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ABSTRACTS
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Contents – Abstracts

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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 Arhythmia & 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 (DO with paroxysmal and 30 with persistent AF) and used to generate computational meshes. Human atrial ex-vivo DT-MRI 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 (CARM) 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 LGE-MRI intensity). Ablation lesion maps and transmembrane potential maps were generated for the resulting post-ablation models.

**Results:** Patient anatomy, patient-specific fibrosis properties and epicardial fibres 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 (CARM) 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 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 provides a visual representation of this model construction,

**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 mapped to a human atrial ex-vivo DT-MRI atlas (3 different views of the same model). (c) Fibrotic tissue mapped through LGE-MRI data registration. (d) AF simulated and phase singularity density maps generated. Models were ablated using one of six (a-f) ablation approaches. (e) A post-ablation map. (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 incorporation of patient-specific and ablation pattern specific metrics, rather than simply including ablation type.

**2/Enhancing mutant IKS channel activity by altering endogenous PIP2 levels and its interaction with KCNE1:**

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

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**Introduction:** Congenital Long QT 1 (LQT1) syndrome are predisposed to Polymorphic VT due to mutations in KCNQ1, leading to impaired channel activity. We initially transfected Human Embryonic Kidney (HEK) cells with a mammalian vector expressing KCNQ1 gene tagged with green fluorescent protein, along with KCNE1 to form the wild type (WT) channel. The cells were also transfected with a constitutively active PI(3)K (PKPl)A, which converts the phospholipid Phosphatidylinositol-4-phosphate to PKP, therefore increasing endogenous levels of PKP. To ensure the enzyme remains localised at the plasma membrane we attached it to CFP-PIPK and we co-transfected the cells with a cherry tagged lyn11–FBS construct that tethers to the plasma membrane. When these cells were perfused with Papacamycin it induced chemical demineralization of CF-PIPK to lyn11. We utilised an inactive PIPK as a control. Using a site directed mutagenesis kit we introduced mutations in KCNQ1 and to mimick Long QT 1 patients the mutants were co-transfected with WT KCNQ1 and KCNE1 to generate heterozygous genotype.

**Results:** In the presence of endogenous PI(3)K levels, the S270/S920 failed to demonstrate a statistical increase in current density compared to wild type. Pseudojanin (PJ) causes depletion of PI(3)K hence decreasing channel activity by perturbing channel activity. When PJ was expressed with KCNQ1 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 PI(3)K levels can rescue channel activity in mutant genotype therefore supporting evidence of its capabilities as a potential therapeutic tool. This modulation is independent of the PKA–CAMP pathway.

**Figure:**

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Young Investigators Competition – Basic Science

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

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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 the electrophysiological parameters, such as action potential duration (APD), effective refractory period (ERP) and AF propensity. SK3 channel activity was monitored using the 5K 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 (9.7 vs. 16.8 s, p=0.05). These AF events were also significantly shorter in duration (p=0.03). 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 1 June 2016 and 31 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.

Results: The designed 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 aortic valve prosthesis. Overall procedure-related mortality at 6 months was therefore 0.07% (2 patients), a total of 19 reported deaths (0.33%) occurred over 12 months follow up (Figure 1). 12 months survival was 99.6%.

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 per year), and therefore supports the argument that AF ablation should be concentrated in such centres.

Figure
You 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 BH BFA BRugada project

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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 by 24-hour ambulatory ECG could contribute to the diagnosis and risk stratification of BrS.

Methods: A total of 147 BrS patients (55 males, mean age 47±15 years, 10 with spontaneous diagnostically type 1 pattern, 22 with arrhythmic events - syncope, aborted cardiac arrest or appropriate ICD intervention) and 48 healthy subjects (55% males, mean age 29±11 years) with no previous cardiac symptoms, no family history of sudden death and no 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 (taking into account 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 and female). Table 1 shows the predicted ST segment amplitude values 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.

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

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
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<tbody>
<tr>
<td>00:00-06:00</td>
<td>2.68</td>
<td>2.63</td>
<td>2.73</td>
<td>0.12</td>
</tr>
<tr>
<td>06:00-12:00</td>
<td>2.65</td>
<td>2.45</td>
<td>2.63</td>
<td>0.23</td>
</tr>
<tr>
<td>12:00-18:00</td>
<td>2.65</td>
<td>2.45</td>
<td>2.63</td>
<td>0.23</td>
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<tr>
<td>18:00-24:00</td>
<td>2.65</td>
<td>2.45</td>
<td>2.63</td>
<td>0.23</td>
</tr>
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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 and female). Table 1 shows the predicted ST segment amplitude values 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 am...
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 2020 were enrolled in 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 transcriptions 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 in person 2-12 week check 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=11) 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.
- 93% (n=77) patients were consented to RM and received a RM transmitter on the day of implant.
- 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.

Figure 1

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 and 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 receiving upgrade, 54 were receiving downgrade and 22 had no change in pacing indication. 5/76 (6.6%) patients who were not seen in the clinic were also identified as having a change in indication through direct patient contact. 5/76 (6.6%) of patients who were not seen in the clinic had a change in indication identified through alternative visits.

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

<table>
<thead>
<tr>
<th></th>
<th>PPM</th>
<th>CRT-P</th>
<th>ICD</th>
<th>CRTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total seen in clinic</td>
<td>88 (55%)</td>
<td>1 (10%)</td>
<td>8 (5%)</td>
<td>9 (6%)</td>
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<td>Change in indication identified</td>
<td>7 (7%)</td>
<td>1 (10%)</td>
<td>5 (38%)</td>
<td>2 (14%)</td>
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<tr>
<td>Change in indication identified elsewhere</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>10%</td>
<td>2</td>
<td>2</td>
<td>1</td>
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</table>

<table>
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<tr>
<th>Change in pacing indication</th>
<th>PPM</th>
<th>CRT-P</th>
<th>ICD</th>
<th>CRTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change</td>
<td>90 (57%)</td>
<td>3 (15%)</td>
<td>7 (50%)</td>
<td>8 (57%)</td>
</tr>
<tr>
<td>Rate of change</td>
<td>9 (9%)</td>
<td>1 (10%)</td>
<td>1 (6%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td>Lead complications</td>
<td>7 (7%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>New onset</td>
<td>1 (1%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>2-3%</td>
<td>0</td>
<td>0</td>
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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):abstr10

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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 challenged 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 proportion of the daily face-to-face attendees. Of the 18,000 patients within the clinic, 85% 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 locally. 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 rescheduling protocol and changes in practice (Fig 1). Routine follow-up, CS called patients after triaging to explain their new schedule and rescheduling protocol and changes in practice (Fig 1). Routine follow-up, CS called patients after triaging to explain their new schedule and rescheduling protocol and changes in practice (Fig 1). Routine follow-up, CS called patients after triaging to explain their new schedule and rescheduling protocol and changes in practice (Fig 1). Routine follow-up, CS called patients after triaging to explain their new schedule and rescheduling protocol and changes in practice (Fig 1).

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 VDX 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. 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/Prediction 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


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. A centralised pharmacist model was implemented in the delivery of the NHS atrial fibrillation (AF) patient optimisation demonstrator programme 2018-2020 aimed at preventing AF related stroke in Haringey. The workforce supported practices to identify patients with undiagnosed AF and ensure 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 education and pharmacist review.

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 94% (2019/2020) in Haringey-GP practices.

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 patients in primary care will continue to allow for better detection, protection and perfection of AF.

