Is it safe to cut pacing wires flush with the skin instead of removing them?

Kasra Shaikhrezai*, Maziar Khorsandi, Marios Patronis and Sai Prasad

Department of Cardiothoracic Surgery, Royal Infirmary of Edinburgh, Edinburgh, UK

* Corresponding author. Department of Cardiothoracic Surgery, Royal Infirmary of Edinburgh, Little France Crescent, Dalkeith Road, Edinburgh EH16 4SA, UK. Tel: +44-131-2423902; fax: +44-131-2423929; e-mail: kasrash@gmail.com (K. Shaikhrezai).

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Abstract

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was whether it is safe to cut the temporary epicardial pacing wires (TEPWs) flush with the patient's skin surface prior to discharge. Altogether 105 relevant papers were identified of which 13 case reports represented the best evidence to answer the question. The author, journal, date, country of publication, complications, the culprit TEPW and relevant outcomes are tabulated. All case reports demonstrated a wide spectrum of complications. Complications from a retained TEPW mainly arise after a long dormant period. A recent case report has demonstrated the herniation of intra-abdominal contents through a diaphragmatic defect created by the abandoned epicardial pacing wires after a few decades. In multiple case reports, the migration of TEPW was the culprit of serious complications. In two case reports, the TEPWs attached to the right chambers of the heart had migrated to the pulmonary artery via the right atrium and then the right ventricle. In one case report, a similar migration of the right ventricular TEPW to the right ventricular outflow track was observed. The TEPW migration was not limited to the right side of the heart, as in one case report the right atrial TEPW had migrated to the right carotid artery via the ascending aorta. A distant extravascular migration of TEPWs to the skin surface and intra-peritoneal and pelvic cavities has also been reported. Retained TEPWs have also been reported to inflict complications locally. One case report has shown a large right-sided para-cardiac mass caused by a right atrial TEPW. In two other case reports, the bronchocutaneous fistula, lobar consolidation and bronchiectasis were the manifestations of a retained TEPW. We conclude that the retention of TEPW after cardiac surgery is not necessarily safe and may cause severe complications. We recommend that TEPWs should be completely removed when possible. If TEPWs are retained, this should be appropriately documented and the surgeon should be mindful of this when the patient presents with complications postoperatively.

Keywords: Epicardial pacing wire · Cardiac pacemaker · Complications · Migration

INTRODUCTION

A best evidence topic was constructed according to a structured protocol, which is comprehensively described in the ICVTS [1].

CLINICAL SCENARIO

You are having difficulty removing a temporary epicardial pacing wire (TEPW) on a patient 4 days after coronary artery bypass graft surgery (CABG), as there is some resistance and you are not too keen to pull harder. You contact the surgeon who put the wires in and he says that he had to put in a few extra sutures into the right atrium and he may have included the pacing wire in one of the sutures. He tells you to be brave and just pull harder, but you would rather cut the wire flush with the skin and leave it in situ. You resolve to check for the safety of your approach.
### Table 1: Summary of best evidence papers in chronological order

