. Although there was no statistical difference there was a trend towards shorter length PV sleeves in patients with persistent AF. Our findings suggest a possible process leading to PV sleeve atrialisation in patients with dilated LA that could influence the ablation strategy in this cohort. ❑

Posters

79/ATP and prevention pacing to reduce AF burden in pacemaker patients

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr79

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Background/Objectives: Pacemakers detect subclinical atrial fibrillation that may be a predictor of risk of stroke. Evidence for the efficacy of algorithms for prevention and treatment of atrial fibrillation is controversial. The aim is to systematically review current evidence on the efficacy of atrial anti-tachycardia pacing (a-ATP) and atrial prevention (APP) algorithms in the reduction of atrial fibrillation (AF) burden in patients with implantable dual chamber pacemakers.
Methods: Systematic searches were made using electronic databases: Scopus and Medline Ovid using the keywords: atrial anti-tachycardia pacing, atrial ATP, pacemaker, DDD, atrial fibrillation, AF, atrial flutter, advisa, enrhythm, atrial therapy, atrial preference pacing. Secondary hand searches were performed using the reference lists of relevant articles. Controlled trials investigating the efficacy of atrial anti-tachycardia pacing (a-ATP) and/or atrial pacing prevention (APP) algorithms in pacemakers for the reduction of atrial fibrillation were included. The van Tulder score was used to assess the methodological quality of the papers.
Results: Eight papers reviewed were of good to high methodological quality. Findings were mildly in favour of the efficacy of atrial prevention (APP) algorithms and moderately against atrial anti-tachycardia pacing (a-ATP). However, when programmed in combination, there is good evidence to demonstrate a reduction in atrial fibrillation (AF) burden.
Conclusions: The findings are conflicting. Newer generation, reactive atrial anti-tachycardia pacing (a-ATP) may be promising. However, further research is needed to assess the algorithms independently and to identify the clinical characteristics of the sub-group of patients that may benefit. ❑

Posters

80/Conduction block and the impact of multipoint pacing with fusion optimization in cardiac resynchronization therapy, an electrocardiographic imaging mapping insight

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr80

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Background: MultiPoint Pacing (MPP) CRT may improve electrical resynchronization of the left ventricle (LV). Optimization with SyncAV dynamically combines intrinsic atrioventricular (AV) conduction and pacing.
Objective: To assess regions of fixed and functional conduction block in patients with LBBB and the impact of MPP & SyncAV, evaluated by electrocardiographic imaging (ECGi).
Methods: Patients in sinus rhythm with LBBB, having CRT implantation (MPP CRT, quadripolar LV lead) underwent ECGi mapping; during intrinsic rhythm, nominal AV delay and optimized SyncAV (offset minimizing QRS duration) during biventricular (BiV), MultiPoint pacing (MPP) and LV only MPP (LVMPP). Activation times (AT) were calculated. Sites with conduction block were defined as difference in AT >50ms over 10mm.
Results: ECGi was completed in 10 patients (80% male, mean age 66±16 years, 60% ischemic, LVEF 30±6%, QRSd 167±15ms). Latest activating LV segments during intrinsic rhythm were heterogenous: basal-anterior 20%, anterolateral 30%, lateral 10%, inferolateral 30%, inferior 10%. LV lead positions were concordant to the latest activating segment in 50%; adjacent 20% and remote (≥2 LV segments) 30%. Two or more lines of block of varying distribution were present in all cases. Leads were concordant with lines of block in 0%, adjacent 60% and remote 40%. Area of block was reduced by LVMPP SyncAV from intrinsic ($p<0.05$). MPP was superior to BiV by resolving (functional) block in 50% of cases
Conclusion: Patterns of conduction block and latest activating segment were heterogenous. MPP vs BiV SyncAV reduced functional block in 50% of cases. Evaluation with ECGi mapping may be of value for complex CRT programming. ❑

Posters

81/Outcomes of patients with structural heart disease with VT storm directly to a tertiary centre experience

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr81

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Introduction: Ventricular tachycardia (VT) storm is a medical emergency characterised by clustered episodes of ventricular arrhythmia seen in patients with structurally abnormal hearts. Effective management of this complex, life-threatening phenomenon requires an understanding of arrhythmia mechanisms and the multi-modality treatment options. Although ablation can be life-saving, it is associated with significant risk in this sick cohort and considered patient selection is essential. Direct admission of patients with recurrent ICD shocks or incessant VT to a tertiary electrophysiology centre from the community can provide early expert-led decision-making.

Methods: VT storm was defined as three or more separate episodes of sustained VT within 24 hours, each requiring termination by an intervention. Incessant VT was defined as sustained VT for more than one hour, refractory to, or recurring promptly after, termination by intervention. These patients were eligible for direct admission to St Bartholomew's Hospital from the community under the Electrophysiology on-call service. Admissions via this pathway between August 2018 and February 2019 were screened. Additional cases were identified from a manual search of the hospital's catheter ablation database between June 2016 to August 2018. Cox regression analysis was performed to identify associations between pre-specified variables.

Results: 89 patients met inclusion criteria with an average age of 68±17 years, of whom 82 (92%) were male. Shock-free survival was seen in 62 (70%) patients at 12 months. 1-year mortality was 22.5% with no significant difference between patients presenting with incessant VT or VT storm (HR 1.84 [0.75-4.53] (p=0.19)). Patients selected to undergo ablation had similar outcomes at 1-year to those who managed non-invasively (HR 0.63, [0.25-1.59] p=0.33). CKD at baseline (HR 3.36 [1.07-10.59] p=0.04) and admission duration (HR 1.08, [1.03-1.14], p<0.01) were associated with mortality after multi-variate analysis. CKD was associated with mortality in subgroup analysis in patients with incessant VT or VT storm. We did not identify significant association with age or re-do procedure.

Table to show adjusted hazard ratio (HR) for mortality in patients presenting with VT storm

	Univariate		Multivariate	
	HR	P-value	HR	P-value
Age	1.04 (0.99-1.08)	0.113		
Chronic kidney disease	3.95 (1.55-10.07)	0.004	3.36 (1.07-10.59)	0.038
Diabetes	2.52 (1.01-6.27)	0.047	1.98 (0.68-5.76)	0.208
Hospital stay duration	1.04 (1.00-1.07)	0.040	1.08 (1.03-1.14)	0.004
Inpatient ablation	0.63 (0.25-1.59)	0.326		

Conclusion: Occurrence of VT storm is a poor prognostic marker and concurrent CKD may confer greater risk. Further extrapolation of findings and associations is limited as patient's management was non-random and based on informed decision-making. Although the outcomes between non-invasive and invasively managed cohorts was similar, these may represent very different patient groups, with patients at both ends of the disease severity spectrum potentially managed more conservatively. Outcomes are similar to other published International experiences and it demonstrates feasibility of early specialist engagement, in keeping with consensus recommendations. Further study and sub-group analysis could guide strategy choice and would be valuable to support decision-making. ❑

Figure:

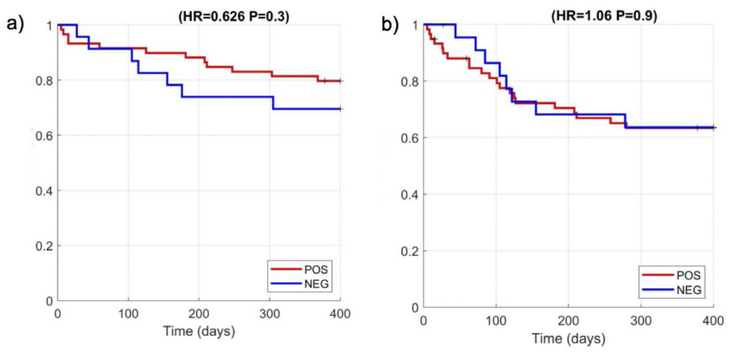

Figure 1: Kaplan-Meier survival curves to show the a) mortality outcome and b) prevalence of ICD shock of patients undergoing catheter ablation (POS) on index inpatient admission versus those who did not (NEG).

Posters

82/Outcomes after PVC catheter ablation: comparing technical, objective and subjective markers of success

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr82

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Introduction: Retrospective studies have demonstrated catheter ablation can reduce premature ventricular complex (PVC) burden. However, the association between objective and patient reported outcomes is unclear, with reporting on the latter particularly limited. The aim of this study was to measure and correlate objective and subjective outcomes of patients undergoing PVC ablation for symptomatic benefit.

Methods: This was a retrospective, observational single centre study. Acute procedural success was operator reported and defined as the elimination of the targeted PVC(s) at the termination of the procedure at least 30 minutes after the last ablation. Objective success was the absence, or greater than 50% reduction, of PVC burden on ≥24 hours Holter monitoring at follow-up compared to baseline. Subjective success was defined by the patient as the reported absence, or significant reduction, of their PVC-associated symptoms at follow-up. Logistic regression analysis was performed to identify association.

Results: 125 PVC ablation procedures were performed between November 2016 and July 2019 at our institution. The mean age was 52.5±15.7 and 67 (53%) patients were male. Symptom relief was the primary indication in 104 (83%). 66 (53%) had a structurally normal heart on echo or MRI with an average LV ejection fraction of 41±12% amongst those with structural heart disease. Acute procedural success was reported in 81 (65%) cases. No significant association was seen between the procedural success reported by the operator and subjective improvement in symptoms at follow-up. 48 (38%) patients had objective and subjective follow-up. Subjective success was reported by 39 (81%). Symptomatic improvement was associated with a greater reduction in PVC burden than in those who had unchanged or worse symptoms. (-88% [-100%- -60%] vs -76%, [-84%- -0%] p=0.045). Patients with symptomatic improvement also had a lower absolute PVC burden at follow-up (2.6%, [0%- 8%] vs 5%, [4%- 22%] p=0.041). The ability to discriminate positive vs negative symptomatic outcomes based on absolute PVC burden at follow-up was moderate (AUC=0.80).

Conclusions: Objective benefit after PVC ablation in our study is in line with published International registry outcomes. Subjective success was common, but patients should be aware that procedural success may not be indicative of final outcome. Objective evaluation of PVC burden may be of value in discriminating symptom origin but further study is required to better delineate any correlation. Although the study design may be vulnerable to confounder bias, the results support prospective, blinded study to provide evidence-based decision-making and consent as well as expectation management. ❑

Posters

83/Baseline NYHA class predicts response to cardiac resynchronisation therapy at 6-months

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr83

H Wilburn (Presenting Author) - Rotherham General Hospital, Rotherham; L Broadhurst - Rotherham General Hospital, Rotherham; S Smith - Rotherham General Hospital, Rotherham

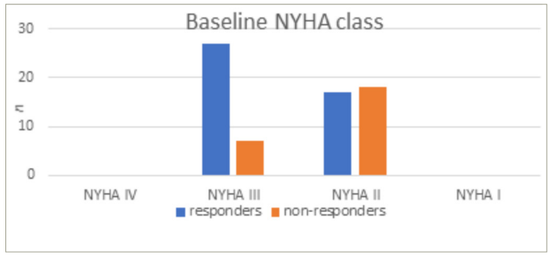
Introduction: Cardiac resynchronisation therapy (CRT) is used in select heart failure patients[1,2] to improve quality of life and mortality.[3-5] Some patients are reported to experience no benefit; so called 'non-responders'. This retrospective service evaluation aimed to determine the CRT response rate at Rotherham General Hospital (RGH), exploring which variables may be influencing response.

