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

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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 intraperitoneal 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.

THREE-PART QUESTION

[In patients with temporary pacing wires] is [cutting flush with the skin] compared with [complete removal] the safest approach to avoid [long-term complications with the retained wire vs an acute problem with removal].

SEARCH STRATEGY

Medline from 1948 to week 1 July 2012 using the OVID SP interface was searched utilizing the following strategy:

(epicardial pac$.mp OR temporary pac$.mp OR epicardial wire. mp) and (exp Postoperative complications/).

SEARCH OUTCOME

One hundred and five papers were identified utilizing the reported search strategy. Thirteen of these were selected as
### Table 1: Summary of best evidence papers in chronological order

<table>
<thead>
<tr>
<th>Author, date, journal and country</th>
<th>Study type</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>Case report (level 5)</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>
</tr>
<tr>
<td>Kapoor et al., (2011), Interact CardioVasc Thorac Surg, India [7]</td>
<td>Case report (level 5)</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>Case report (level 5)</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 Electrophysiol, USA [9]</td>
<td>Case report (level 5)</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</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>
</tr>
<tr>
<td>Sakellaridis et al., (2009), J Cardiothorac Surg, Greece [10]</td>
<td>Case report (level 5)</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>Angiography revealed RCA stenosis</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>Case report (level 5)</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>The breathing reserve was 50% and VO2max was 60% of predicted. CT chest revealed right upper lobe consolidation and bronchiectasis secondary to a retained TEPW</td>
<td>Rare manifestation of retained TEPWs</td>
</tr>
<tr>
<td>Juchem et al., (2008), Europace, Germany [12]</td>
<td>Case report (level 5)</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>TOE, CT and duplex scan showed a 20-cm linear opacity (TEPW) extending from the aortic valve through to the ascending aorta to the right carotid artery</td>
<td>Retained TEPWs are potential risk factors for infective endocarditis and endovascular migration</td>
</tr>
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Continued
### Table 1: (Continued)

<table>
<thead>
<tr>
<th>Author, date, journal and country</th>
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<th>Patient group</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Garcia-Bengochea et al., (2007), Tex Heart Inst J, USA [13]</td>
<td>Case report (level 5)</td>
<td>A 83-year old male with the previous replacement of IV pacing system/abdominal generator for SSS and TV vegetectomy (coagulase-negative Staphylococc), acute abdomen and proximal intestinal obstruction</td>
<td>Delayed complication of possibly a retained ventricular TEPW, 7 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>
</tr>
<tr>
<td>Meier et al., (2004), Ann Thorac Surg, USA [14]</td>
<td>Case report (level 5)</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 right 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 TEPWs. Further discussion required to discriminate between the angiogram findings (blocked grafts) and the migrated TEPWs as the cause of VT arrest</td>
</tr>
<tr>
<td>Gentry et al., (1993), Ann Thorac Surg, USA [16]</td>
<td>Case report (level 5)</td>
<td>A 52-year old male with chest pain radiating to his back and previous haemoptysis and CABG</td>
<td>Delayed complication of a possibly a retained atrial TEPW, 1 year after insertion</td>
<td>Patient survived</td>
<td></td>
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<tr>
<td>Korompai et al., (1987), J Thorac Cardiovasc Surg, USA [17]</td>
<td>Case report (level 5)</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>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>The patient was treated by conservative management</td>
</tr>
<tr>
<td>Mansur et al., (1984), Am Heart J, Brazil [18]</td>
<td>Case report (level 5)</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>The patient laparotomy for the removal of the TEPW</td>
<td>The report implies the importance of TEPWs removal in younger patients</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 epidemidis; 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.
representing the best evidence on this topic and summarized in Table 1.

COMMENTS

Dysrhythmia post-cardiac surgery occurs frequently [2]. Haemodynamic instability secondary to such dysrhythmias can be prevented by attaching the TEPWs to the heart chambers intra-operatively [2]. TEPWs are generally clipped or sutured to the atria and/or the ventricles at the conclusion of surgery. However, the removal of TEPWs has been associated with catastrophic complications such as laceration to the coronary grafts (especially venous grafts), the atria and/or the ventricles leading to significant morbidity and mortality [3, 4]. Generally, TEPWs can be removed postoperatively by gentle traction. Alternatively, they can be cut flush with the skin so that the residual wire retracts into the tissue. It has been reported that traction removal may be associated with cardiac arrhythmias [5]. The delayed complications associated with the retained epicardial pacing wires have been previously observed and reported by Hodam and Starr [6].

From our review, the range of complications associated with retained TEPWs varied from minor complications, e.g. localized cutaneous abscess and fistula formation to major complications, e.g. the distant migration of the TEPWs and the development of infective endocarditis requiring reoperation leading to significant morbidity and often mortality.