References
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 procedures 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 continuing to COVID-19 with vulnerable patients advised to shield at home. Patients were 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 to 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/relatives preference. One foilary advisory had to be admitted due to prematurely triggering ERI. Three patients had their procedures done locally instead. Ten further patients have been deferred 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 surgical 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 (RTT) was constant at 50 days.

**Discussion:** Adaptations to this service involved multiple teams working together to maintain patient safety. This involved changing pre-admissions and Cardiac Surgeons. 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 RTT was indifferent. Collaborating with colleagues internally across 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>
<thead>
<tr>
<th>Categories for admissions</th>
<th>Criteria</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Very urgent or inpatient</td>
</tr>
<tr>
<td>2</td>
<td>Urgent</td>
</tr>
<tr>
<td>3A</td>
<td>Time dependent, not urgent benefit of ERI</td>
</tr>
<tr>
<td>3B</td>
<td>Time dependent, not urgent benefit of COVID</td>
</tr>
<tr>
<td>3C</td>
<td>Not time dependent e.g. reveal</td>
</tr>
</tbody>
</table>

**Figure 1**

Number of device procedures vs requests

---

**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 ICD 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 1/2 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 (Figure 1). Of the 134 patients that received remote only follow up a total of 61317.50 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 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. Patients would be best suited to this follow up schedule.
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 modeling 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 expenditure of AF in 2020 for each of the assumed increases of 3%, 4% and 6% projected annual increase in AF prevalence amongst the population was applied.

Conclusions: Focusing on 2020 and direct costs alone, AF is predicted to cost between 1.1-1.6% 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.

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 period. 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 (66.4%) were performed using cryoablation. 21.4%, 6.1% and 16% of ablations were performed using radiofrequency ablation, microwave, and cryoablation respectively. The proportion of procedures performed using cryoablation increased year on year from 22% in 2015, 58% in 2016, 52% in 2017 and 72% from 2018 to April 2019. 96.0% 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 more likely to 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).

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%).

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.

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 [73-80] years, 64.2% female) who underwent successful LAA occlusion with the Amulet device at our centre between November 2014 and March 2017.

Results: Median CHA 2DS2-VASC and HAS-BLED scores were 4 (4-5) and 2 (2-3), respectively. 49 (66.7%) 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 aspirin, 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%), aspirin 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.
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°C 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 patients (73.2%; 95% CI 66.9-79.2%). 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 patients (73.2%; 95% CI 66.9-79.2%).

Conclusion: Second-generation cryoballoon ablation 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, ongoing electrical mapping results in short procedure times, thus potentially increasing catheter lab capacity.

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 (ech) prior to specialist cardiologist input, in patients whom they suspect have heart failure, based on symptoms and raised N-terminal pro-BN-Peptide (NT-proBNP). 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 NT-proBNP 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 (≥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 48.6% were male. Overall, diagnostic yield for HFrEF was 20.4% vs 36.7% in GpA vs GpB patients (p=0.001). In GpA, there were 140 patients with AF and 14% without AF. The median NT-proBNP levels 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 NT-proBNP was 2019 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 NT-proBNP 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 NT-proBNP 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 NT-proBNP 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 NT-proBNP.
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(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 success and 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 <4 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, CHA2DS2-VASc 1.6 ± 1.4). Cardiovascular hospitalizations were reduced by 42% (99 to 57, p=0.0015) and cardiovascular morbidity was reduced by 62% (77 to 29, p<0.0001) after ablation (Figure 1). The 57 post-ablation cardiovascular hospitalizations included 35 repeat ablations in 33 subjects (10%).

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.

20/Dynamic high-density functional substrate mapping improves outcomes in ventricular tachycardia ablation
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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 ablation. 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 AT/ VT were enrolled from six 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 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 VT or ICD shocks vs 40% 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 mm² vs 6.4 mm² 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/CART therapy with SP mapping vs standard institutional protocol. Patients were matched for Age: SP vs Institutional: 67.2 ± 9.0 vs 68.5 ± 5.2, p=NS and 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, p<0.05).

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 historical institutional cohort of patients who underwent VT ablation.
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 #4 coronary catheter inside a sterile 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 CO₂ 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 effusions 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 prostamine in one of the patients who had received heparin, and spontaneously in the remaining cases. There were no other epicardial access complications.

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.
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. 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 CHA2DS2-VASc was greater in patients with abdominal obesity compared to those without abdominal obesity (2.1 - 4 vs 2.1 - 3, p=0.01). 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 1). 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=0.035). Anderson obesity was found to be an independent predictor for AF recurrence (HR 1.14, 95% CI 1.00 - 1.30, p=0.035).

Conclusion: Abdominal obesity as indicated by waist circumference was associated with a greater burden of concomitant diseases and an increased risk for AF recurrence. There was a positive correlation between abdominal obesity and AF recurrence in the long-term follow-up after catheter AF ablation.
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 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 IIa). 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 cardiologist consult 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 II 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 207 patients had block at the level of the AV node - 36 of these patients also fulfilled the class IIa criteria for His-bundle pacing 202 patients (16% of the total) had a sole class Ib indication for His-bundle pacing.

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:

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

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/QTc, Tpe/QTc, Tpe/T or Tpe/Tc ratios) in obesity. Owing to greater thoracic coverage, body surface potential mapping (BSMP) 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 BSMP at rest and during recovery from exercise to assess whether BSMP 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 23.8±0.9) individuals at rest and 2 minutes following exercise. QTc was defined as the standard deviation of QT intervals (QTSD).

Results: Obese individuals had significantly prolonged QT (380±25 vs 367±26, p<0.0001), QTc (404±24 vs 379±21, p<0.0001) and JTc (309±22 vs 288±22, p<0.0001) intervals at rest compared to normal-weight individuals. There were no differences in the JTc or Tpe intervals or the Tpe/QTc, Tpe/QT, Tpe/QTc, Tpe/Tc JTc and Tpe/Tc ratios between the groups. There were no differences in the QTSD between obese and normal-weight individuals 12-lead ECG (19±3.4 vs 19±4.2, p=0.05) or 252-lead BSMP (20±5.7 vs 19±3.3, p=0.50). 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. BSMP 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.

Body surface potential mapping is no more sensitive than 12-lead ECG for measuring ventricular repolarisation in obese individuals.
Oral Abstracts – Arrhythmia Mechanisms

27/A comprehensive assessment of atrial arrhythmogenesis in ASD patients

Oral Abstracts – Arrhythmia Mechanisms

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

Background: Uncorrected atrial septal defects (ASD) are associated with atrial arrhythmias however the bi-atrial arrhythmia substrate, and as 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 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.

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36 ASD and 36 control patients underwent bi-atrial CMR imaging. Right atrial fibrosis burden was greater in ASD patients with atrial arrhythmias than those without (P=0.034).

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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

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 chemotactic protein-1 (MCP-1) was significantly higher at 72 hours of SAT culture (469 ± 79 arbitrary units, a.u) compared with 24 hours (245 ± 2037 a.u, p = 0.0199) and 48 hours (425 ± 2087 a.u, p = 0.0438). 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 ± 1033 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 culture 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.

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

Background: Freedom from AF following ablation remains at around 40% even with the addition of electrogram guided procedures alongside pulmonary vein isolation. Gap junctional (GJ) connexin proteins have been established as being determinants 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 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=25) and porcine (n=8) hearts using a Langendorff system and high-density grid catheter (Abbott Medical). All hearts were paced at cycle lengths (CL) between 300-1500ms and administered 1mM carbamazepine (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=278120), 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=49533).