Methods: Medical records of CRT patients at RGH were reviewed. The following departmental definition of response was used: alive at 6-month follow-up with 2/3 of the following: ≥1 improvement in New York Heart Association (NYHA) class; ≥10% improvement in 6 Minute Walk Test; ≥15-point improvement in Minnesota Living with Heart Failure Questionnaire. Response was assessed for association with pre-defined variables.

Results: Of 69 patients included, response was 64%. Univariate logistic regression indicates that baseline NYHA class is the only significant predictor of response (χ2(1df, n=69) =7.288, p=0.007, OR=0.245, 95% CI [0.085, 0.709]). Patients with baseline NYHA III class were more likely to respond than NYHA II. Although no other variables showed statistically significant association with response, there was a trend towards higher response in females and with lateral LV lead position. There was also a trend towards a greater reduction in QRS duration in responders.

Discussion: CRT response at RGH is comparable to response rates reported in literature which used similar definitions of response.[6,7] More severe heart failure at baseline was a significant predictor of response. Evidence of the benefits of CRT in NYHA III/IV patients in terms of functional improvements and symptom relief at 6-months is consistent.[3,4] Based on data from larger trials, reported benefits of CRT in NYHA I/II patients appear to be more related to reduced hospitalisation and death over longer timeframes.[5,8] Consideration is being made to adjust the departmental definition of response to incorporate a 3rd group of 'non-progressors'. This may be a more accurate representation of CRT benefits in patients that have disease status halted or slowed, but not reversed. Of those variables which did display a trend towards a positive association with response, the lack of statistical significance may be attributable to the relatively small sample size of this project. This was

Figure 1: Baseline NYHA class of responders vs non-responders



namely female sex, lateral LV lead position and greater reduction in QRS duration. These three variables have previously been reported by others to be associated with a positive response to CRT.[6,9,10] ❑

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Posters

84/The benefit of opportunistic screening at Know Your Pulse community-based events to identify people with undiagnosed AF in Oxfordshire & Warwickshire

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr84

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Summary: Arrhythmias affect more than two million people every year in the UK (NHS, 2018). Atrial Fibrillation (AF) is the most common cardiac arrhythmia, with over 1.5 million people diagnosed, however approximately 500,000 individuals remain undiagnosed, and at risk of suffering a life-threatening, debilitating AF-related stroke. It is paramount that these individuals are anticoagulated effectively to reduce their risk of such a stroke. The Arrhythmia Alliance (A-A) Know Your Pulse campaign was established in 2010 following a need for community-wide awareness and education of the importance of knowing your pulse rate and rhythm. In response to the need to identify the undiagnosed person with AF, the 'Know Your Pulse' campaign has undertaken opportunistic screening of people at all of its events, using manual pulse rhythm checks and mobile ECG technology.

Aims: To demonstrate the benefit of opportunistic screening at Know Your Pulse community-based events to identify people with undiagnosed AF within Warwickshire & Oxfordshire.

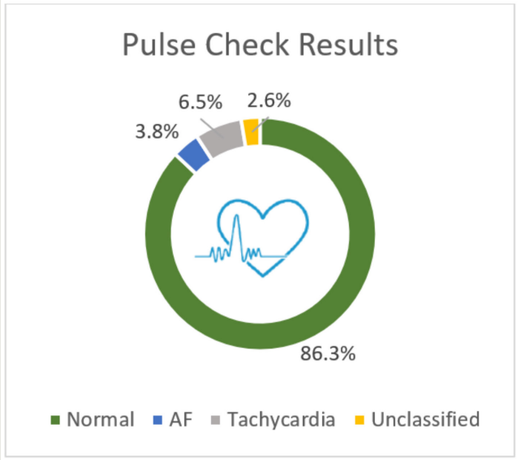
Methodology: Know Your Pulse (KYP) events are set up in high-footfall locations in towns/cities across the UK, publicised through local media, pharmacies and surgeries, where agreed. Attendees were offered a 30 second mobile ECG pulse check, using the AliveCor Kardia mobile single-lead ECG device. If an irregularity was detected, trained staff provided support and advice with A-A NHS approved resources for their information. If AF was detected, the participant was given an information form to share with their GP or healthcare professional. Signed consent was sought from each participant to record their data.

Results: During the first half of 2020, A-A and AF Association carried out KYP events across Oxfordshire & Warwickshire, taking 154 pulse rhythm checks. This opportunistic process identified 6 people with AF (3.8%), 10 people with tachycardia (6.5%), 4 people were unclassified (2.6%) and every other pulse check resulted in a normal reading (87.1%). Data collection has been hampered by the COVID-19 pandemic, due to government restrictions regarding lockdown. If restrictions are lifted further data collection will be undertaken later in the year.

Conclusion: Community-based AF awareness events, such as KYP, are an effective opportunistic screening tool to identify people with undiagnosed AF.

References – Can be provided upon request. ❑

Figure:



Posters

85/The COVID Lab Arrhythmia Procedures (CLAP) symptom audit

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr85

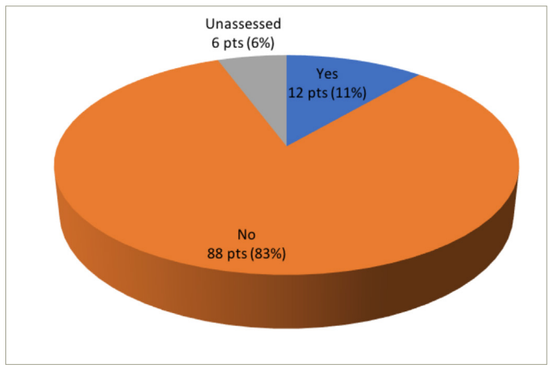
T Ganeswaran (Presenting Author) - Barts Heart Centre, London; R Mravljak - Barts Heart Centre, London; H Page - Barts Heart Centre, London; S Jones - Barts Heart Centre, London; C Monkhouse - Barts Heart Centre, London

Introduction: COVID-19 (C19) is a novel coronavirus characterised as a severe acute respiratory syndrome. The UK government advised the cancellation of elective procedures in March 2020 to reduce virus transmission and to increase intensive care capacity. Several risk factors, including cardiovascular disease (CVD), have been shown to increase vulnerability to C19. In light of new guidelines, we developed a C19 protocol where only emergency and clinically urgent cardiac rhythm management (CRM) procedures were performed and government guidance for PPE was followed. For procedures which posed a high risk of aerosolization i.e. general anaesthetic or high risk of CPR; respirators, visors, appropriate donning and doffing were utilized. This is not the case for the majority of arrhythmia procedures. We audited the prevalence of C19 symptoms in patients post discharge, hypothesizing that the patient's exposure to the virus would not increase, enabling us to carry out procedures safely.

Methods: We retrospectively audited patients admitted for emergency and urgent procedures to the arrhythmia Cath lab from 23rd March 2020 to 24th April 2020. Patients were contacted post-discharge via telephone and completed a survey with twenty-six close-ended questions, ten of which specifically addressed symptoms which show correlation to the virus.

Results: Our sample population consisted of 106 patients. 100 patients completed the survey (94.3%), out of which 65 of the patients (65%) were male. Mean age was 68 ± 16 years, mean BMI was 28.43 ± 6.15 kg/m^2, 62% of the patients were white, 10% were black, 5% were Indian/Asian and 23% were characterised as other. 90 patients underwent device procedures (90%) and 10 patients had EP procedures (10%). Average number of co-morbidities for the whole population was 1.92. After assessing patients' medical history, we found 17% of patients had COPD or other pulmonary condition, 12% had diabetes mellitus, 8% had chronic kidney disease, 6% of the patients were prescribed immunosuppressants and 1% had chronic liver disease, An age value of >70 years represented a moderate risk of C19 which applies to 51% of patients. Underlying CVD included coronary artery disease, inherited heart disease, cardiomyopathies, valvular insufficiency/repair, electrophysiological abnormalities and congestive heart failure, which affected 49% of the patients. As categorised via NHS UK, overall, 56% of our cohort had high risk factors and 44% had moderate risk factors. The results revealed that 88 patients (83%) had no C19 related symptoms post-discharge. 12 patients (11%) had mild C19 related symptoms; sneezing, wheezing, nasal discharge, hoarseness, mild cough and mild SOB (*Figure 1*). No patients experienced fever. Overall, 5 patients were tested for C19, all with negative results. One patient was re-admitted to hospital post discharge due to deteriorating HF and one patient died which was unrelated to C19.

Figure 1:



Conclusion: Of our cohort of at-risk patients, 92% had >1 risk factor, who underwent procedures in the cath lab, with only 11% experiencing mild potential C19 symptoms. No transmissions were confirmed with virus tests. However, this audit has limitations; the questionnaire was unverified to expedite the results during the pandemic, only 5 patients were tested post procedure and C19 status was unknown pre-procedure. Despite the limitations, this audit shows that whilst complying to the national guidance for PPE C19 transmission is manageable. ❑

Posters

86/Implantable cardioverter defibrillator complications in patients with hypertrophic cardiomyopathy at a tertiary centre

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr86

J Fox (Presenting Author) - Barts Heart Centre, London

Introduction: Hypertrophic cardiomyopathy (HCM) is the commonest inherited heart disease. Implantable cardioverter defibrillators (ICDs) are routinely implanted to protect against risk of sudden cardiac death (SCD) in those patients who meet criteria. Whilst the consequence of not having an ICD when needed is clear, the implantation of cardiac devices is not without short and long-term risks to the patient. We sought to evaluate the ICD complication rate in HCM patients and place them in context with the frequency of appropriate therapies delivered.

Methods: We retrospectively assessed consecutive patients who underwent ICD implantation between July 2016 and October 2018 and were coded as hypertrophic cardiomyopathy in the device database (MediConnect™). HCM diagnosis was confirmed by reviewing implant procedure notes, and only new device implants were included (excluding generator changes). Complications were described according to timing, with acute considered in the same admission, and late being post-discharge.

Results: Between July 2016 and October 2018, 136 HCM patients underwent ICD implantation, 127 (93%) for primary prevention of SCD. During 261.1 patient years of follow-up (mean 1.9 ± 0.7 years), there were 3 deaths, 2 from cardiac cause (myocardial infarction). 8 patients (5.9%) received appropriate therapies. 7 patients had both a shock and anti-tachycardic pacing (ATP), and one patient had ATP alone. 6 patients (4.4%) received an inappropriate shock. 4 patients (2.9%) experienced acute complication, including pericardial effusion / tamponade, a torn cephalic vein after difficult access, right atrial lead displacement/loss of function requiring revision, and finally high lead impedance with a new lead required. 6 patients (4.4%) experienced late complications, including right ventricular lead displacement/loss of function requiring revision (2), atrial lead displacement (2), wound infection requiring antibiotics (1), and high shock impedance at follow-up (1). Adverse ICD events (inappropriate shocks and / or device complications) were seen in 16 patients (12%) or 4.5%/year.