<table>
<thead>
<tr>
<th>Author, date, journal and country</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benson et al., (2011), Congenit Heart Dis, USA [6]</td>
<td>A 23-year old pregnant female patient with LUQ pain at 20 weeks of gestation, congenital (S,L,L) transposition of great arteries and high-grade conduction disease in infancy requiring the placement of two right ventricular epicardial pacing wires with the implantation of an abdominal generator</td>
<td>Delayed complication of two retained right ventricular epicardial pacing wires, 22 years after insertion.</td>
<td>Herniation of intra-abdominal contents through a diaphragmatic defect created by the abandoned epicardial pacing wires.</td>
<td>Serious long-term life threatening complication of abandoned pacing wires. This is a very relevant complication considering the increasing number of pregnant women with congenital heart disease.</td>
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<tr>
<td>Kapoor et al., (2011), Interact CardioVasc Thorac Surg, India [7]</td>
<td>A 38-year old male with previous mechanical AVR and asymptomatic</td>
<td>Delayed complication of retained single atrial TEPWs, 12 weeks after insertion</td>
<td>Patient survived</td>
<td>The hazards of retained TEPWs in the context of anticoagulation therapy. The management of the complication and the final outcome have not been discussed.</td>
</tr>
<tr>
<td>Worth et al., (2011), J Thorac Cardiovasc Surg, USA [8]</td>
<td>A 65-year old male with progressive shortness of breath and lower extremity swelling with previous CABG</td>
<td>Delayed complication of two retained right ventricular TEPWs, 24 years after insertion</td>
<td>Patient survived</td>
<td>Migration of TEPW leading to morbidity.</td>
</tr>
<tr>
<td>Sheikh et al., (2011), Pacing Clin Electrophysiolog, USA [9]</td>
<td>A 73-year old male with worsening CCF, raised WCC, positive blood culture for staphylococcus epidermidis and previous CABG</td>
<td>Delayed complication of a single retained right ventricular TEPW, 13 years after insertion</td>
<td>TOE showed severe TR with a 19-cm linear echogenic structure (right ventricular TEPW) from the base of the RV extending to the RVOT. Angiography revealed RCA stenosis</td>
<td>Case report demonstrates serious complications of a retained TEPW leading to significant morbidity. The authors favoured postoperative removal of TEPWs prior to discharge.</td>
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<tr>
<td>Sakellaridis et al., (2009), J Cardiothorac Surg, Greece [10]</td>
<td>A 70-year old male with previous CABG and sternotomy wound infection requiring sternal wire removal and debridement presenting with productive cough and discharge from a lower sternal pustule</td>
<td>Delayed complication of retained right atrial and ventricular TEPWs in the context of wound infection, 10 years after insertion</td>
<td>Patient survived</td>
<td>Although the reported complication is very rare, it is not clear whether this is a result of chronic wound infection or a retained TEPW.</td>
</tr>
<tr>
<td>Horng et al., (2008), Ann Thorac Surg, USA [11]</td>
<td>A 60-year old male with unremitting dyspnoea, productive cough, recurrent pneumonia and previous CABG</td>
<td>Delayed complication of possibly two retained right atrial TEPWs, 6 years after insertion</td>
<td>Patient survived</td>
<td>Rare manifestation of retained TEPWs.</td>
</tr>
<tr>
<td>Juchem et al., (2008), Europace, Germany [12]</td>
<td>A 71-year old female with dyspnoea, TIA symptoms, leucocytosis, previous MVR, positive blood culture for MRSE and mitral and aortic valve endocarditis</td>
<td>Delayed complication of a retained right atrial TEPW 2 years after insertion</td>
<td>Patient survived</td>
<td>Retained TEPWs are potential risk factors for infective endocarditis and endovascular migration.</td>
</tr>
</tbody>
</table>