Results: The average prediction accuracy on the validation dataset was found to be 90%, with BL accuracy at 94% and CBX at 88%. Precision was 99% BL and 92% 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 +55.6%, EGM Duration -2.6%, Amplitude +10.0%, QR Interval -98.9%, Q point Amplitude -23.7%, S-Point Amplitude -24.1%, RS Gradient +123.9%, 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.
Over a mean follow-up of 1.9 ± 0.7 years, there were 3 deaths, 2 from underwent ICD implantation, 127 (93%) for primary prevention of SCD.

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.

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 (99%) 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 cephhalic 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%) received an inappropriate shock. There were 4 procedural complications (2.9%), including a pericardial effusion / tamponade, torn cephhalic 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%) received an inappropriate shock. There were 4 procedural complications (2.9%), including a pericardial effusion / tamponade, torn cephhalic 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%) received an inappropriate shock. There were 4 procedural complications (2.9%), including a pericardial effusion / tamponade, torn cephhalic vein after difficult access, right atrial lead displacement/loss of function requiring revision, and finally high lead impedance with a new lead required.

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.

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

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). 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 epidermidis 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.
**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. 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<0.001) 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<0.001). Mode 5 also showed significant reduction in QRSd when compared to Modes 1 (p=0.05), 2 (p<0.01) and 4 (p=0.01).

**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 to 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, with previous clinical trial data. CCM therapy provides a potential new basis 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 of 10 patients who met the inclusion criteria (EF 25-45%, NYHA class ≥3 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 Minnesota Living with Heart Failure Questionnaire (MLHFQ) scores over the follow-up period.

**Results**: The mean age of the patients was 65.8 ± 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<0.04) and quality of life as measured by the MLHFQ improved significantly from 56.3 ± 19.6 to 34.0 ± 21.8 (p≤0.01).

**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.
Results: A total of 323 TAVI procedures were performed during this study period. 60 patients were excluded for having a permanent pacemaker (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 post procedure PPM. 

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.

Table: 

<table>
<thead>
<tr>
<th>Subject Categories</th>
<th>China</th>
<th>EMEA (n = 170)</th>
<th>Total (n = 187)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micra</td>
<td>62.1%</td>
<td>60.9%</td>
<td>61.9%</td>
<td>0.012</td>
</tr>
<tr>
<td>HeartRhythm</td>
<td>68.3%</td>
<td>68.6%</td>
<td>68.4%</td>
<td>0.035</td>
</tr>
<tr>
<td>21.8%</td>
<td>21.8%</td>
<td>21.8%</td>
<td>21.8%</td>
<td>0.012</td>
</tr>
<tr>
<td>19.6%</td>
<td>19.6%</td>
<td>19.6%</td>
<td>19.6%</td>
<td>0.012</td>
</tr>
<tr>
<td>18.8%</td>
<td>18.8%</td>
<td>18.8%</td>
<td>18.8%</td>
<td>0.012</td>
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<tr>
<td>15.9%</td>
<td>15.9%</td>
<td>15.9%</td>
<td>15.9%</td>
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<tr>
<td>13.5%</td>
<td>13.5%</td>
<td>13.5%</td>
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</tr>
<tr>
<td>10.4%</td>
<td>10.4%</td>
<td>10.4%</td>
<td>10.4%</td>
<td>0.012</td>
</tr>
<tr>
<td>7.4%</td>
<td>7.4%</td>
<td>7.4%</td>
<td>7.4%</td>
<td>0.012</td>
</tr>
<tr>
<td>6.3%</td>
<td>6.3%</td>
<td>6.3%</td>
<td>6.3%</td>
<td>0.012</td>
</tr>
<tr>
<td>5.6%</td>
<td>5.6%</td>
<td>5.6%</td>
<td>5.6%</td>
<td>0.012</td>
</tr>
<tr>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>0.012</td>
</tr>
</tbody>
</table>

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

Background: Voltage thresholds for ventricular scar definition are based on historic data collected using catheters with widely spaced bipole. 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 0.1-0.5 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 on historic data collected using catheters with widely spaced bipoles. Modern multipolar mapping catheters were used to map the left ventricular free wall. 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 identification.

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 mV (IQR 0.59-1.03). The 90th centile for dense scar was 3.72 mV and for scar borderzone was 1.24 mV.

ROC analysis AOC 90% suggested the optimal cut off for endocardial dense scar was 0.45 mV (Sensitivity 88%, Specificity 81%) (Figure 1A). ROC analysis AOC 91% suggested the optimal cut off 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:

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

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 5,144 procedures of which 1,278 (23%) were redo 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%), pericardial 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.

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.
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 confounding 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 AF-positive patients and 50 AF-negative patients (200 hours total). AF was diagnosed of the CNN was done with CAM ECG recordings from 1,227 patients, 474 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 was diagnosed if variable p-wave morphology was present for at least 30 seconds. 

Results: 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.
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;14(Suppl. 1):abstract 40

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 (LAIA) 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 8 weeks survival free from ICD therapies. 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 97% in the Duodeca group 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 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 procedural workflow, long-term clinical outcomes are improved.

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;14(Suppl. 1):abstract 41

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 (40W/LSI 3, 40W/LSI 4, 20W/LSI 3, 20W/LSI 4 and 40W/LSI 5). The primary endpoint of the study was the occurrence and number of oesophageal temperature alerts (OTA) per patient during ablation. Acute indicators of procedure success were considered as secondary endpoints. Long term follow-up data were also collected for all patients.

Results: Oesophageal temperature alerts (OTA) 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.
Background: The advent of leadless and subcutaneous devices. However, the long-term outcomes of F-CIED, in particular complex F-CIED (implantable electronic devices (CIED) is not always possible. Devices implanted via femoral route to insert cardiac implantable electronic devices (CIED) is not always possible. Devices implanted via femoral route (F-CIED) remain an alternative option despite the advent of less-invasive 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).

Results: Early complications were similar between F-CIED and C-CIED (6% vs 5%; p=0.83) 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 (62% 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 expert operators in experienced centres is feasible and safe.

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

S Griffiths (Presenting Author) - Royal Brompton Hospital, London; J Behar - Royal Brompton Hospital, London; M Debnery - Royal Brompton Hospital, London; C Monkhouse - Barts Heart Centre, London; M Lowe - Barts Heart Centre, London; E Cantor - Royal Brompton Hospital, London; V Bayalla - Royal Brompton Hospital, London; N Karim - Royal Brompton Hospital, London; J Tiv - Royal Brompton Hospital, London; V Markides - Royal Brompton Hospital, London; J Clague - Royal Brompton Hospital, London; T Wong - Royal Brompton Hospital, London

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

SK Kamalathasan (Presenting Author) - Pinderfields General Hospital, Wakefield; JW Wren - Pinderfields General Hospital, Wakefield; VK Nayar - Pinderfields General Hospital, Wakefield

Background: CRT improves prognosis in selected patients with symptomatic 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=77) 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 (Chi² 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). Mortal 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

<table>
<thead>
<tr>
<th>Drug</th>
<th>NICOR data 2017/18 (%)</th>
<th>% Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta blocker</td>
<td>90</td>
<td>69</td>
</tr>
<tr>
<td>Mineralocorticoid receptor antagonist</td>
<td>46.7</td>
<td>53</td>
</tr>
<tr>
<td>ACE inhibitor / Angiotensin receptor blocker / Angiotensin receptor neprilysin inhibitor</td>
<td>53.3</td>
<td>84</td>
</tr>
<tr>
<td>Insulin-like growth factor</td>
<td>43.3</td>
<td>N/A</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>10.0</td>
<td>N/A</td>
</tr>
<tr>
<td>Ibutilide</td>
<td>3.3</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt;3 Drugs</td>
<td>53.3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
44/Acute conduction recovery post cardiac surgery in patients with high grade atrioventricular block

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 follow-up.