Conclusions/implications: Over a relatively short follow-up period, occurrence of appropriate device therapy was low. The adverse ICD event rate was in line with published data, but the relatively high occurrence of inappropriate shocks signals this is an important complication to discuss with patients given the lasting psychological impact of such an event. ❑

Posters

87/Eligibility for cardiac contractility modulation therapy in patients hospitalised with heart failure

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr87

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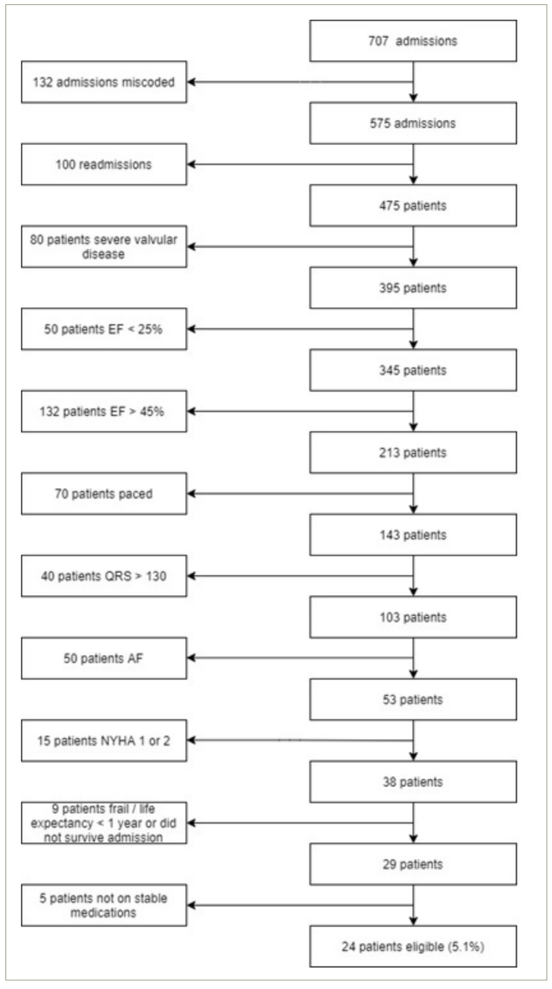
Background: Cardiac contractility modulation (CCM) is a new device based technology which applies non-excitatory electrical stimuli during the absolute refractory period, which enhances the strength of cardiac contractions. Increasing evidence exists suggesting that CCM improves symptoms in heart failure if various selection criteria are fulfilled. It is unknown how many people might benefit from this therapy. The aim of this study is to analyse an unselected sample of heart failure patients requiring hospital admission to establish what percentage of patients would meet the current criteria for CCM therapy.

Methods: Over one calendar year (2018) all patients admitted to two district general hospitals (Eastbourne District General Hospital and Conquest Hospital, Hastings) in the UK who were classified with a diagnosis of heart failure, were audited for eligibility for CCM therapy. The selection criteria were 1) EF 25-45%, 2) QRS duration less than 130 ms, 3) NYHA class 3 or 4 and 4) treated for heart failure for at least 90 days and on stable medications. Exclusion criteria included 1) significant valvular disease, 2) permanent or persistent atrial fibrillation, 3) biventricular pacing system implanted or QRS duration more than 130 ms and 4) patients not suitable for device therapy due to palliative treatment intent.

Results: 475 patients were admitted with heart failure during the study period. From this group 24 (5.1%) patients fulfilled the criteria for CCM therapy (*figure 1*). The mean age of patients was 70.8 ± 10.2 and the mean ejection fraction was 32.5 ± 7.4%. The majority of patients were male (70.8%) and the majority (75%) had ischaemic cardiomyopathy as the cause of their heart failure. There were no significant differences in age, QRS duration, gender, aetiology of heart failure, diabetes, COPD or CKD between patients with severe left ventricular (LV) dysfunction versus those with moderate LV dysfunction. Patients with severe LV dysfunction were significantly more likely to be hypertensive (10 (62.5%) vs 1 (12.5%), p=0.03).

Conclusion: Only 5.2% of all patients presenting with heart failure might benefit from cardiac contractility modulation therapy. This is a smaller proportion of the overall heart failure population than previously estimated. However, this population has no other current option for device therapy of their condition. This may have cost implications to the health service and may encourage the uptake of this novel therapy. ❑

Figure 1: Evaluation of all heart failure patients admitted in 2018



Posters

88/Underutilisation of DeFT Response™ optimisation in the ICD clinic

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr88

A Simpson (Presenting Author) - Manchester Royal Infirmary, Manchester; S Allen - Manchester Royal Infirmary, Manchester; S Rooker - Manchester Royal Infirmary, Manchester; C Cunnington - Manchester Royal Infirmary, Manchester; F Ahmed - Manchester Royal Infirmary, Manchester; A Zaidi - Manchester Royal Infirmary, Manchester

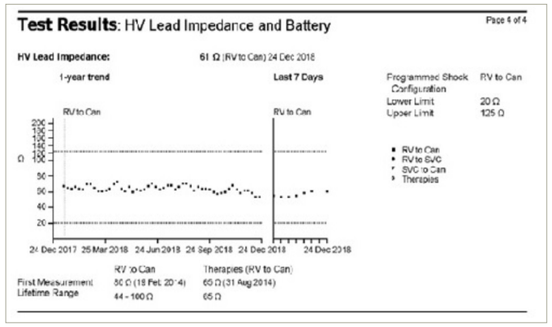
Introduction: Implantable cardioverter-defibrillators (ICDs) are conventionally programmed to deliver maximum energy shocks for the treatment of ventricular arrhythmias. DeFT Response™ is an algorithm available in Abbott ICDs that reduces the typical shock duration from 10.0 ms to 7.5-8.0 ms. This technology has been shown to reduce the risk of pro-arrhythmia, and has been successfully used in patients with high defibrillation thresholds. As implant centres move away from routinely performing a defibrillation threshold test at implant, DeFT Response™ programming is a safe alternative to conventional programming. Once DeFT Response™ is enabled, it is important for the ICD clinic to continue to re-optimise DeFT Response™ settings. Optimisation is based on the high voltage impedance (HVI) of the ICD system. A review was conducted to establish how many patients with Abbott ICDs had DeFT Response™ enabled, and how frequently these patients were re-optimised in our clinic. In addition, we investigated whether HVI measurements in clinic represented those seen on a day-to-day basis.

Method: Patients with Abbott ICDs implanted between January 2014 and October 2019 were identified. Patients with <2 years follow-up since implant were excluded to allow a suitable duration to track changes in HVI measurements. The HVI measurements from all scheduled in-clinic and remote follow ups were reviewed for each patient. The range of HVI measurements from scheduled checks (i.e. highest HVI – lowest HVI) was compared against the lifetime daily HVI range reported by the device in the "HV Lead Impedance and Battery" diagnostic, an example of which is shown in *Figure 1*.

Results: A total of 76 patients were identified with ≥2 years of follow-up data, 14 of whom had DeFT Response™ enabled. The lifetime range of HVI measurements seen on daily checks was higher than those seen on scheduled downloads (40.5 ohms vs 21.7 ohms respectively). This highlights the difficulty with maintaining day-to-day optimisation of DeFT Response™ parameters, as these are based on in-clinic measurements alone. Re-optimisation occurred in only 2 patients with DeFT Response™ enabled, even though it was indicated during the follow up of all 14 patients.

Conclusions: DeFT Response™ offers a theoretical benefit for patients with high defibrillation thresholds. Optimal programming is based on the HVI, but subsequent variations in this measurement can temporarily lead to programmed parameters being "sub-optimal". Re-optimisation of DeFT Response™ programming during clinic visits is important, but has been underutilised in our ICD clinic. The development of an auto-adapting DeFT Response™ algorithm would greatly aid in maintaining optimal programming at all times. ❑

Figure 1: HV impedance diagnostic, showing the current HV impedance, the baseline measurement, and the lifetime range of daily values



Posters

89/Electrical cardioversion for persistent atrial fibrillation in the era of catheter ablation: a real-world observational study

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr89

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Background: Electrical cardioversion (ECV) is frequently performed for persistent atrial fibrillation (AF). Although several large trials have suggested that rate control in AF may be non-inferior to rhythm-based strategies, individual patients may have better outcomes in terms of quality of life if sinus rhythm (SR) is achieved and maintained. This real-world, prospective observational study aimed to define the success rate and role for ECV in management of persistent AF in the era of catheter ablation.

Methods: Between January 2014 and August 2019, all patients who underwent electrical cardioversion for persistent atrial fibrillation at our institution were analysed. Clinical and echocardiographic baseline characteristics were used to identify independent predictors for AF recurrence at 12 and 24 months, using a Cox multivariable model.

Results: We identified 1,028 consecutive patients with persistent AF. 319 patients were excluded from the study because they either spontaneously reverted to SR prior to ECV or declined ECV. We evaluated 709 patients (mean age 71 ± 10.8 years, male 67.3%). Acute success was achieved in 96.8% of patients. Sinus rhythm at 12 and 24 months was seen in 26.6% and 14.3% of patients (p<0.0001), respectively. SR at 12 months was seen in 20.4% of patients with a left atrial (LA) diameter <4 cm and in 6.2% of patients with a LA diameter >4 cm (p<0.0001). At 24 months, SR was seen in 11.5% of patients with LA diameter <4 cm, while 2.8% of patients with LA diameter >4 cm were in SR at 24 months (p<0.0001). 10.8% and 22.5% of patients in SR at 12 and 24 months respectively underwent AF ablation. Predictors of SR at 12 months on a univariate analysis were normal LV systolic function and mild LV systolic impairment, OR 1.61 (1.08–2.45), p=0.021 and OR 0.5 (0.24–0.94) p=0.043, respectively. In addition, flecainide and sotalol therapy improved the chances of SR at 12 months, OR 2.87 (1.16–7.12) p=0.021, and 2.25 (0.98–5.05) p=0.049, respectively. Multivariate analysis revealed no positive predictors for SR maintenance.

