

Case Report

Innovative method for extraction of a fractured pacemaker lead

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Abstract

Percutaneous fractured pacemaker lead removal is considered a challenging process and may be complicated by vascular rupture, pneumothorax, cardiac perforation, tamponade, or even death. Here we described a successful case of percutaneous fractured pacemaker lead extraction. Pacemaker right ventricular lead is coaxial screwing type and the proximal end is fractured, so we are not able to unscrew the proximal end conventionally with screwing clip. As the screw portion of the lead mainly contributed by inner cathode wire, patient was planned to remove pacemaker lead four layers one by one. Using the serrations of small artery forceps, inner pacing wire was held firmly and unscrewing done without any damage to the wire. Pacemaker lead was successfully extracted with no procedure complications.

Keywords: Percutaneous fractured pacemaker lead removal, coaxial screwing, inner cathode wire, small artery forceps

Introduction

Patients with bradyarrhythmias benefit greatly from the use of pacemakers in their care. However, issues following implantation may result in noticeably inferior outcomes in few cases. Leads are thought to be the most delicate component of a pacemaker. Lead fractures occur at a reported incidence rate of 0.1% to 4.2% annually. Lead fracture is a complication of pacemaker implantation that can be brought on by excessive mobilization and local trauma. Compared to fractures brought on by trauma or injury, lead fractures brought on by excessive mobilization are reported more frequently. In our case report, it was regarded as the cause of the lead fracture ^[1, 2].

Physicians should consider fracture pacemaker lead whenever the pacemaker-implanted patients had a history of injury or trauma to the chest. Considering the subclavian vein anatomy, pacemakers implanted in the right subclavicular region with intrathoracic punctures are more likely to have pacemaker lead fractures ^[2, 3].

The removal of fractured lead was thought to be a difficult procedure that might worsen by tamponade, heart perforation, pneumothorax, vascular rupture, or even death. Because fibrous attachment can make it challenging to remove a nonfunctioning cardiac pacemaker lead, most situations can be resolved by only putting a new lead next to the retained nonfunctioning lead. Although it is not common, cases of retained lead detachment with subsequent migration and right atrial or right ventricular perforation have been treated with traditional open surgical methods. The successful and unusual instance of a percutaneous fractured pacemaker lead extraction is described in this article ^[4].

71yr male, known hypertensive on regular medications, diagnosed as degenerative complete heart block and underwent percutaneous permanent pacemaker insertion (Boston scientific – INGEVITY RV lead) on 15/6/2021. After one year he presented with history of mucopurulent foul-smelling discharge at Permanent Pacemaker Insertion site for last 3 months associated with shortness of breath on exertion with NYHA III symptoms. He was evaluated and detected to have pacemaker dysfunction with lead resistance > 3000ohms. After hemodynamic stabilization, he underwent immediate temporary pacemaker insertion. Chest X ray and Computed Tomography Chest revealed lead tip in pericardium (Fig 1).

After initial course of antibiotics, he was planned for pacemaker removal, extracting pacemaker lead and Right Ventricle repair if required. During permanent pacemaker removal procedure, he was detected to have lead fracture at the operated site. Due to lead fracture, unscrewing is not possible with the pacemaker lead clip. However we attempted to remove the fractured lead using small artery forceps after explaining the high risk consent.



Fig 1: Right Ventricular screwing lead displaced into the pericardium with fractured proximal end

Boston scientific INGEVITYRV pacing lead had four layers of insulation between conductors. INGEVITY is co-axial lead with a unique coil design. A stylet can pass through the central lumen of coaxial pacemaker leads, which feature an inner conductor that runs the entire length of the lead to the cathode (tip of electrode). The conductor is arranged in a coil arrangement. An additional coil conductor that travels down the lead to the ring electrode (anode) wrapped around this coil and covered by a cylindrical length of inner insulation. The design is completed by adding a second outer layer of insulation and a lead covering to shield the ring conductor [5].

Patient right ventricular lead is coaxial screwing type, the proximal end is fractured, so we are not able to unscrew the proximal end conventionally with lead clip. We planned to remove the pacemaker lead in four layers, one at a time, since the inner cathode wire contributed primarily to the screw section of the lead. The lead's outermost layer of insulation is taken off with scissors, the outside coil conductor wire (anode) is trimmed and straightened. The insulation's inner layer is taken off and attempted to unscrew the cathode wire using tiny artery forceps, which is the primary inner circuit. The inner pacing wire was securely grasped without causing any damage to it. Using small artery forceps, the wire was turned sixteen times to begin the unscrewing process. The pacemaker lead was successfully extracted without any complications. There is no evidence of pericardial effusion with serial monitoring.

He underwent explantation of the permanent pacemaker and a temporary pacemaker was placed in Right Ventricle apex through right IJV route. Pacemaker generator, remaining lead and soft tissue was sent for culture & sensitivity, which revealed growth of Coagulase-negative Staphylococci and antibiotics were modified accordingly. He was managed conservatively and underwent permanent pacemaker implantation after 04 weeks of antibiotic therapy.

Discussion

Patients who are physically active have higher risk of experiencing lead fracture, which is a common consequence of cardiac implantable electronic devices. Removal of right ventricular pacemaker lead might result in severe and possibly fatal bleeding. Because of this, the accepted procedure in these situations has been to perform open surgical removal of the lead and epicardial pacing while leaving the catheter positioned across the wall of the right ventricle [1, 2, 6].

In few case studies it is reported that fracture lead can be removed percutaneously. Larry-Stuart Deutsch, Hong Dang, *et al* case report, chosen Cook 0.038-inch alligator jaw retrieval guide for the retraction of the proximal tip of the pacemaker lead because of its sidebiting grasping capability and successfully removed the perforated lead from right atrium [4].

Shohei Imaeda *et al* case report showed extraction of the atrial lead using a laser sheath. A 7 Fr ablation catheter was then inserted through the right femoral vein to extract the floating lead body into the inferior vena cava. The proximal end of the lead was removed from the atrium using the hooking technique, and the distal end was locked and removed using a Goose Neck Snare. Percutaneous non-invasive lead extraction with the snaring technique can be used for floating right ventricular leads, leading to the avoidance of surgical risks [5].

In view of potential complications of fractured lead removal, lead abandonment with placement of a new lead may also be performed. There are no controlled clinical studies comparing lead abandonment and lead extraction. However, extraction is currently recommended only in patients in whom the old lead causes life-threatening arrhythmias, infection not controlled after course of antibiotics, interferes with the operation of implanted cardiac devices, interferes with radiation therapy or needed surgery, or, due to its design or failure, poses an immediate threat to the patient if left in place [3, 4]. Every time conventional method of percutaneous fractured lead removal may not be possible, so we tried unconventional method and removed the lead successfully without any complications.

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