Methods: 193 consecutive patients underwent cardiac device implantation post cardiac surgery and whether ULR at implant and 6 weeks was predictive of late conduction recovery.

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=5). Surgery included aortic valve replacement (n=45 [61%]), mitral valve repair or replacement (n=21 [38%]), combined aortic and mitral valve (n=3 [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
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
CUJ 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%); diabetes 20 (14%); cerebrovascular disease 11 (8%); median lead dwell time 88.4 ± 17.5 months; range, 5-360. Procedure details and outcomes: EAM cases (368.0 s [239.0–680.0] vs 599.0 s [371.0–1060.5], p<0.01), 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), and there was no statistically significant difference in procedure time (144.0 min [121.5–168.5] vs 123.0 min [112.0–146.0], p=0.15). Procedure time was longer in EAM cases (126.0 ± 180.0) vs 123.0 min (112.5–147.5), 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=0.19). Procedure time was longer in EAM cases (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 (245.5 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=0.04) in EAM vs non-EAM cases respectively.

Conclusion: 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 in fluoroscopy time 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.

Table 1. Lead and device characteristics

<table>
<thead>
<tr>
<th>Leads, N (%)</th>
<th>Active fixation</th>
<th>Passive fixation</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>260</td>
<td>156 (60)</td>
</tr>
<tr>
<td>Mean lead dwell time x SD, months</td>
<td>88.4 ± 17.5</td>
<td>4 ± 3.2</td>
</tr>
<tr>
<td>Devices, N (%)</td>
<td>69 (26)</td>
<td>13 / 52 / 4</td>
</tr>
<tr>
<td>Implantable cardioverter defibrillators, N (%)</td>
<td>70 (50.4)</td>
<td>32 / 17 / 21</td>
</tr>
<tr>
<td>Dual coil</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

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
SE Moxud (Presenting Author) - Bristol Heart Institute, Bristol; KM Marrsfield - Bristol Heart Institute, Bristol; K Maciver - Bristol Heart Institute, Bristol; R Marriott - Bristol Heart Institute, Bristol; P Barber - 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 (6 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 tachycardia, and 38 had had a documented pre-excitation on ECG. The presenting symptoms were palpitations in 69 patients, 5 had a documented tachycardia, and 58 had manifest pre-excitation on ECG. The presenting symptoms were palpitations in 69 patients, 5 had a documented tachycardia, and 58 had manifest pre-excitation on ECG. No cases were omitted for clarity but included in analysis.

Conclusion: 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 in fluoroscopy time 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.
Our trust recently replaced our defibrillators with the Zoll R Series Plus. This has a restrictive 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 (70, 120, 190, 200), 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 (2020 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 (75J or 120J initial shock) were compared with 18/18 who had a successful cardioversion using the New Protocol (p=ns). There were 16 patients who 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=0.005). There were no safety issues.

<table>
<thead>
<tr>
<th>Zoll Protocol</th>
<th>New Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>18</td>
</tr>
<tr>
<td>Age (± SD, years)</td>
<td>66.7 ± 7.8</td>
</tr>
<tr>
<td>Sex (no. of men)</td>
<td>13</td>
</tr>
<tr>
<td>Body Mass Index (± SD, Kg/m²)</td>
<td>29.0 ± 5.2</td>
</tr>
<tr>
<td>Left Ventricular Function</td>
<td>Normal</td>
</tr>
<tr>
<td>Mild-moderate impairment</td>
<td>6</td>
</tr>
<tr>
<td>Severe impairment</td>
<td>8</td>
</tr>
<tr>
<td>Left atrial size (± SD, mm)</td>
<td>44.8 ± 10.8</td>
</tr>
<tr>
<td>1st cardioversion</td>
<td>15</td>
</tr>
<tr>
<td>Average Duration of AF (± SD, days)</td>
<td>126.4 ± 87.5</td>
</tr>
<tr>
<td>Previous ablation (Y, %)</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>On amiodarone (Y, %)</td>
<td>7 (38.9%)</td>
</tr>
<tr>
<td>1st shock successful (Y, %)</td>
<td>8 (44.4%)</td>
</tr>
</tbody>
</table>

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 running a cardioversion list more efficient. No safety issues were encountered.

Table 1

Figure.

**Poster:** The 1st shock efficacy of the recommended Zoll protocol for cardioverting atrial fibrillation

**Abstract:**

Our trust recently replaced our defibrillators with the Zoll R Series Plus. This has a restrictive 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 (70, 120, 190, 200), 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 (2020 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 (75J or 120J initial shock) were compared with 18/18 who had a successful cardioversion using the New Protocol (p=ns). There were 16 patients who 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=0.005). There were no safety issues.
Chronic kidney disease was defined as an eGFR <60 ml/min/1.73 m² with AF and the predictive value of the 2MACE score.

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 m² 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 clinical and procedural characteristics were recorded and outcomes of interest included incidence of pneumothorax and subsequent management outcomes.

Results: Of the 4,504 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).

Multivariate 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 CHA2DS2-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.

Posters

50/Major adverse cardiovascular events with renal failure in atrial fibrillation
European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr50

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 m² 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 clinical and procedural characteristics were recorded and outcomes of interest included incidence of pneumothorax and subsequent management outcomes.

Results: Of the 4,504 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).

Multivariate 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 CHA2DS2-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.

Posters

51/Incidence and outcomes of iatrogenic pneumothorax secondary to cardiac pacemaker implantation
European Journal of Arrhythmia & Electrophysiology. 2020;6(Suppl. 1):abstr51

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.

Methods: 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 (0.65%). Those suffering from pneumothorax had an average age of 74.2 years, 24 (56%) were male, 10 (23.3%) had previously known lung disease. Vascular access was obtained via subclavian vein 25 (58%), axillary 16 (37%), cephalic 1 (0.2%), revision 1 (0.2%). 43/6643 (0.65%). Those suffering from pneumothorax had an average age of 74.2 years, 24 (56%) were male, 10 (23.3%) had previously known lung disease. Vascular access was obtained via subclavian vein 25 (58%), axillary 16 (37%), cephalic 1 (0.2%), revision 1 (0.2%).

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.

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.

Figure. Receiver-operating characteristic curves comparison for MACE (composite of myocardial infarction, cardiac revascularisation and cardiovascular mortality) with the 2MACE, CHA2DS2-VASc, CHADS2 and HAS-BLED scores.
Background: Delivery of cardiac resynchronisation therapy (CRT) using conventional systems can be limited by sub-optimal venous anatomy. The WiSE-CRT (iBEAR 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.

Methods: A 73-year old male with ischaemic 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 was 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 fusion with intrinsic cardiac conduction, with negative AV hysteresis programmed on (delta -20ms).

AV delay was optimized to 150 ms to allow fusion with intrinsic cardiac conduction, with negative AV hysteresis programmed on (delta -20ms).

Results: The patient was seen in the research clinic 10 days and 6 months later, with improvement in EF.