Conclusion: Electrical cardioversion does not appear to be an effective long-term strategy for maintenance of sinus rhythm. Catheter ablation therapy may be the preferred strategy for patients with persistent atrial fibrillation. ❑

Posters

90/Focal activation patterns are a common phenomenon during persistent atrial fibrillation

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr90

CL Coyle (Presenting Author) - Imperial College, London; I Mann - Imperial College, London; J Chow - Imperial College, London; N Qureshi - Imperial College, London; M Koa-Wing - Hammersmith Hospital, London; Z Whinnett - Imperial College, London; PB Lim - Imperial College, London; DP Francis - Imperial College, London; N Peters - Imperial College, London; N Linton - Imperial College, London; P Kanagaratnam - Imperial College, London

Background: Applying conventional approaches of 'window of interest' setting and local activation time (LAT) assignment to map atrial fibrillation (AF) is difficult. We overcame this problem using an algorithm to time-shift for best match of adjacent electrograms, using these relative differences in timing to create wavefront activation maps. Understanding AF also requires the interpretation of both temporal and spatial domains. 'RETRO-map' was designed to assimilate all these factors.

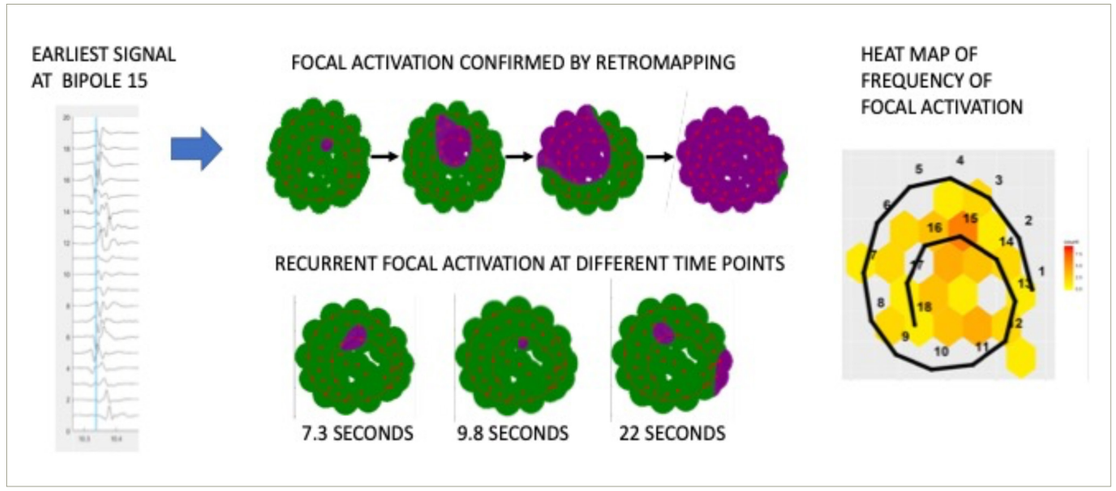
Objective: The RETRO-map algorithm was used to analyse incidence and frequency of focal activation in persistent AF.

Method: Using atrial bipolar electrograms recorded from a 20-pole double loop catheter across the left atrial endocardium, we validated the algorithm against manual activation mapping in 1373 uniform wavefronts. We then analysed a total of 522 episodes of focal activation from activation maps of 12 recording locations in the left atrium. 'Heat maps' of focal activity were created to summarise the frequency of focal activation at each recording location (summarised in *Figure*).

Results: Focal activation occurred in all recording locations (range 13 to 74 times). Each location demonstrated at least one locus of repeated focal activation. Overall, there were 92 single focal activations, 78 with 2-5 repeats, 39 with 6-9 repeats and 7 with ≥10 repeats.

Conclusion: Focal activation is a common phenomenon in persistent AF. It is not known how to differentiate drivers from passive episcardial-endocardial activation. ❑

Figure:



Posters

91/Compliance with BHRS implantable device report guidelines – a single centre experience

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr91

C O'Neill (Presenting Author) - Royal Brompton and Harefield NHS Foundation Trust, London; S Griffiths - Royal Brompton and Harefield NHS Foundation Trust, London; K Lascelles - Royal Brompton and Harefield NHS Foundation Trust, London; J Jarman - Royal Brompton and Harefield NHS Foundation Trust, London

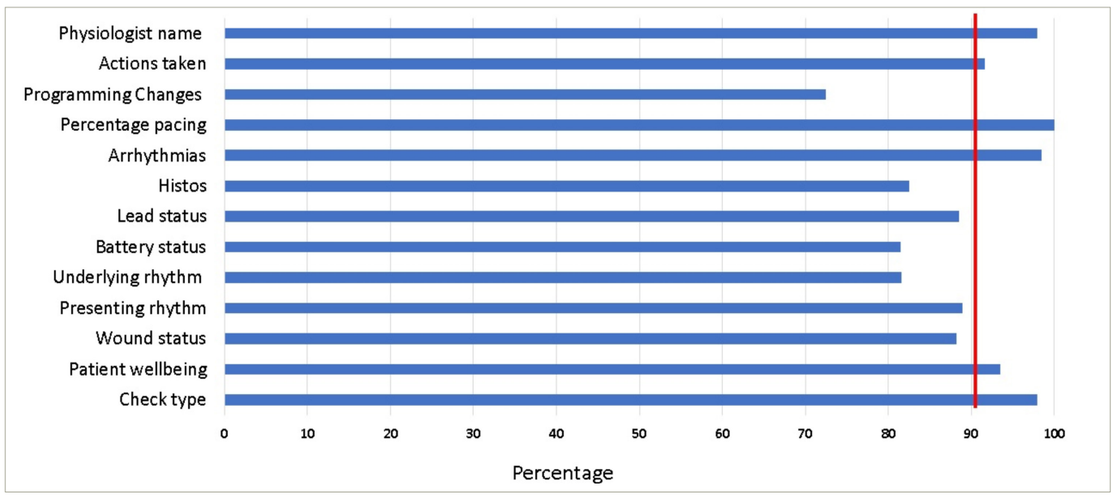
Introduction: In February 2020 the British Heart Rhythm Society (BHRS) published updated standards for the follow up of cardiac rhythm devices which included new standards for report writing following device interrogations. Creation and adherence to these guidelines can provide structured device reports to facilitate the safe delivery of high-quality patient care. These guidelines were used to create a departmental standard operating procedure (SOP) at our centre and disseminated amongst Cardiac Physiologists/Scientists. This study assesses compliance of device follow up reports to the departmental SOP.

Methods: All pacing follow-up reports over a five-month period were extracted from our Institutional implantable device database at the Royal Brompton Hospital (n=1791). A random number generator was used to select 200 follow up reports to include in the analysis. Follow up reports and programmer/transmission data were systematically reviewed to assess compliance with departmental SOP criteria including: follow up check type, documentation of patient symptoms, wound status, presenting rhythm, underlying rhythm, battery and lead status, pacing percentages, heart rate histograms, arrhythmia episodes/burden, programming changes and the individual who completed the report. Documentation of patient symptoms and underlying rhythms were excluded for remote monitoring reports.

Results: Of the 200 reports analysed, 102 were via remote monitoring (51%) and 98 were in person clinic follow up checks (49%). All follow ups were performed by Cardiac Physiologists or Cardiac Scientists. There was an overall compliance of 89.5% with local SOP reporting standards. Poor compliance was noted for documentation of the presenting rhythm (89%), underlying rhythm (81%) and heart rate histograms (82.5%). Compliance was higher for patient symptoms (93.5%), pacing percentages (100%), arrhythmias (98.5%) and the individual performing the check (98%). These criteria are all demonstrated in *Figure 1*. Of 17 reports for the first post implant check, 15 documented a wound assessment had taken place (88.3%). Forty-four reports (22%) documented programming changes or a requirement for further action (e.g. medication review/referral for other tests). Nine reports on remote transmissions required an action to be taken by the physiologist or clinician (8.82%).

Conclusion: In our single centre experience, there is a good compliance rate of follow up reports with departmental and national standards. Particular attention should be paid to accurate documentation of the presenting and underlying rhythm as well as heart rate histograms. An additional audit, with more post implant checks evaluating compliance with documentation of wound assessments would also be useful. Audits of device reporting compliance with SOPs should be completed regularly to ensure high compliance levels and the standardisation of reporting. ❑

Figure 1: Compliance levels to each individual criteria in the departmental SOP



Posters

92/Long QT syndrome type 1 mutant channels reported to have blunted channel activation following sympathetic modulation have preserved responsiveness to adrenergic stimulation when recorded using perforated patch

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr92

VS Rathod (Presenting Author) - Queen Mary University, London; SC Harmer - Queen Mary University, London; GS Salsbury - Queen Mary University, London; Q Aziz - Queen Mary University, London; J Cartwright - Queen Mary University, London; PD Lambiase - Queen Mary University, London; A Tinker - Queen Mary University, London

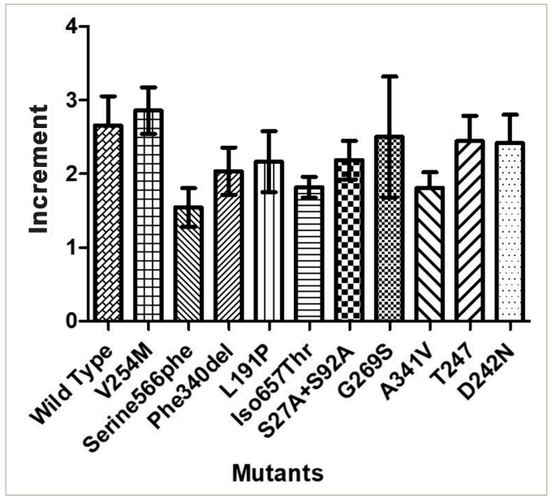
Introduction: Long QT Syndrome type 1 (LQT1) is caused by mutations in KCNQ1. KCNQ1 co-assembles with KCNE1 to underlie the slow delayed rectifier potassium current (I_{Ks}). The relative contribution of I_{Ks} to ventricular repolarisation is thought to be greater during sympathetic activation. Beta-adrenergic receptor stimulation leads to activation of Protein Kinase A (PKA) and subsequent phosphorylation of KCNQ1, resulting in augmentation of I_{Ks}. The significance of sympathetic influence on channel activity is corroborated by the finding that patients with LQT1 have a high incidence of ventricular arrhythmias during exercise. Various LQT1 mutations have been reported to blunt sympathetic mediated augmentation of I_{Ks} and it is postulated that this plays a key role in disease pathogenesis. In general, the effects of sympathetic stimulation on the wild-type (WT) channel or LQT1 mutant channels have been assessed using the whole-cell patch clamp configuration, which has the disadvantage of disrupting the intracellular environment and intracellular signalling pathways. In this study, to overcome this problem, we determined the effects of beta-adrenergic stimulation on the WT channel or non-responsive LQT1 mutant channels using the perforated patch whole-cell (PPWC) configuration.