**Continued**
### Table 1: (Continued)

<table>
<thead>
<tr>
<th>Author, date, journal and country Study type (level of evidence)</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garcia-Bengochea et al., (2007), Tex Heart Inst J, USA [13]</td>
<td>A 83-year old male with the previous replacement of IV pacing system/abdominal generator for SSS and TV vegetectomy (coagulase-negative Staphylococcus), acute abdomen and proximal intestinal obstruction</td>
<td>Delayed complication of retained right ventricular and paraesophageal pacing wires and the generator, 4 years after insertion</td>
<td>Imaging revealed intraperitoneal migration of the epicardial pacing wires and the generator which was initially in the left anterior rectus sheath</td>
<td>Acute abdomen can be a manifestation of the pacing system migration</td>
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<tr>
<td>Meier et al., (2004), Ann Thorac Surg, USA [14]</td>
<td>A 66-year old male with severe respiratory distress followed by VT cardiac arrest (successfully resuscitated) and previous CABG</td>
<td>Delayed near fatal complication of a retained atrial TEPW, 3 years after insertion</td>
<td>TOE revealed a migrated TEPW originating from the right atrium, to the right ventricle and the pulmonary artery</td>
<td>VT arrest is associated with the migration of TEPW. Further discussion required to discriminate between the angiogram findings (blocked grafts) and the migrated TEPW as the cause of VT arrest</td>
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<tr>
<td>Matwiyoff et al., (2000), J Am Acad Dermatol, USA [15]</td>
<td>A 77-year old male with intermittent bloody discharge from a pustule at the lower left sternal edge and previous CABG</td>
<td>Delayed complication of possibly a retained ventricular TEPW, 7 years after insertion</td>
<td>During excisional biopsy a firm metal wire (TEPW of 16.5 cm) was discovered and extracted</td>
<td>Cutaneous manifestation of a retained TEPW</td>
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<td>Gentry et al., (1993), Ann Thorac Surg, USA [16]</td>
<td>A 52-year old male with chest pain radiating to his back and previous haemoptysis and CABG</td>
<td>Delayed complication of possibly a retained atrial TEPW, 1 year after insertion</td>
<td>Chest CT scan demonstrated the presence of a new mass associated with the right lower lobe bronchus. A subsequent bronchoscopy revealed the presence of a foreign body, which was confirmed to be a retained TEPW</td>
<td>TEPWs may migrate to the bronchial tree. The authors emphasized on the importance of documentation of the retained TEPWs. The actual management has not been comprehensively discussed</td>
</tr>
<tr>
<td>Korompai et al., (1987), J Thorac Cardiovasc Surg, USA [17]</td>
<td>A 31-year old male with severe perineal pain and previous AVR</td>
<td>Delayed complication of a retained right ventricular TEPW, 6 years after insertion</td>
<td>Imaging revealed an extravascular migration of a retained TEPW to the pelvis</td>
<td>The distant migration of TEPW may occur. The report implies the importance of TEPWs removal in younger patients</td>
</tr>
<tr>
<td>Mansur et al., (1984), Am Heart J, Brazil [18]</td>
<td>A 45-year old female with signs and symptoms of sepsis, prosthetic mitral valve endocarditis and previous MVR</td>
<td>Delayed fatal complication of retained TEPWs, 2 years after insertion</td>
<td>Abscess formation was confirmed around the retained TEPW. The patient was initially treated with antibiotics and discharged. 30 days post-discharge she was readmitted with refractory cardiac failure, mitral and TV insufficiency due to vegetations and annulus abscess</td>
<td>The fatal association of an infected retained TEPW with bacterial endocarditis</td>
</tr>
</tbody>
</table>

AVR: aortic valve replacement; CABG: coronary artery bypass grafting; CCF: congestive cardiac failure; CT: computed tomography; CTPA: computed tomography pulmonary angiogram; ECG: electrocardiogram; IV: intravenous; LUQ: left upper quadrant; MRSE: methicillin-resistant Staphylococcus epidermidis; MVR: mitral valve replacement; PE: pulmonary emboli; RCA: right coronary artery; RV: right ventricle; RVOT: right ventricular outflow tract; SSS: sick sinus syndrome; TEPW: temporary epicardial pacing wire; TIA: transient ischaemic attach; TOE: transoesophageal echocardiography; TR: tricuspid regurgitation; TV: tricuspid valve; VO₂max: maximal oxygen consumption; VT: ventricular tachycardia; WCC: white cell count.
Retained TEPWs can present with various and often vague signs and symptoms that may present decades postoperatively and may lead to significant morbidity and further surgery. We recommend that any retained TEPWs should be documented in the patients’ notes prior to their discharge and the surgeon should be mindful of retained TEPWs when patients present with any postoperative complication. We acknowledge that the extraction of TEPWs may not always be possible. However, taking the above-mentioned complications into account, it is imperative that TEPWs are completely removed when no longer needed.

**CONCLUSION**

The routine retention of TEPWs by cutting them flush with the skin is not recommended.

Conflict of interest: none declared.

**REFERENCES**