Conclusion: 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), and an "enzyme-linked" technique in plasma samples (enzyme-linked immunosorbent assay; ELISA). Analysis 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=0.006) 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)

<table>
<thead>
<tr>
<th>Method</th>
<th>Indices/biomarkers</th>
<th>AF</th>
<th>SR</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microparticle assay</td>
<td>Lag time (s)</td>
<td>30.5 (+25.5)</td>
<td>31.0 (+25.3)</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>Rate of clot formation (units/ml)</td>
<td>37.0 (20.8-41.3)</td>
<td>30.2 (23.4-37)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Max optical density (units)</td>
<td>0.48 (0.42-0.56)</td>
<td>0.38 (0.33-0.45)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Rate of clot dissolution (units/ml)</td>
<td>20.2 (16.8-22.5)</td>
<td>16.6 (14.1-20.0)</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Time 50% lysis (s)</td>
<td>224 (98-158)</td>
<td>272 (182-321)</td>
<td>0.42</td>
</tr>
<tr>
<td>Coagulation-linked immunosorbent assay</td>
<td>D-dimers (mg/ml)</td>
<td>7.82 (2.4-13.6)</td>
<td>7.74 (3.8-11.7)</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>Tissue plasminogen activator (ng/ml)</td>
<td>0.48 (0.42-0.62)</td>
<td>0.54 (0.46-0.62)</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Plasminogen activator inhibitor 1 (g/ml)</td>
<td>0.16 (0.12-0.23)</td>
<td>0.16 (0.14-0.41)</td>
<td>0.008</td>
</tr>
<tr>
<td>Microparticles</td>
<td>Platelet derived microparticles (10^10/ml)</td>
<td>20.5 (7-71)</td>
<td>7.3 (47)</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Apoptotic microparticles (10^10/ml)</td>
<td>480 (290-1181)</td>
<td>144 (64-1958)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

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.
AF prevalence in LTC residents, ranging from 7.1%-38% (n=3 reported). After full-text review, 21 studies were identified which reported registered with PROSPERO (CRD42020164963). Disagreements were resolved by discussion with another reviewer. The protocol was quality and risk of bias using the Newcastle Ottawa Scale. Disagreements identified relevant articles, performed data extraction and assessed the review for any additional relevant studies. Two authors independently searched for conference abstracts and bibliographies of identified articles were hand-searching of two geriatric cardiology journals and Google Scholar. searched for unpublished literature/dissertations, complemented by diagnosis, resident characteristics and type of LTC facility. The limited 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.

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% 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 incidence 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.

Conclusion: 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 2000 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 (1.1%), £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%), £6,468m (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 £2,256m and £4,031m, depending on the annual population increase of AF prevalence.

Conclusions: Focusing 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.
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

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, 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. 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.

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

European Journal of Arrhythmia & Electrophysiology

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–EPD system (EPD Solutions, Phil) is a novel non-contact navigation and mapping system using the unique dielectric properties of biological tissue. The system measures the varying electrical 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 also includes a PV occlusion tool which measures the change in dielectric 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) to 4 (total occlusion with complete contrast retention). Grades 3 and 4 were considered indicative of satisfactory PV occlusion. The Kodex–EPD system displaying 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 4 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 92.3% 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–EPD system had a high sensitivity and moderate positive predictive value but low specificity for PV occlusion as determined by contrast venography. 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-EPD maps – PA view of left atrium with the left and AP panographic 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.
**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 ventilation (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 CO₂. During HFJV, GA was induced and maintained with total intravenous anaesthesia using depth of anaesthesia monitoring (BIETA, Medtronic Inc.). A Manoson III ventilator (Aufrun 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 atrial posterior wall (LAPW) sites during HFJV. Time to pure R morpholgy change and impedance drop (at both total and maximum rate) were measured at the first-ablated LAPW sites using exported VISITAG Module data.

**Table:**

<table>
<thead>
<tr>
<th></th>
<th>IPPV (n=25)</th>
<th>HFJV (n=22)</th>
<th>IPPV vs HFJV (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left-sided (20W)</td>
<td>Right-sided (20W)</td>
<td>p</td>
</tr>
<tr>
<td>Time to pure R (s)</td>
<td>6.36</td>
<td>6.74</td>
<td>0.01</td>
</tr>
<tr>
<td>Max rate of rmp at peak (s/nm/s)</td>
<td>1.19</td>
<td>0.49</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

**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=0.07). 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 HFJV when comparing left and right-sided LAPW sites (Tables). 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.

**Figure:**

**Conclusion:** Ablation results in significant reductions in AF burden 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

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 (CHA2DS2-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.
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.

Figure:
Aims: Cardiac perforations caused by pacemaker and implantable-carotid stent (ICD) leads are serious events. Due 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 replacement. 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 procedures spanning 3 years from 2016-2019. 6 months follow-up was assessed in all patients with perforation. 20 (63%) female, mean left ventricular ejection fraction 51% (±11). 9 (39%) were identified acutely (<24 hours), median time to diagnosis was 32 (±49) days in sub-acute/chronic perforation. All but one lead 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 percutaneous in 31/32 (97%), sternotomy with surgical repair was required in 10/32 (31%), pericardial drainage was performed in 7 patients (22%). There were no deaths. 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 intermittent (0.3%), 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.

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/A) 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. 16/1 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. Abdominal perforation 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. Kaplan-Meier curve for AF recurrence. Recurrence of AF in 44 patients occurred at a median of 212 days post op (range H1-1090). 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.
### 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.

### Discussion

- The small proportion reduction of disconnected RM patients on 1 and 2 can be attributed to the high volumes of patients enrolled during the pandemic. The 3rd platform only consists of ICD patients. For that reason, few RM were provided during the audit period, resulting in a significant decrease in disconnected RM proportion. Whilst imaging 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.

### Figure 1 – Patients’ characteristics

![Patients’ characteristics]

<table>
<thead>
<tr>
<th>Condition</th>
<th>Platform 1</th>
<th>Platform 2</th>
<th>Platform 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pts – patients</td>
<td>160</td>
<td>120</td>
<td>160</td>
</tr>
<tr>
<td>DCM – dilated cardiomyopathy, LV – left ventricle, CRT – Cardiac Resynchronization Therapy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 1

<table>
<thead>
<tr>
<th>Platform</th>
<th>Disconnected Monitors Pre (%)</th>
<th>Disconnected Monitors Post (%)</th>
<th>Number of Patients Reconnected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform 1</td>
<td>16</td>
<td>9.7</td>
<td>160</td>
</tr>
<tr>
<td>Platform 2</td>
<td>15.9</td>
<td>8.4</td>
<td>84</td>
</tr>
<tr>
<td>Platform 3</td>
<td>22</td>
<td>11.7</td>
<td>117</td>
</tr>
</tbody>
</table>

### 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 on all platforms. The third 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 imaging 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.

### Results

- In complete lead removal was achieved in 93.3% of cases. The prevalence of procedure related major complications was 2.9%.
- Peri-procedural mortality was 0.5%.
- The proportion of disconnected RM across two platforms decreased marginally (1 & 2) and one (3) significantly (Table 1).
- The small proportion reduction of disconnected RM patients on 1 and 2 can be attributed to the high volumes of patients enrolled during the pandemic.

### Discussion

- The small proportion reduction of disconnected RM patients on 1 and 2 can be attributed to the high volumes of patients enrolled during the pandemic. The 3rd platform only consists of ICD patients. For that reason, few RM were provided during the audit period, resulting in a significant decrease in disconnected RM proportion. Whilst imaging 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.

### Conclusion

- A collaborative working relationship to reduce the number of patients with disconnected RM was undertaken under local anaesthesia and conscious sedation. 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%.
- Peri-procedural mortality was 0.5%.
- The proportion of disconnected RM across two platforms decreased marginally (1 & 2) and one (3) significantly (Table 1).
- The small proportion reduction of disconnected RM patients on 1 and 2 can be attributed to the high volumes of patients enrolled during the pandemic.