Methods: Site directed mutagenesis was used to generate mutant channels. To replicate previous studies, we mimicked patient phenotype by transfecting cells Human Embryonic Kidney-293 cells with WT and mutant KCNQ1 (with green fluorescent protein fused at the C-terminus) along with KCNE1 to create a heterozygous form (WT+mutant). Homozygous mutants were created by transfecting mutant KCNQ1 with KCNE1. Currents were recorded at room temperature using the PPWC configuration 48-72 hrs after transfection. Isoprenaline (ISO) (100 nM) was used to activate beta-adrenergic receptor

Results: First, we validated our system by determining channel responsiveness when key PKA phosphorylation sites were removed by mutation of serine residues (S27A) and (S92A). At +80 mV the WT channel had a significant 2.67-fold increase in current density after exposure to ISO. Both phosphorylation site mutants (when expressed in homozygous form individually or combined- S27A, S92A or S27A/S92A) prevented a statistically significant response to ISO. Next, we established the responsiveness of S27A/S92A+WT, or the previously reported non-responsive LQT1 mutations G269S+ WT, A341V+WT and V254M+WT, when expressed in heterozygous form. Upon exposure to ISO the mutant channels displayed significant 2.19, 2.50, 1.81 and 2.86-fold increments in current density (at +80 mV) respectively (*Fig 1*). Interestingly, the fold-change response to ISO was not significantly different between the WT channel and mutant channels.

Conclusion: Our data postulates that these mutations have preserved channel activation during sympathetic stimulation, hence highlighting the importance of using the PPWC configuration when investigating responsiveness to beta-adrenergic receptor stimulation. ❑

Figure 1: HV impedance diagnostic, showing the current HV impedance, the baseline measurement, and the lifetime range of daily values.



Posters

93/Safety and feasibility of Micra transcatheter pacing system insertion in a non-surgical United Kingdom cardiac centre

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr93

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Introduction: The Micra TPS, a leadless single-chamber ventricular pacemaker, is increasingly preferred over the transvenous system. Its significantly smaller profile and fewer reported adverse effects, without compromising the pacing efficacy, makes it an innovative pacing device. We report the first sequential 75 Micra insertion cases in Northampton General Hospital (NGH) and 6 months post insertion data to investigate implantation success, pacing thresholds, deployment attempts and adverse effects. The data gathered aims to provide insight into the safety of Micra implant service offered by the only UK District General Hospital with no on-site cardiac surgery backup. A protocol was agreed for emergency transfer to a surgical centre if required. Vascular access ultrasound, echocardiogram and pericardiocentesis kit were available in the lab. Implanters were trained and proctored by Medtronic.

Methods: All patients who had a Micra implant attempted in NGH were included. Implantation and 6-month pacing data were recorded. Results are presented in percentage and compared to the Micra Post Approval Registry (PAR).

Results: There was successful implantation in 100% of the patients (age 76.58 ± 9.56), with 51 males (68%) (age 76.58 ± 9.56). 6 out of 75 patients are currently awaiting 6 month pacing interrogation. One patient died before the 6-month check, unrelated to the Micra implant. 97.0% (n=65) of patients had adequate pacing capture threshold (PCT) at the 6-month follow up meaning PCT ≤2 volts at 0.24 ms pulse width and the increase in PCT from implant to 6 months ≤1.5 volts. This correlates to the PAR study with 97% patients in this group. There were no long-term complications. There was only 1 major complication – a patient with a raised threshold immediately post-implant, settling to 1.88V at 6 months. There were no device infections, tamponade, major vascular complications, device dislocation or VTE. Pacing indications were AF with bradyarrhythmia (76.0%, n=57), Sinus or AV nodal disease (5.3%, n=4), infection (endocarditis, infected device removal) (8.0%, n=6), removal of conventional pacemaker for cancer radiotherapy (8.0%, n=6) and "twiddlers" syndrome (2.7%, n=2). There was reduction in fluoroscopy time (mean of 8.50 ± 1.03 min in first 10 cases to 4.80 ± 0.42 in the last 10) and our Micra deployment attempts (mean of 2.7 ± 0.83 in first 10 cases to 1.3 ± 0.15 in the last 10). In our initial 20 implants, we had 5 episodes of minor bleeding (25%) needing manual compression. We introduced double Z sutures technique with a resultant reduction to 1 episode of minor bleeding in the next 55 cases (1.8%).

Table:

	NGH Data n=73	MICAR PAR n=744
Demographics		
Diabetes	18 (24.0%)	196 (24.7%)
HTN	48 (64.0%)	454 (57.1%)
Renal Dysfunction	34 (45.3%)	152 (19.1%)
Major Complications		
Vascular(Arteriovenous fistula, Haematoma, Pseudoaneurysm)	0 (0%)	6 (0.75%)
Pericardial effusion	0 (0%)	1 (0.13%)
Infection	0 (0%)	2 (0.28%)
Pacing issues	1 (1.3%)	1 (0.14%)
Device dislocation	0 (0%)	1 (0.14%)
VTE	0 (0%)	1 (0.13%)

Conclusion: We are the first non-surgical centre / District General Hospital in the UK and the second in Europe offering Micra implantation. Over the course of implants, both our fluoroscopy time and number of Micra deployments have improved. This study, with a low number of complications corresponding to the primary outcomes in the PAR study, indicates non-surgical centre Micra implant with proctoring and protocols, is both feasible and safe. ❑

Posters

94/Same-day discharge after atrial fibrillation (AF) ablation is safe and cost effective

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr94

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Background: Cardiac centres are facing increasing demand for elective AF ablation, which has conventionally required overnight admission due to potential procedural complications. Routine care has included trans-thoracic echocardiography (TTE) one day after ablation to exclude procedure-related pericardial effusion prior to discharge. Local audit suggested this did not detect significant new effusion compared to on table TTE at the end of procedure. The safety and feasibility of same-day discharge after AF ablation has recently been reported in a small number of UK centres.

Purpose: To evaluate the safety and feasibility of same-day discharge in patients undergoing AF ablation, in addition to any associated cost saving.

Methods: A retrospective analysis was performed of all patients undergoing atrial fibrillation ablation from November 2017 until January 2020. During this period, patients underwent same-day discharge if procedure finished before 15:00, there were no procedural complications, on table TTE excluded the presence of a new pericardial effusion and there was no vascular access site complication after 4 hours.

Results: 191 cases were identified. Complete pulmonary vein isolation was achieved in 177 of 191 cases. Five cases were abandoned due to difficult trans-septal puncture and all returned for successful procedures under general anaesthetic (GA). Procedure time was less in patients undergoing cryo-ablation (126 and 134 minutes for local anaesthetic and GA respectively) than those undergoing radiofrequency ablation (242 minutes, all GA). Same-day discharge rates were correspondingly higher for patients undergoing cryo-ablation (70%) than radiofrequency ablation (49%). Same-day discharge was achieved in 114 of 191 cases (60%). Three patients (1.6%) were found to have a new pericardial effusion during or at the end of procedure (two cryo-ablation, one radiofrequency ablation). Two effusions were small and conservatively managed, one developed cardiac tamponade requiring pericardiocentesis. Of 114 patients who underwent same-day discharge, no patient subsequently developed symptomatic pericardial effusion. One patient required procedure-related re-admission (0.9%), due to pericarditic pain after four days and was discharged within 24 hours. No patient undergoing same-day discharge experienced a complication that would have been identified during an overnight stay. Based on an average local cost of £300 for an overnight admission, 114 patients who underwent same-day discharge was associated with a £34,200 cost saving.

Conclusion: In a single centre cohort of patients undergoing AF ablation, same-day discharge was safe with no evidence that overnight stay prevents readmission due to procedural complications, or that clinically significant pericardial effusion develops following on table TTE. Same-day discharge is technically feasible in a majority of patients and is associated with a bed occupancy reduction and cost saving. ❑

Posters

95/Ultrasound guided axillary venous access for cardiac device implantation: safety, efficacy, learning curve and radiation exposure

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr95

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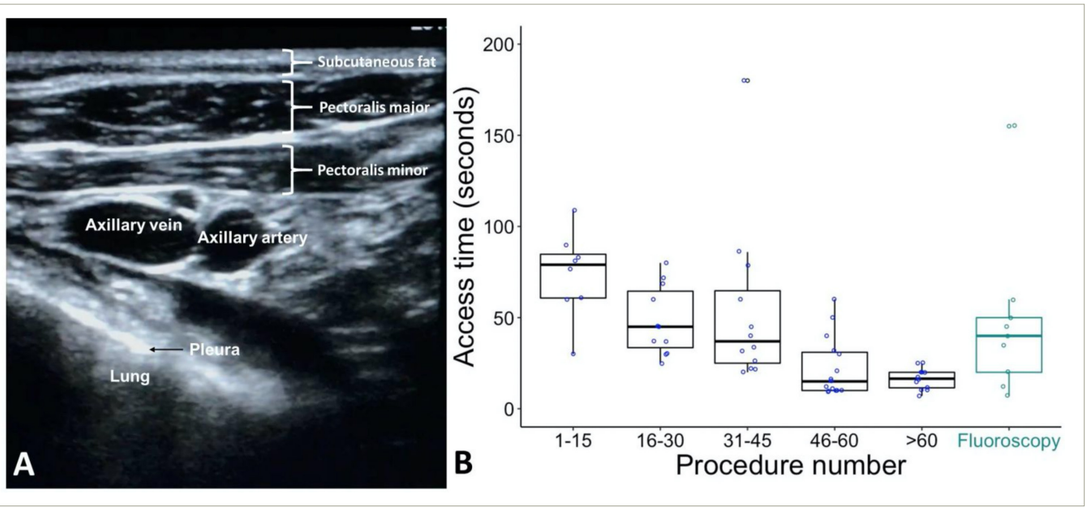
Introduction: There is limited experience of ultrasound (US) guided axillary vein access for cardiac electronic device implantation in the United Kingdom. We investigated the safety, efficacy, learning curve, and radiation exposure of US-guided axillary vein access.

Methods: US-guided axillary vein access was attempted in consecutive patients requiring cardiac device implantation between June 2018 and November 2019. Procedures were performed by an experienced electrophysiologist with no prior application of the technique. Access (needle to wire) and fluoroscopy times for US-guided access were compared to times for conventional fluoroscopy landmark-guided access in ten consecutively acquired control patients.

Results: US-guided axillary vein puncture was successful in 72 (97%) of 74 patients attempted (age 72 ± 16 years, 58% male), who required 147 punctures for one (8%), two (71%) or three (17%) leads, or upgrades (4%). In the two patients with unsuccessful US-guided access, the axillary vein was either not visualized (small calibre on subsequent venography) or situated deeply with prohibitively steep wire angulation. There were no peri-procedural complications related to venous access, including pneumothorax. US-guided access time ranged from 5 to 506 seconds per puncture. First US-guided puncture per patient was 30 (interquartile range, IQR: 17,60) seconds, and was similar to fluoroscopy guided access time (43, IQR: 24,58 seconds; p=0.45). Time for US-guided access decreased from 81 (IQR: 61,90) to 16 (IQR: 10,20) seconds from the first to the last fifteen procedures (p<0.001). 69 (96%) patients did not require fluoroscopy using US-guided access. 3 (4%) patients required 1 second fluoroscopy time after successful US-guided access to confirm 0.035-inch J wire position due to difficult passage. Controls required 29 (IQR: 17,56) seconds of fluoroscopy time for access, resulting in 0.25 (IQR: 0,1.4) mGy cumulative skin dose, and 0.03 (IQR 0.02–0.5) Gy.cm^2 effective dose area product, and equivalent to 0.64 (95% confidence interval: 0.16–1.45) chest radiograph radiation exposure.

