Lead Extraction – Future Treatment for an Old Problem

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The implantation rate of electronic cardiac devices, such as pacemakers and implantable cardiac defibrillators, has grown substancially over recent years. As a consequence, we are facing a rising number of related complications, such as systemic and/or local infections and malfunctions. It is generally accepted that transvenous lead extraction (TLE) is actually the better strategy to manage the majority of such complications, although the procedure is not exempt from minor and major risks. Despite the advent of laser techniques, surgery may still be required in both elective and emergency cases. Hybrid operative strategies (TLE combined with minithoracotomy and thoracoscopy) have been developed for procedures considered to confer an high risk. The strict collaboration between electrophysiologist and cardiac surgeon, and the setting up of a multidisciplinary team, are crucial points at each step of a planned TLE procedure.

Keywords

Transvenous lead extraction, cardiac implantable devices, hybrid lead extraction

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The use of electronic devices has increased during the past years; approximately 3.25 million pacemakers (PMs) and 180,000 implantable cardiac defibrillators (ICDs) have been implanted worldwide.[1] The PM implant rates range from 200 implants per million in the UK, and 420 per million in the US, to 600 per million in Belgium. At the same time, the number of patients with cardiac implantable devices (CIEDs) continues to grow, due to increasing indications in older patients. As a result, the number of complications has risen. Systemic infection is an unusual (found in 0.5–12.6% of cases) but occasionally catastrophic complication, of which physicians and patients should be aware due to the deleterious consequences if not treated.[2–4] Infections typically present as lead endocarditis, valvular endocarditis, pocket infection, device erosion, and chronic draining sinus. In addition, malfunctions of the lead or the generator are an emerging problem, in parallel with expanding new technologies.

Following device insertion, thrombus formation develops along the lead. Within four to five days after implantation, fibrosis occurs with almost complete encapsulation of the leads and generator by a fibrin sheath.[5,6] The most common binding sites include the contact point of venous entry, the passage subclavian/superior vena cava (SVC) and the electrode–myocardial interface. Although the predictors of adherence with fibrosis and/or calcification have not been clearly identified, evidence suggests that younger patients develop more vigorous fibrotic reactions and more frequently progressive calcification.[7]

In the majority of cases, transvenous lead extraction (TLE) is necessary for the management of complications. CIED infection remains the strongest and most common indication for TLE, followed by device recall and venous thrombosis. However, TLE is a challenging procedure that requires a high level of operator expertise (a cardiac electrophysiologist and/or a cardiac surgeon), a multidisciplinary team and surgical back-up to manage the most difficult cases. Planning a strategy for lead management is essential, starting at the time of CIED implant or generator change, with careful assessment of indications, measures to avoid infection and education of the patients and their caregivers. The decision must be taken either to abandon or extract a lead at the time of system revision, or to upgrade the lead.

During recent years, the number of TLE procedures has risen substantially, as a consequence of wider use of CIEDs. It is estimated that the demand for TLE has reached an annual rate of 10,000–15,000 leads worldwide.[8] In addition, a disparity exists between lead and patient longevity. Due to the expansion of the current indications for CIED implants, it is likely that younger patients will receive CIED implants and require TLE in future. The use of TLE in more complex cases has led to the introduction of novel technologies. In addition to locking stylets and mechanical telescoping sheaths, the development of powered sheaths (in particular, the excimer laser technology) has facilitated the removal of chronically implanted PM and defibrillator leads through a transvenous approach.[9] However, despite advances in technology, there is a limited but significant risk of major complications associated with this procedure.[10] Several established patient and lead characteristics

may influence the outcome of the procedure, the degree of complications and associated mortality.[11] Major intraprocedural complications include myocardial avulsion, damage to the tricuspid valve, cardiac tamponade, vascular tear, haemothorax, pneumothorax and pulmonary embolism.[12] The incidence of major complications associated with laser-assisted lead extraction is typically between 1.4% and 5.1% but incidences as high as 10.9% have been reported.[13–15] Major injury of the SVC or innominate vein is the worst complication and mortality may be as high as 50% when major vascular injury occurs.[16]

Despite the advent of laser techniques, surgery may still be required in both elective and emergent cases. The need for involvement of a surgical team during a TLE procedure is still under debate. Recent findings suggest that serious complications including death may not be mitigated by emergency surgery.[17] More recently, hybrid operative strategies (TLE combined with minithoracotomy or thoracoscopy) have been developed for procedures considered to confer a high risk.[18–20] Such strategies require strict collaboration between electrophysiology and cardiac surgical teams.

In conclusion, these considerations not only illustrate the complexity of the decision-making process, in particular regarding malfunctioning leads, but also the need to select cases that may benefit from a more aggressive strategy at referral TLE centres. ❑

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