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</tr>
</tbody>
</table>
Background: The IMPACT study established the role of esophageal cooling in reducing ablation-related thermal injury during 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 with esophageal injury. 1:1 randomisation assigned patients to the use of the ensoETM® device by AI (30W at 350-400 AI posteriorly, 40W at ≥450 AI anteriorly). A blinded endoscopy was performed for all study ablations, using RF powers of 20, 30 or 40 W. Tissue impedance drop was 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 during RF delivery was progressively higher with use of higher RF powers (Figure 2). No correlation was observed between contact force and maximum impedance drop achieved during RF delivery (Figure 3).

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.

Figure 1: 
Figure 2: 
Figure 3: 
Figure 4: 

Posters

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

European Journal of Arrhythmia & Electrophysiology 2020(suppl. 1) abstracts


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 an indicator 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 achieve standard procedural endpoints, or to obtain clinical success in the short term.

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.
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 bradyarrhythmia 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 or echocardiographic parameters to such an end, Sub-group analysis alludes to the fact that certain clinical parameters were less useful. In the sub-group analysis, clinical heart block and PR>300 conveyed 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 bradyarrhythmias, 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 less accurate. 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

<table>
<thead>
<tr>
<th></th>
<th>SND</th>
<th>CSD</th>
<th>CHB</th>
<th>SND+PR&lt;160</th>
<th>PR&gt;300</th>
<th>Syncope</th>
<th>Non-Syncope</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>698</td>
<td>267</td>
<td>216</td>
<td>88</td>
<td>60</td>
<td>409</td>
<td>344</td>
</tr>
<tr>
<td>Sens</td>
<td>64.4%</td>
<td>97.7%</td>
<td>100%</td>
<td>6.3%</td>
<td>100%</td>
<td>86.4%</td>
<td>87.9%</td>
</tr>
<tr>
<td>Spec</td>
<td>98.3%</td>
<td>62.0%</td>
<td>45.2%</td>
<td>97.1%</td>
<td>0%**</td>
<td>89.9%</td>
<td>79.6%</td>
</tr>
<tr>
<td>PPV</td>
<td>87.0%</td>
<td>90.6%</td>
<td>97.6%</td>
<td>98.3%</td>
<td>96.2%</td>
<td>92.5%</td>
<td>92.5%</td>
</tr>
<tr>
<td>NPV</td>
<td>87.9%</td>
<td>87.9%</td>
<td>100%</td>
<td>81.5%</td>
<td>77.6%</td>
<td>90.5%</td>
<td>90.5%</td>
</tr>
</tbody>
</table>

** only 1 patient did not 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.
Background: Atrial fibrillation (AF) is the most common sustained arrhythmia in adult population with increased prevalence particularly in elderly. AE 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 get severe left ventricular systolic dysfunction. RV pacing is known to cause LV dysfunction in pacemaker 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 treated with other measures. Exclusion criteria: 1. Patients undergoing ablate and pace strategy at University hospitals of Leicester between 2014 and 2019.

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 uncomplicated 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

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):abstr88

A Elsayed (Presenting Author) - Glenfield Hospital, Leicester; A Abouzaid - Glenfield Hospital, Leicester; K Balasubramaniam - Glenfield Hospital, Leicester; A Shah - Glenfield Hospital, Leicester; M Ibrahim - Glenfield Hospital, Leicester

Background: Atrial fibrillation (AF) is the most common sustained arrhythmia in adult population with increased prevalence particularly in elderly. AF 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 get severe left ventricular systolic dysfunction. RV pacing is known to cause LV dysfunction in pacemaker 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.

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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.

70/HD grid mapping of complex atrial arrhythmias

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


Introduction: Complex atrial tachycardias (AT) are frequently encountered in patients after left atrial catheter ablations. 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. Electromanethical 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). 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±10.3 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 (2.6±0.5, 6.6 vs. 2.18±0.18, 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 bipolar electrodes, 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.
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(Suppl. 1):abstr71

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 DCVV 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 could reduce the failure rate in high risk populations.

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. 10/19 (53%) of these patients then achieved SR >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, 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

<table>
<thead>
<tr>
<th>Factor</th>
<th>Number of patients in SR for &lt;1 week</th>
<th>Number of patients in SR for &gt;1 week</th>
<th>p-value for association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal or mild LA dilatation**</td>
<td>16</td>
<td>106</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Moderate or severe LA dilatation*</td>
<td>25</td>
<td>82</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Normal LV systolic function**</td>
<td>27</td>
<td>88</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Impaired LV systolic function*</td>
<td>14</td>
<td>100</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

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

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

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

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 limb 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; 36% 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.

References:

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(Suppl. 1):abstr71

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

European Journal of Arrhythmia & Electrophysiology. 2020(Suppl. 1):abstr72
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: A total of 14 studies (n = 71) against matching placebo (n = 73) were included. Patients receiving amiodarone were 63 ± 6 years of age and 57% male. Successful cardioversion in amiodarone was significantly greater than placebo (RR = 0.37, 95% CI: 0.21-0.65, p < 0.01) and compared to placebo (RR = 0.38, 95% CI: 0.21-0.71, p < 0.01). Of the three clinical trials, two were placebo-controlled, single-blind RCTs that compared amiodarone with placebo and one was a non-randomized controlled trial. The use of oral amiodarone as first-line therapy for recent-onset AF is largely effective in achieving sinus rhythm in 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 = 73) 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).

Conclusions and Implications: A single, oral cardioverting 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.

For clinical practice, 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 Philips haemodynamic system, together with the maximum (QRS_Max) and Mean (QRS_Mean) of the individual leads. 30mm/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 of 2.7ms to 12.1ms. 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 1 showed an average difference of 14.2ms with 95% confidence interval of 36.6ms.

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, 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

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™ (Medronic) 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 under general anaesthesia with planned overnight admission for observation. Clinical Audit & Effectiveness Group (CAEG) approval was obtained.

Results

• 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), urinary retention requiring urethral catheterisation (n=1).

Mean impedance 747 ohms ± 190 (mean ± SD)

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)

Early data suggested a good safety and efficacy profile, however real-world data is limited.

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 (19%).

Pacing was obtained in 22/28 (79%) of patients with 7 patients (25%) being paced <15%.

Conclusion: There were no major long-term complications. One patient developed pacemaker syndrome and required a traditional transvenous pacemaker.

References


Introduction

Background: Coronavirus disease 2019 (COVID-19) has presented unparalleled 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

- 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 (1299-1803) during COVID) with a 98.7% reduction in IP follow ups (1335 per month (865-1546) to 15 (13-17) offset by a 63.9% increase in RM follow ups (880 per month (650-920) vs 1311 (1282-1340)). IP follow ups were only performed for urgent Mills in patients with CIEDs. PPM follow ups decreased by 77% (661 per month (495-799) to 152 (123-177) and CRT-P by 53% (102 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% (98 per month (56-1030) to 150 (148-1522) during COVID with substantial increases for PPMs (19 per month (9-27) to 172 (168-170), 830% increase) and CRT-Ps (70 per month (6-25) to 58 (57-58), 475% increase). ICD/CRT-D transmissions increased by 55.3% (95 per month (56-1010) to 146 (146-536). 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.