Discussion: Ultrasound guided axillary venous access for cardiac device implantation is a feasible alternative to fluoroscopy guided access, and reduces radiation exposure. The learning curve time is acceptable, and the procedure is safe, even during training. ❑

Figure 1: Ultrasound-guided axillary vein access anatomy (A) and access times (B)



(A) Ultrasound images are obtained by placing a vascular probe below and perpendicular to the clavicle. (B) Access times are for first puncture per patient and decrease with experience. The first procedure required 506 seconds which is not represented on the graph. Statistically similar fluoroscopy guided access times for controls are shown in green for reference.

Posters

96/Impact of COVID-19 on ventricular tachycardia and atrial tachycardia events in patients with transvenous devices

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr96

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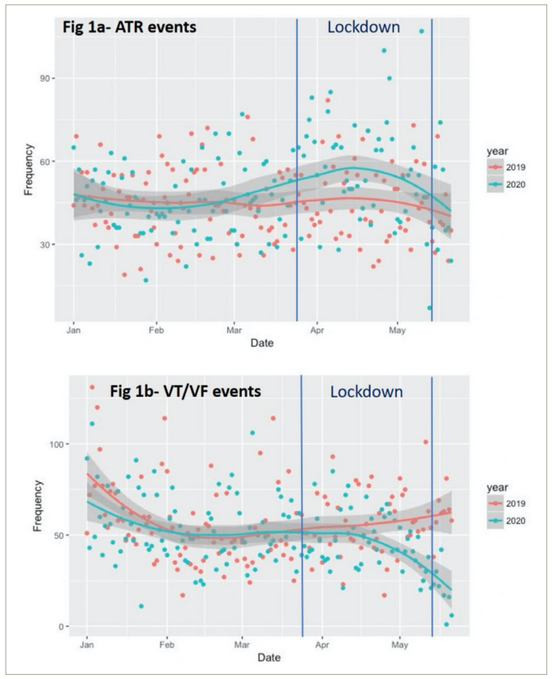
Background: COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It has resulted in a significant number of increased hospitalizations and excess deaths worldwide. Though reports regarding myocardial injury/inflammation relating to Covid-19 are known, little is known about larger scale effects of the virus on cardiac arrhythmias. Additionally, it is known that autonomics play a large role in the incidence of cardiac arrhythmias, and the temporal relationship of the national lockdown on cardiac arrhythmias has not well characterized. We aimed to assess the temporal trends of cardiac arrhythmias seen in the Barts device clinic and compare it to the previous year. Hypothesizing that there had been a decrease in the burden of Ventricular Tachycardia (VT).

Methods: We exported all arrhythmia events that have been transmitted to the Latitude remote monitoring platform (Boston Scientific) retrospectively between January 2020 to May 2020 and January 2019 to May 2019. We will compare trends against the previous year to exclude any seasonal variation.

Results: From the cohort of 2,110 patients on latitude remote monitoring, this produced 28,005 arrhythmia episodes in the study period. From January to 21 May 2019 there were 7,940 Ventricular events (Mean 56/day; SD ± 20) vs 7,017 events (Mean 49/day; SD ± 19) in the same time period in 2020. *Figure 1A* shows a lowess regression curve of ventricular events in 2019 vs 2020 with confidence intervals. It can be seen that events are largely similar until after lockdown when there are fewer ventricular events, Annova with Turkey post hoc correction (p=0.01, mean difference 19 events per day). From January to 21 May 2019 there were 6,380 atrial events (Mean 45/day; SD ± 13) compared with 6,690 events during the same time period in 2020 (Mean 49/day; SD ± 16). *Figure 1B* shows a lowess regression curve of atrial events in 2019 vs 2020 with confidence intervals. It can be seen that events are largely similar until lockdown there is an increase on atrial events, Anova with Tukey post hoc correction (p=0.02, mean difference 12 events per day).

Conclusion: These data suggest that ventricular events were largely similar pre-lockdown but decreased during the lockdown, while atrial events increased during the period of the lockdown before normalizing. This suggests that autonomic and psychological impacts of lockdown had an important effect on the frequency of atrial and ventricular events that presented to our joint VT clinic, and underlines the important role of the autonomic nervous system in arrhythmia. ❑

Figure:



Posters

97/Predictors of atrial fibrillation detection on cardiac monitoring in the first year after acute ischaemic stroke or transient ischaemic attack – a systematic review and meta-analysis

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr97

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Introduction: Extended cardiac monitoring increases atrial fibrillation (AF) detection after stroke but is unlikely to be available for all patients due to cost and may not be necessary for all patients. Identifying patients at higher or lower risk of AF detection after stroke may allow the duration of cardiac monitoring to be decided on a more personalised basis. We performed a systematic review and meta-analysis to identify variables associated with AF detection on cardiac monitoring after acute ischaemic stroke or transient ischaemic attack (TIA).

Methods: We followed the Cochrane Collaboration Guidelines and retrieved 12,722 studies from MEDLINE, EMBASE, Cochrane and Web of Science. After screening, 28 studies were selected and data on 54 variables were extracted. We assessed clinical variables and blood biomarkers at the time of index stroke/TIA and the outcome was AF >30 seconds detection in the first year after stroke/TIA. Comprehensive Meta-analysis software was used to generate an odds ratios and forest plot for each variable. Studies were assessed for quality using the Quality in Prognostic Studies (QUIPS) tool.

Results: The 28 studies included 9,871 patients and AF was detected in 1,104 patients (11%). Of the 54 variables assessed, 36 were not associated with AF detection, 14 were associated with higher odds of AF and 4 were associated with lower odds of AF. A summary of the main variables associated with higher or lower odds of AF detection is included in *Table 1*. Risk of bias was identified as low in 15 studies, medium in 10 studies and high in 3 studies.

Table 1: Summary of Main Variables Associated with Higher or Lower Odds of AF Detection

Variable	AF Detection Odds Ratio (95% CI)
Age	2.98 (2.50-3.56)
Heart failure	2.52 (1.77-3.59)
Ischaemic heart disease	1.86 (1.34-2.58)
Thrombolytic therapy for stroke	4.35 (1.48-12.78)
Brain natriuretic peptide (BNP)	7.69 (3.73-15.85)
C-reactive protein	2.19 (1.19-4.04)
Smoking	0.49 (0.37-0.64)
Transient ischaemic attack as index event	0.62 (0.42-0.91)
Triglycerides	0.58 (0.34-0.96)

Conclusion: We have identified clinical variables and blood markers that can stratify the probability of AF detection on cardiac monitoring after stroke. Our results may help to guide the duration of cardiac monitoring to detect AF after stroke on a more personalised basis. ECG parameters may also be associated with AF detection and should be evaluated in future studies. ❑

Posters

98/Impact of adenosine on mechanisms sustaining persistent atrial fibrillation: analysis of contact electrograms and non-invasive ECGI mapping

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr98

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Background: We evaluated the effect of adenosine upon mechanisms sustaining persistent AF through analysis of contact electrograms and ECGI mapping.

Methods: Persistent AF patients undergoing catheter ablation were included. ECGI maps and cycle length (CL) measurements were recorded in the left and right atrial appendages and repeated following adenosine administration. Potential drivers (PDs) were defined as focal or rotational activations completing ≥1.5 revolutions. Distribution of PDs was assessed using an 18 segment biatrial model.

Results: 46 patients were enrolled. Mean age was 63.4 ± 9.8 years with 33 (72%) being male. There was no significant difference in the number of PDs recorded at baseline compared to adenosine (42.1 ± 15.2 vs 40.4 ± 13.0; p=0.417), nor in the number of segments harbouring PDs (13 (11–14) vs 12 (10–14); p=0.169). There was a significantly higher percentage of PDs that were focal in the adenosine maps (36.2 ± 15.2 vs 32.2 ± 14.4; p<0.001). There was a significant shortening of CL in the adenosine maps compared to baseline which was more marked in the right atrium than left atrium (176.7 ± 34.7 vs 149.9 ± 27.7 ms; p<0.001 and 165.6 ± 31.7 vs 148.3 ± 28.4 ms; p=0.003).

Conclusion: Adenosine led to a small but significant shortening of CL which was more marked in the right than left atrium and may relate to shortening of refractory periods rather than an increase in driver burden or distribution. ❑

Posters

99/Heart rhythm emergencies receiving timely expertise

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr99

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Background: Heart rhythm emergencies require specialist expertise from cardiologists and cardiologists who specialise in heart rhythm disorders. Currently access to such services across Liverpool and the wider UK is insufficient. This has led to a number of high-profile adverse events where in some cases have resulted in avoidable morbidity and mortality. In particular, patients presenting with bradycardia emergencies may find themselves in a centre where there is no access to acute temporary pacing. Access to permanent pacing requires a long in hospital wait or a transfer to a second centre. Data suggests that temporary pacing systems placed by non-cardiologists have up to a 60% complication rate. Even when placed by a cardiologist, there is a complication rate of up to 20% (McCann 2006). Published data show temporary pacing systems carry a 10% risk of septicaemia and a 4.5% risk of pneumothorax or cardiac perforation (Betts 2003). In almost a quarter of cases, the implantation of the permanent system is delayed by a temporary pacing wire complication. Long wait for inpatient devices and the risks to patients have prompted the British Heart Rhythm Society (BHRS) in 2016 to produce a document that states early access to permanent pacing and temporary pacing on 24/7 basis.

Methods/Purpose: We analysed the retrospective data April 2018 to March 2019 in Liverpool region. Our key objectives were to assess the following:

1. Time frame from point of diagnosis to actual treatment
2. Complications and factors that prolonged the hospital stay
3. Non clinical factors that potentially delayed the treatment (logistics - transfers, bed availability, referral delays)

This will help us understand the logistic barriers to efficient and streamlined care.

Results: A total of 227 patients were admitted for non-elective pacemaker implantation. 82 patients with acute brady arrhythmias were transferred from a local district hospital without any pacing service provision. 80 out of 82 patients received a permanent pacing device within 36 hrs of admission at our tertiary centre. Remaining 2 received pacemaker within 72 hours. Complications, there were 2 lead displacements and 2 pneumothoraxes (1 required chest drain). Length of stay post procedure 0-22 days, mean ± SD 2.02 days. 43 patients were discharged or treated and returned within 24 hours. In this process we interpreted that the process of pacemaker implantation in acute brady arrhythmias can expedited by transferring the patient straight to the tertiary centre for urgent pacemaker implantation. This would the prevent the delay in getting the treatment to the patient and also avoid unnecessary complications whilst waiting for the transfer, prolonged stay in hospital and reduced procedure related complications.