Benson et al. [7] reported diaphragmatic herniation of the intra-abdominal contents into the thoracic cavity secondary to a retained TEPW. Kapoor et al. [8] reported significant mediastinal haematoma formation compressing the right atrium in an anticoagulated patient as late as 12 weeks postoperatively due to a retained TEPW. In a case report by Worth et al. [9], the migration of a retained TEPW into the right ventricle and then to the left pulmonary artery has been observed. Sheikh et al. [10] reported the migration of a TEPW through the tricuspid valve (TV) leading to severe tricuspid regurgitation. The patient required surgery to remove the wire and TV repair. Sakellaridis et al. [11] reported a case of a bronchocutaneous fistula following CABG caused by a retained TEPW requiring intravenous antibiotics therapy, wound debridement and removal of the TEPW. Horng et al. [12] published a case of a male patient with unremitting dyspnoea 6 years post-CABG secondary to a migrated TEPW to the right upper lobe of the lung causing consolidation. The patient required thoracotomy to remove the wire. Juchem et al. [13] reported a case of infective endocarditis 2 years post-mitral valve replacement (MVR). The cause was identified as a retained TEPW requiring open-heart surgery to remove the wire and perform aortic valve replacement (AVR) accompanied by MVR. In a case report Garcia-Bengochea et al. [14] reported that the pacing wires and the generator have migrated to the abdominal cavity leading to small bowel obstruction requiring laparotomy. Meier et al. [15] reported a case of cardiac arrest induced by ventricular tachycardia (VT) due to a migrated TEPW that had been inserted 3 years previously at a CABG operation. Matwiyoff et al. [16] reported a case of a lower sternal cutaneous abscess and fistula formation to major complications, e.g. the distant migration of the TEPWs and the development of infective endocarditis requiring reoperation leading to significant morbidity and often mortality.

Korompai et al. [18] reported an extreme case of migration of a retained TEPW to the pelvis in a 31-year-old man leading to an unremitting perineal pain 6 years post-AVR leading to laparotomy. Mansur et al. [19] published a case of a 45-year-old patient who presented with severe sepsis due to dura mater valve endocarditis 2 years post-MVR. The cause was identified as a retained TEPW requiring reoperation. The patient died peri-operatively.

CONCLUSION

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.

CLINICAL BOTTOM LINE

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

Conflict of interest: none declared.

REFERENCES


eComment. Retained temporary epicardial pacing wires in cardiac surgery

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We read with great interest the best evidence topic by Shaikhrezai and colleagues regarding retained temporary epicardial pacing wires (TEPWs) in cardiac surgery and we agree with their recommendations [1].

TEPWs are used routinely in the postoperative period following cardiac surgery and its use is associated with low morbidity and mortality [1, 2]. Significant predictors for pacing in the postoperative period include diabetes mellitus, preoperative arrhythmias and need for pacing during the operation (coming off cardiopulmonary bypass, etc). If patients with these risk factors were excluded, only 2.6% patients of coronary artery bypass graft (CABG) surgery will require pacing [2].

The incidence of major complications following TEPWs removal is 0.04% [2]. The risk of complications is higher in redo cardiac surgery and anti-coagulated patients [2]. Patients’ vital signs should be monitored following the removal of TEPWs to allow early and prompt identification of related potential complications [2].

Retained TEPWs rarely cause problems [1, 2]. Chung and Smith have reported on two cases of delayed presentation of anterior mediastinal foreign body reaction secondary to retained TEPWs [3]. The first case was related to a 59-year-old man who had CABG and six years later, presented with an abscess in the lower third of his sternotomy incision, which was treated with debridement and removal of the underlying sternal wires. Even though the wound had healed well, a mid-sternal swelling combined with right subcostal sinus eventually developed [2]. A computed tomography scan showed a retrosternal, ill-defined area of soft tissue extending into the superior mediastinum containing the retained TEPWs. The patient was treated successfully with opening of the sinus, removal of the TEPWs and remaining sternal wires with healing of the wounds by secondary intention [3]. The second case was quite similar to the first one and was related to a 64-year-old woman who had CABG and five years later was presented with abscess in the lower third of the sternotomy scar. The same approach with the first case was used successfully after confirmation with a CT scan of the retrosternal collection associated with retained TEPWs [2].

Lyons et al., in 1986, have reported on four cases with infection and bacteraemia due to retained TEPWs [3]. The authors illustrated that the failure of removal of the TEPWs should be considered as a real surgical complication and not just a trivial event [4].

In conclusion, because it is suggested that off-pump CABG may be associated with reduced requirement of TEPWs, its routine insertion might be considered carefully [2, 5]. In the case of retained TEPWs, the patient has to be aware of any related potential complication, the incident has to be documented in the patient records and its inclusion in the differential diagnosis of any relevant postoperative complication is of paramount importance [1].

Conflict of interest: none declared

References