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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 which factors sustain 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. Mutations in pulmonary veins (PVs) and the region over the mitral valve were clipped or removed. All the PVs were labelled along the segment of the left atrial appendage. Epicardial and endocardial fibres from a human atrial ex-vivo DTMRI atlas were added to each of the virtual atrium through the universal atrial coordinate system. The effects of fibrotic remoulding were included as changes in conduction velocity and ionic properties based on the LGE-MRI intensity distribution. Simulations were then run through the Cardiac Arrhythmia Research Package simulator through pre-assigned start points. PVI outcome was classified as non-responder where there is a termination of AF or macro-re-entrant re-entries. LA area was significantly smaller in the responder group than non-responder group (p=0.03). Neither the total fibrosis burden (10.4cm² vs 7.7cm², p=0.1) nor the AF cycle length (206ms vs 206ms, p=0.52) 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.

Figure 1: 
(A) LGE-MRI
(B) Atrial Fibres
(C) Simulate AF
(D) Driver density map
(E) PVs

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 41 ± 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 (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 persistent AF. Our findings suggest a possible process leading to PV sleeve atrofication in patients with dilated LA that could influence the ablation strategy in this cohort.

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 atrofication in patients with dilated LA that could influence the ablation strategy in this cohort.
79/ATP and prevention pacing to reduce AF burden in pacemaker patients

LM McMahon - Ulster University, Belfast; CJ Breen (Presenting Author) - Ulster University, Belfast

**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.

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

Peter Waddingham (Presenting Author) - St Barths Health NHS Trust, London; M Orini - St Bartholomew’s Hospital; M Orini; A Muthumala - St Bartholomew’s Hospital, Barts Health NHS Trust, London; S Sporton - St Bartholomew’s Hospital, Barts Health NHS Trust, London; PD Lambiase - St Bartholomew’s Hospital, Barts Health NHS Trust, London; AWC Chow - St Bartholomew’s Hospital, Barts Health NHS Trust, London

**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 (LV/MPP). 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%. Leads were concordant with lines of block in 0%, adjacent 60% and remote 40%.

**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.
Introduction: Ventricular tachycardia (VT) storm is a medical emergency characterised by clustered episodes of ventricular arrhythmia seen in patients with structural heart disease. 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 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 52.5±15.7 years, 67 (53%) patients were male. Symptom relief was the primary indication in 104 (83%). 66 (53%) had a structurally normal heart. 62 (70%) patients at 12 months. 1-year mortality was 22.5% with no 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.

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. Objective evaluation of PVC burden may 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.

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariable</th>
<th>Multivariable</th>
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</thead>
<tbody>
<tr>
<td>Age (per 10 y)</td>
<td>1.04 (0.99-1.08)</td>
<td>0.113</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>3.95 (1.55-10.07)</td>
<td>0.004</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.52 (1.01-6.25)</td>
<td>0.047</td>
</tr>
<tr>
<td>Hospital stay duration</td>
<td>1.04 (1.00-1.09)</td>
<td>0.040</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>0.42 (0.25-1.59)</td>
<td>0.266</td>
</tr>
</tbody>
</table>

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).

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%–69%) vs 76%, [84%–9%] p=0.046). Patients with symptomatic improvement also had a lower absolute PVC burden at follow-up (2.6%, [0.8%–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=0.803).

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.

Table for adjusted odds ratio (OR) for PVC ablation success

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td>Age (per 10 y)</td>
<td>1.04 (0.99-1.08)</td>
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</tr>
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Figure: 2. Graph showing the association between PVC burden and subjective outcomes.
Cardiac resynchronisation therapy (CRT) is used in select heart failure patients to improve quality of life and mortality. 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 analysis showed that baseline NYHA class is the only significant predictor of response ($\chi^2(1) = 7.788$, $p=0.005$, OR=2.450, 95% CI [1.094, 5.479]). 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 lower 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. More severe heart failure at baseline was a significant predictor of response. Evidence of the benefits of CRT in NYHA IV patients in terms of functional improvements and symptom relief at 6-months is consistent. Some patients are reported to experience no benefit; so-called ‘non-responders’. 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 response to CRT, baseline NYHA III class appeared to be associated with a positive response to CRT.

**References**


**Summary:** Atrial fibrillation affects 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 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 AlereCor Karda 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 (6.4%), 4 people were undiagnosed (2.6%) and every other pulse check resulted in a normal reading (97.7%). 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.
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 surgery or cardiac rhythm management (CRM) procedures were performed and government guidance for PPE was followed. For procedures which posed a high risk of aerosolisation i.e. general anaesthetic or high risk of CPR; respirators, visors, appropriate donning and offing 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 22nd 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/m², 42% 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 follow-up for the majority of arrhythmia procedures (90%) and 10 patients had EP procedures (10%). Average follow-up for the majority of arrhythmia procedures (90%) and 10 patients had EP procedures (10%).

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.

Conclusion: Of our cohort of at-risk patients, 92% had >1 risk factor, 56% 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.

Conclusions/implications: Despite the limitations, this audit shows that whilst complying to the new guidelines, we were able to carry out procedures safely with no reported cases of 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 surgery or cardiac rhythm management (CRM) procedures were performed and government guidance for PPE was followed. For procedures which posed a high risk of aerosolisation i.e. general anaesthetic or high risk of CPR; respirators, visors, appropriate donning and offing 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.
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 unsolicited 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.

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 of their condition. This may have cost implications to the smaller proportion of the overall heart failure population than previously might benefit from cardiac contractility modulation therapy. This is a 5.2% of all patients presenting with heart failure were significantly more likely to be hypertensive (10 (62.5%) vs 6 (37.5%), 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.
We identified 1,028 consecutive patients with persistent 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. 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.

Focal activation patterns are a common phenomenon during persistent atrial fibrillation

Background: Focal activation is a common phenomenon in persistent AF. It is not known how to differentiate drivers from passive 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). 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). 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.
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 reports and programmer/transmission data were reviewed to assess compliance with departmental SOP criteria including: follow up reports and programmer/transmission data were reviewed to assess compliance with departmental SOP criteria including: follow up reports and programmer/transmission data were reviewed to assess compliance with departmental SOP criteria including: follow up reports and programmer/transmission data were reviewed to assess compliance with departmental SOP criteria including: follow up reports and programmer/transmission data were reviewed to assess compliance with departmental SOP criteria including:

Fig 1: HV impedance diagnostic, showing the current range of daily values.

Conclusion: In our single centre experience, there is a good compliance rate of follow up reports with departmental and national standards. In particular attention should be paid to accurate documentation of the presenting 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.

<table>
<thead>
<tr>
<th>Physiologist name</th>
<th>Actions taken</th>
<th>Percentage pacing</th>
<th>Arrhythmias</th>
<th>Histos</th>
<th>Lead status</th>
<th>Battery status</th>
<th>Underlying Rhythm</th>
<th>Presenting rhythm</th>
<th>Wound status</th>
<th>Patient wellbeing</th>
<th>Check type</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>51%</td>
<td>98%</td>
<td></td>
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Figure 1: Compliance levels to each individual criteria in the departmental SOP.
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=60) of patients had adequate pacing capture threshold (PCT) at the time of implant. 18 (24.3%) of patients had adequate pacing capture threshold (PCT) at the time of implant.

Pacing Indications: AF with bradyarrhythmia (76.0%, n=57), sinus or AV nodal disease (5.3%, n=4), complications, device dislocation or VTE. Pacing indications were AF with bradyarrhythmia (76.0%, n=57), sinus or AV nodal disease (5.3%, n=4), complications, device dislocation or VTE. Pacing indications were AF with bradyarrhythmia (76.0%, n=57), sinus or AV nodal disease (5.3%, n=4), complications, device dislocation or VTE. Pacing indications were AF with bradyarrhythmia (76.0%, n=57), sinus or AV nodal disease (5.3%, n=4), complications, device dislocation or VTE.