Conclusion: In providing a primary pacing service 24/7, we realised the following are essential in setting up the service:

Reduced wait for patient's permanent implantation system	Timely elective list attendance Timely non elective transfer Weekend pacing lists
Reduce patients for permanent pacing transferred with temporary systems	Procedure performed in a stabilised tertiary care
Reduce number of transfers before receiving treatment	Emergency services to identify more direct transfer to Liverpool Heart and Chest

❑

Posters

100/Very long-term outcomes following catheter ablation in patients with persistent atrial fibrillation and heart failure: impact of early ablation versus a delayed selective strategy from the ARC-HF and CAMTAF trials

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr100

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Introduction: In addition to symptomatic improvement, catheter ablation (CA) of atrial fibrillation (AF) improves left ventricular systolic function and functional capacity when performed in selected patients with heart failure. The impact of CA on long term outcome in the heart failure cohort is poorly understood. Furthermore, the impact of early ablation for all patients versus a delayed selective strategy is unknown.

Methods: ARC-HF and CAMTAF were two similar UK single centre RCTs performed between 2006-2012. Both enrolled patients with persistent AF, symptomatic HF and left ventricular systolic dysfunction. Patients were randomised to CA or medical rate control and studied for 12 months. Subsequent to the study period patients underwent CA as clinically indicated. Contemporary longitudinal follow-up of patients enrolled in these trials was performed to determine the long-term outcomes. The primary outcome was a comparison of the long-term mortality in the two groups using multi-variate Cox regression analysis. The need for repeat CA was also assessed.

Results: 102 patients were included, with a mean age of 60 ± 11 years, 93 (91%) were male (*Table 1*). Baseline characteristics were similar between groups apart from small differences in baseline LV EF which was lower in the ablation versus medical therapy cohort (29.0 ± 8.7% vs 33.7 ± 12.0%, p=0.02). Mean follow-up was 7.0 ± 3.6 years. 29 (59.2%) patients initially randomised to the medical therapy cohort underwent AF CA after the trial period although median number of procedures remained lower over long-term follow-up (1 [0-2] vs 2 [1-2], p<0.01). 31 (30.4%) patients died during follow-up. Based on an intention to treat analysis, catheter ablation was not associated with a significant reduction in very long-term mortality after multi-variate analysis controlling for age and baseline LV EF (HR 0.81 [95% CI 0.39-1.67], p=0.57; *Figure 1*).

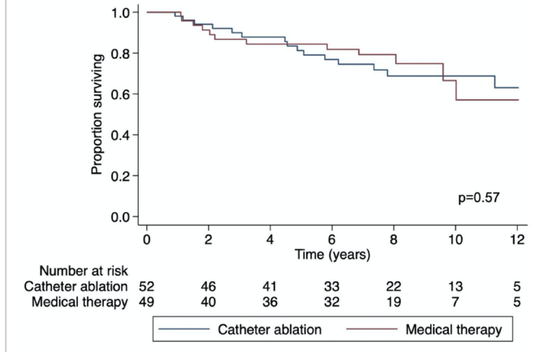
Conclusion: These long-term outcomes support the reasonable use of CA in selected patients with HF. Post-hoc follow-up after trial completion coupled with therapeutic crossover limits direct comparison of the two treatment pathways on an intention-to-treat analysis. However, these data suggest that an early ablation strategy produces similar long-term outcomes to a delayed selective approach to ablation in patients with persistent AF and heart failure. ❑

Table 1: Baseline characteristics of the two study groups. Cohorts based on index randomisation group

Characteristic	Medical therapy (n=50)	Ablation (n=52)	p-value
Age (years)	61.3 ± 9.3	59.3 ± 11.9	0.091
Male, n (%)	47 (94.0)	46 (88.5)	0.324
Coronary artery disease, n (%)	21 (42.0)	17 (32.7)	0.331
Hypertension, n (%)	17 (34.0)	16 (30.8)	0.727
Averaged ambulatory heart rate (bpm)	106 ± 32	103 ± 35	0.565
Peak VO_2 (ml/kg/min)	17.2 ± 6.5	17.6 ± 6.1	0.720
LV ejection fraction (%)	33.7 ± 12.0	29.0 ± 8.7	0.023

Figure 1:

Figure 1: Very long term mortality in the medical and ablation groups. cohorts based on index randomisation group



Posters

101/Justification for a translational model – direct comparison of electrophysiological responses to pharmacological modulation between ex vivo porcine and human hearts

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr101

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Background: Electrogram (EGM)-guided catheter ablation for atrial fibrillation (AF) has poor long-term outcomes and requires further research. Although clinical studies are considered the gold standard, they are restricted by low numbers of volunteers, safety of procedures, and ethical considerations. Small animal models lack clinical translatability due to their lack of similarity to human hearts. Analysis of intact explanted human hearts may overcome some of these limitations by maintaining a controlled setting whilst accounting for the morphological complexities that arise with EGMs in a clinical setting, such as motion artefacts and far-field signals. However, these studies are limited by restricted availability of intact donor hearts for research and variability of confounding factors. Alternatively, intact large animal heart models, and porcine hearts in particular, have extensive anatomical and physiological similarities to the human heart, suggesting their suitability for electrophysiological studies. We aimed to assess the similarities in EGM morphology between explanted porcine and human hearts to validate the *ex vivo* porcine model as a suitable translational step.

Methods: Unipolar EGMs were recorded from Langendorff-perfused porcine (n=2) and human (n=2) hearts, using a high-density grid mapping catheter (Abbott Medical). EGMs were recorded by sequential mapping of the left ventricle from 12 epicardial positions, whilst pacing at a cycle length of 1000 ms. Recordings were taken before (baseline) and after induction of gap junction (GJ) uncoupling via administration of a 1 mM carbenoxolone (CBX) bolus. For all hearts, at each ventricular position, one paced activation recorded from each of two electrode channels were manually annotated (total EGMs n=181) to calculate 21 times, voltage and gradient-domain features of the EGM.

Results: The percentage change from baseline following CBX administration was calculated for each morphological feature of the EGM. For all features measured, the magnitude of the effect of GJ uncoupling was not statistically significantly different between porcine and human hearts (P>0.05, for all features, one-way ANOVA).

Conclusion: These preliminary findings suggest that GJ uncoupling affects the morphology of EGMs recorded from intact porcine hearts and human hearts in a consistent manner. This specific electrophysiological validation builds upon the current general understanding of the high degree of anatomical and physiological similarities between porcine and human hearts. Therefore, these results suggest that EGMs from intact porcine heart studies can be extrapolated to the human heart and that the intact porcine heart is a valid model that could be used in addition to intact human donor hearts to increase sample size, or possibly as an addition/alternative to in vivo human studies, in future EGM-based investigations. ❑

Posters

102/Prevention of AF related stroke through appropriate treatment with anticoagulation – a new centralised pharmacist model in Haringey primary care networks

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr102

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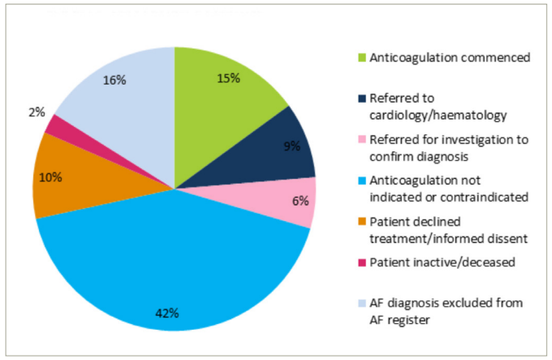
Introduction: Clinical pharmacists are a new workforce in Primary Care Networks (PCN) and can play a critical role in realising the NHS Long Term Plan ambition, principally through secondary prevention.[1] A centralised pharmacist model was implemented in the delivery of the NHSE Atrial Fibrillation (AF) patient optimisation demonstrator programme 2018-2020 aimed at preventing AF related stroke in Haringey.[2] The workforce supported practices to identify patients with undiagnosed AF and ensured patients with a confirmed diagnosis were prescribed appropriate anticoagulation. The focus was to reduce the treatment gap to match the national ambition of anticoagulation rate in high risk patients with AF.

Method: 13 clinical pharmacists covering 36 GP practices in Haringey received AF training. In-house education sessions, AF case review templates and AF detect, protect and perfect pathways were designed to support upskilling. The APL AF tool by UCL Partners helped identify AF patients with a CHADSVASC≥2 who were not anticoagulated or on suboptimal therapy. The baseline data for all the practices in Haringey were obtained from the NHS quality and outcomes framework (QoF) indicators. Clinical pharmacists reviewed patients not prescribed anticoagulation treatment or prescribed aspirin as monotherapy. The cases were discussed in the virtual clinics with the specialist anticoagulation pharmacist and GPs. Actions post virtual clinic were also completed by the practice-based pharmacist including patient follow ups for shared decision.

Results: In total, 807 AF case reviews were discussed in the virtual clinics for 36 practices. Of these reviews, 121 patients were commenced on anticoagulation, 70 patients were referred to cardiology/ haematology, 47 patients were referred for investigation to confirm diagnosis and 340 patients were contraindicated or not indicated to treatment (*Figure 1*). Overall, there was an increase in percentage of AF patients with a CHADSVASC ≥2 prescribed anticoagulant from 78% (2018/19) to 84% (2019/2020) in Haringey GP practices.

Conclusion: Improvement in anticoagulation rates and reduced inappropriate antiplatelet monotherapy will provide better outcomes for patients and demonstrates successful utilisation of the newly recruited primary care workforce. A centralised pharmacist model in primary care provided a standardised and sustainable borough wide approach in managing AF patients. The model also provided an opportunity for the pharmacists to upskill GPs and share learning with the multidisciplinary team to improve anticoagulation prescribing and ensure sustainability of the outcomes. Improved confidence of pharmacists in managing AF patients in primary care will continue to allow for better detection, protection and perfection of AF. ❑

Figure 1: AF case review outcomes



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Posters

103/A multi-centre experience of ablation index for evaluating lesion delivery in cavotricuspid isthmus dependent atrial flutter

European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr103

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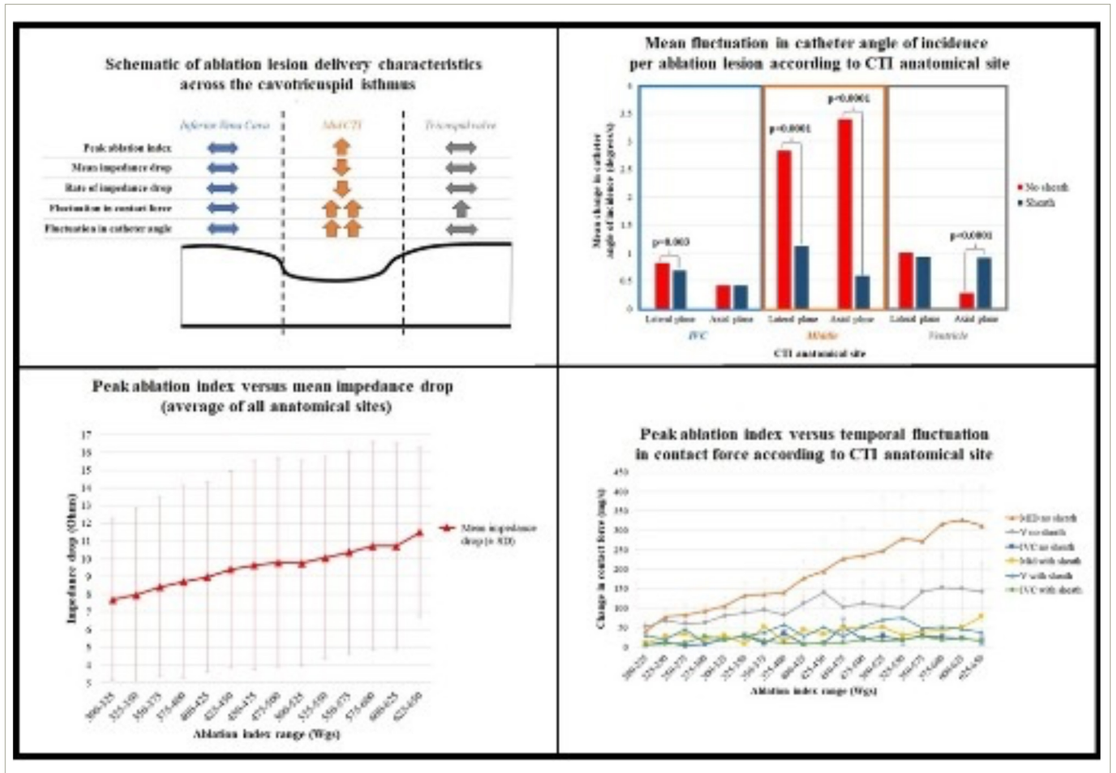
Introduction: Anatomical studies demonstrate significant variation in cavotricuspid isthmus (CTI) architecture. We hypothesised that ablation index (AI) may further our understanding of energy delivery across the CTI.

Methods: 38 patients underwent CTI ablation at two cardiothoracic hospitals. Operators delivered 682 lesions in total with a target AI of 600 Wgs. Ablation parameters were recorded every 10-20 ms. Post hoc, VisiTags were trisected according to CTI position: inferior vena cava (IVC), middle (Mid), or ventricular (V) lesions.

Results: There were no complications. 97.4% of patients (n=37) remained in sinus rhythm at 6.6 ± 3.3 months' follow-up. For the whole CTI, peak AI correlated with mean impedance drop (ID) (R^2=0.89, p<0.0001). However, analysis by anatomical site demonstrated a non-linear relationship Mid CTI (R^2=0.15, p=0.21). Accordingly, whilst mean AI was highest Mid CTI (IVC: 473.1 ± 122.1 Wgs, Mid: 539.6 ± 103.5 Wgs, V: 486.2 ± 111.8 Wgs, ANOVA p<0.0001), mean ID was lower (IVC: 10.7 ± 7.5 Ω, Mid: 9.0 ± 6.5 Ω, V: 10.9 ± 7.3 Ω, p=0.011), and rate of ID was slower (IVC: 0.37 ± 0.05 Ω/s, Mid: 0.18 ± 0.08 Ω/s, V: 0.29 ± 0.06 Ω/s, p<0.0001). Mean contact force was similar at all sites, however temporal fluctuations in contact force (IVC: 19.3 ± 12.0 mg/s, Mid: 188.8 ± 92.1 mg/s, V: 102.8 ± 32.3 mg/s, p<0.0001) and catheter angle (IVC: 0.42°/s, Mid: 3.4°/s, V: 0.28°/s, p<0.0001) were greatest Mid CTI. Use of a long sheath attenuated these fluctuations and improved ablation efficacy.

Conclusions: Ablation characteristics vary across the CTI. At the Mid CTI, operators should appreciate that higher AI values do not necessarily deliver more effective ablation; this may be explained by localised fluctuations in catheter angle and contact force. ❑

Figure:



Posters

104/Incidence, predictors and appropriateness of electrical therapies following CRT-D and ICD implantation: a real world UK experience

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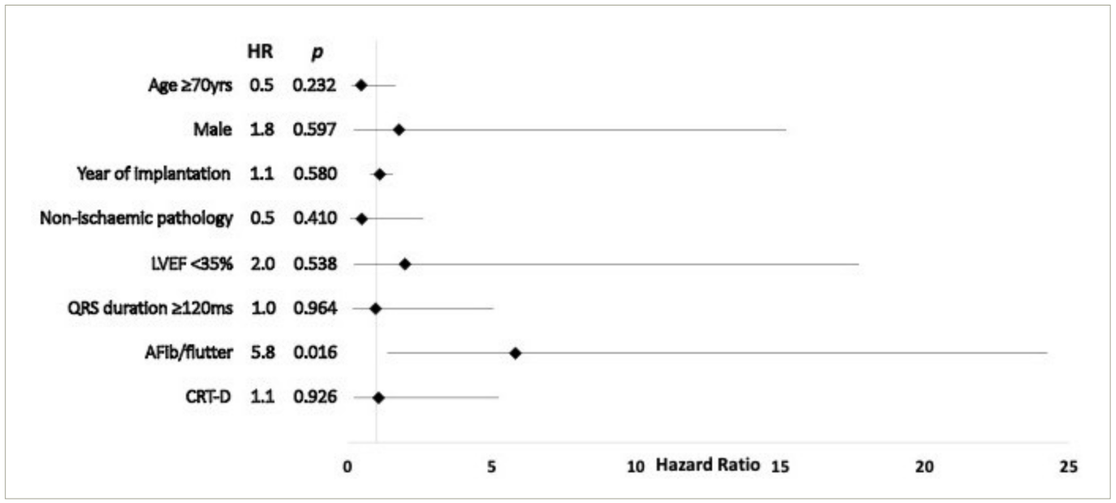
Introduction: Shockable ventricular arrhythmias account for one third of all cardiovascular deaths worldwide. Several randomised control trials have demonstrated ICD and CRT-D devices reduce mortality however the primary concern for both patient and physician remain inappropriate shocks. Aside from the pain and psychological impact, inappropriate shocks have also been independently associated with mortality in patient's recipient of an ICD. To the authors knowledge, there are currently no published UK observational studies in real-world clinical practice.

Methods: The study population consisted of 160 patients with ICD or CRT-D implants who were under regular review between 2011-2019 at the pacing clinic at Hereford County Hospital, UK. The appropriateness of any delivered shocks or ATP was determined by physiologist review of the device intracardiac electrograms, with adjudication from a consultant cardiologist as required. Electronic health records were reviewed.

Results: During the study period 93 ICD (68 single- and 23 dual-chambered) and 67 CRT-D recipients were under regular review for a median follow-up duration of 3.5 years (IQR: 2.2 – 5.1). Mean age at time of device implantation was 68 yrs; 87 patients (54%) were aged 70 yrs or over, and 122 (76%) were male. Pre-device cardiac status was as follows: 112 (73%) had an LV ejection fraction <35%, 104 (74%) had ischaemic pathology and QRS duration was <120 ms in 64 (51%). 50 (34%) patients had existing atrial fibrillation (AFib). Optimal target dose pharmacotherapy was achieved as follows: ACEI/ARB - 65 (47%), β-blocker/ivabradine - 64 (43%), MRA – 75 (58%). 11 (6.9%) patients experienced a total of 18 inappropriate shocks and AFib/flutter was the trigger in 10 of these patients (91%). 6 (3.7%) patients experienced more than one inappropriate shock. The cumulative event rate for first inappropriate shock was 5% at 1 year and 11% at 5 years. Compared to patients receiving appropriate shocks, patients inappropriately shocked were more likely to have pre-device AFib (100% vs 33%, p=0.012) and non-ischaemic pathology (33% vs 0%, p=0.034), and were more likely to be on optimal target dose β-blocker/ivabradine (100% vs 31%, p=0.009). 23 (14%) patients died during follow-up. Cumulative mortality rate was 5% at 1 year and 21% at 5 years. Cox proportional hazards models demonstrated pre-device AFib was an independent predictor of inappropriate shocks, and electrical therapy (HR 5.8, p=0.016, *Figure 1*). Pre-device characteristics and prior delivery of shocks and ATP did not predict all-cause mortality in multivariate analyses.

Conclusions: This is the first UK study to document the real word burden of inappropriate shocks in unselected ICD and CRT-D recipients; it is lower than published European cohorts and lower than seminal clinical trials. AFib/flutter is an independent predictor of inappropriate shocks and electrical therapy. Stringent anti-arrhythmogenic strategies including consideration of catheter ablation are required in this cohort. ❑

Figure:



Posters

105/Emergency out-of-hours complex cardiovascular implantable electronic devices

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Introduction: Emergency out-of-hours destination cardiovascular implantable device (CIDs) insertion has become established as preferable to temporary pacing waiting in anticipation of a working hours procedure slot. A frequent conundrum is the patient who may benefit from a more complex CID such as implantable cardioverter defibrillators (ICD) or cardiac resynchronization therapy (CRT), but who requires immediate pacing. Barts Heart Centre offers out-of-hours emergency complex device insertion where clinically indicated. We aimed to assess the safety of this approach.

Methods: A retrospective analysis of all out-of-hours complex CIDs was performed between June 2015 and May 2019 was performed. An "out-of-hours" case was considered to be a case where start time was after 1700 or before 0800 on weekdays, at weekends or on UK Bank Holidays, and which had been classed as an "emergency" implant. We excluded planned inter-hospital transfers, who were overwhelmingly stable patients, and any out-of-hours elective work.

Results: We identified 766 out-of-hours devices. Of those and after excluding pacemakers, 59 cases fulfilled the inclusion criteria; 24 ICD, 19 CRT-D and 16 CRT-P. Four displaced leads (1 ICD right ventricular lead and 3 CRT-D left ventricular leads) were identified on post-implant check. There were no other procedural complications. In addition, the skin-skin mean procedure time was 93 ± 44 minutes, with 10 ± 9.3 minutes mean fluoroscopy time (*Table*). Of note, complications, procedure and radiation times were comparable to previously published ranges.

Table. Demographic and procedural characteristics

Number of patients (N)	59
Age (years)	68 ± 14
Gender (male) (%)	83
LV function (normal, moderate, severe) (%)	13.6 / 25.4 / 61
Type of device (ICD, CRT-D, CRT-P) (%)	41 / 32 / 27
Complications % *(only lead displacement)*	6.8
Procedure time (minutes) *(in/out of the lab)*	130 ± 44
Skin-skin time (minutes)	93 ± 44
Fluoroscopy time (minutes)	10 ± 9

CRT-D/P: Cardiac resynchronization therapy with defibrillator/pacemaker; ICD: implantable cardioverter-defibrillator; LV: left ventricular.

Conclusions: Our experience demonstrates that implantation of emergency out-of-hours complex devices is safe and does not expose patients to higher radiation or procedure times. ❑

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