- **Major Complications:**
  - 1 episode of major bleeding (25%) needing manual compression. We introduced double Z sutures technique with a resultant reduction to 1 episode of minor bleeding.
  - 5 episodes of minor bleeding (6.7%) were noted in the last 10 implants. In our initial 20 implants, we had 5 episodes of minor bleeding.
  - Our Micra deployment attempts (mean of 2.7 ± 0.83 in first 10 cases) was reduced to 1.3 ± 0.15 in the last 10. In our initial 20 implants, we had 5 episodes of minor bleeding.
  - The Micra TPS, a leadless single-chamber ventricular pacemaker, is both feasible and safe.

- **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 no procedure-related pericardial effusion prior to discharge. Local audit prevented readmission due to procedural complications, or that clinically significant pericardial effusion develops following on table TTE. Same-day discharge was achieved in 114 of 191 cases (59.6%). In our initial 20 implants, we had 5 episodes of minor bleeding.

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

Methods: US-guided axillary venous 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 imaging) or situated deeply with prohibitively steep wire angulation. A second puncture was needed following a mean (SD) 2.6 (1.6) fluoroscopy attempts for each patient. Mean (SD) 0.25 (0.20) second fluoroscopy time per puncture during the first 15 procedures, increasing to 0.35 (0.40) second for the next 15. Overall, mean (SD) 0.50 (0.50) second fluoroscopy time per puncture. 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 wire position due to difficult passage. Controls required 29 (IQR: 17,56) seconds of fluoroscopy time for access, requiring 0.25 (IQR: 0.1-0.4) mGy cumulative skin dose, and 0.03 (IQR 0.02–0.5) Gy.cm² 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 discriminate with experience. The first procedure required 106 seconds which is not represented on this graph. Statistically similar fluoroscopy guided access times for controls are shown in green for reference.
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 detection after stroke. Our results may help to guide the duration of cardiac monitoring to be decided on a more personalised basis. ECG parameters can stratify the probability of AF detection on cardiac monitoring after stroke but is unlikely to be available for all patients.

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 on cardiac monitoring after acute ischaemic stroke or transient ischaemic attack (TIA).

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.

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>AF Detection Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>2.98 (2.50–3.66)</td>
</tr>
<tr>
<td>Heart failure</td>
<td>2.52 (1.77–3.99)</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>1.86 (1.34–2.58)</td>
</tr>
<tr>
<td>Thrombolytic therapy for stroke</td>
<td>4.35 (1.48–12.78)</td>
</tr>
<tr>
<td>Brain natriuretic peptide (BNP)</td>
<td>7.69 (1.23–15.82)</td>
</tr>
<tr>
<td>C-reactive protein</td>
<td>2.19 (1.19–4.04)</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.49 (0.37–0.66)</td>
</tr>
<tr>
<td>Transient ischaemic attack as index event</td>
<td>0.62 (0.42–0.91)</td>
</tr>
<tr>
<td>Glycolites</td>
<td>0.58 (0.34–0.96)</td>
</tr>
</tbody>
</table>

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

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

European Journal of Arrhythmia & Electrophysiology
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 septicemia and a 4.5% risk of pneumothorax or cardiac perforation (Bets 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 demands and the risks to patients have prompted the British Heart Rhythm Society.

Methodology/Purpose: We analysed the retrospective data April 2018 to March 2019 in Liverpool region. Our key objectives were to assess: we assessed 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)

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 pneumothoraces (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 prevent the delay in getting the treatment to the patient and also avoid unnecessary complications whilst waiting for the transfixes 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 associated with temporary systems
- Procedure performed in a stable tertiary care setting
- Reduce number of transfers before receiving treatment
- Emergency services to identify more direct transfer to Liverpool Heart and Chest

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 therapy control and studied for 12 months. Subsequent to the study periods 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 (99%) 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 (29.5 ± 7.5% vs 33.7 ± 12.0%, p=0.002). 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 in long-term follow-up (1 [0-2] vs 2 [1-2], p=0.01). 31 (60.4%) 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.
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 ex vivo porcine and human hearts.

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 EGM-uncoupling via administration of a 1 mM carbamoyl-xylitol (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 vitro human studies, in future EGM-based investigations.

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 ensure 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 protect, prevent and perfect pathways were designed to support upskilling. The APL AF tool by UCL Partners helped identify AF patients with a CHADS2/VASC≥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 anticoagulation pharmacist and GPs. Actions post virtual clinic were also completed by the practice-based pharmacist including patient follow ups.

Results: In total, 807 AF case reviews were discussed in the virtual clinic for 36 practices. Of these reviews, 121 patients were commenced on anticoagulation, 70 patients were referred to cardiology/ haematology. AF 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 CHADS2/VASC≥2 prescribed anticoagulant from 78% (2018/19) to 94% (2019/2020) in Haringey-GP practices.

Conclusion: Improvement in anticoagulation rates and reduced inappropriate antithrombotic 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.
**Posters**

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

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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 W/kg. Ablation parameters were recorded every 10-20 ms. Post hoc, VisiTags were trisected according to CTI position: inferior vena cava (IVC), middle (M), 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) (R² = 0.89, p < 0.0001). However, analysis by anatomical site demonstrated a non-linear relationship. Mid CTI (R² = 0.15, p = 0.21). Accordingly, whilst mean AI was highest Mid CTI (R² = 0.89, p < 0.0001), mean ID was lower (IVC: 473.1 ± 122.1 W/kg; Mid: 539.6 ± 103.5 W/kg; V: 486.2 ± 111.8 W/kg, 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.

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**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 (QR: 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 (64%) had ischaemic pathology and QRS duration was <120 ms in 64 (41%), 50 (31%) patients had existing atrial fibrillation (AFib). Optimal target dose pharmacotherapy was achieved as follows: ACE/ARB - 65 (47%), β-blocker/ibutilide - 64 (43%), MRA – 75 (51%) 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 (90% vs 33%, p = 0.032) and non-ischaemic pathology (33% vs 0%, p = 0.034), and were more likely to be on optimal target dose β-blocker/ibutilide (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 world 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-arrhythmic strategies including consideration of catheter ablation are required in this cohort.
Introduction: Emergency out-of-hours destination cardiovascular implantable electronic device (CED) 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 CED 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 CID insertions 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, 2 CRT-D left ventricular leads) were identified on post-implant check.

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.

<table>
<thead>
<tr>
<th>TABLE 1. Demographic and procedural characteristics</th>
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<tbody>
<tr>
<td>Number of patients (n)</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Gender (male) (%)</td>
</tr>
<tr>
<td>LV function (normal, moderate, severe) (%)</td>
</tr>
<tr>
<td>Type of device (ICD, CRT-D/P, CRT-P) (%)</td>
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<tr>
<td>Complications (only lead displacement)</td>
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<tr>
<td>Procedure time (minutes) (in/out of the lab)</td>
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<tr>
<td>Skin-skin time (minutes)</td>
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<td>Fluoroscopy time (minutes)</td>
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ICD-D/P: Cardiac resynchronization therapy with defibrillator/pacemaker; CRT-D/P: Cardiac resynchronization therapy with defibrillator/pacemaker; CRT-D: Cardiac resynchronization therapy with defibrillator; CRT-P: Cardiac resynchronization therapy with pacemaker.