CASE REPORT

The catastrophic journey of a retained temporary epicardial pacemaker wire leading to *Enterococcus faecalis* endocarditis and subsequent stroke

Harleen Kaur Dyal,¹ Rohit Sehgal²

¹Royal College of Surgeons in Ireland, Dublin 2, Ireland
²Washington Hospital Healthcare System, Fremont, California, USA

Correspondence to
 Dr Harleen Kaur Dyal,
 harleendyal@gmail.com

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SUMMARY

A 52-year-old man underwent triple coronary artery bypass graft (CABG). Three months later, he presented to the emergency room with dizziness and left-sided weakness. Workup revealed right frontal parenchymal haemorrhage; also, two retained temporary epicardial pacemaker wires (TEPW) from his previous CABG were observed, one of which had significantly migrated. One wire was found in the soft tissues below the heart; the other transversed the mediastinum from the expected location of the right atrium, perforating the right atrial appendage, entering the lumen of the ascending aorta and coursing into the mid-descending aorta. There were vegetations (*Enterococcus* spp) on the migrated TEPW and aortic valve, aortic valve endocarditis and aortic regurgitation. In summary, we suspect the migrated TEPW may be the source of bacteria that seeded the aortic valve, causing endocarditis and contributing to the patient's subsequent stroke. Management involved two 6-week antibiotic courses, wire-extraction, aortic valve replacement and redo CABG.

bradycardia backup and rhythm control. Typically, they are inserted at the end of a surgical procedure and removed prior to discharge. Alternatively, as in this case, wires can be cut flush with the skin and left in subcutaneously. In the past, complications from TEPWs have been related to their insertion, removal and migration; they have consisted of bleeding, dislodgement, ventricular arrhythmias, haemorrhage and cardiac tamponade due to atrial or ventricular laceration.¹⁰ Transmyocardial migration of TEPWs has rarely been reported in adult patients following heart surgery. While the safety and efficacy of these wires in the cardiac surgery routine have generally been accepted, it is cases such as the one presented here that beg the question of whether or not TEPWs have the potential of being more harmful than helpful. This patient's story draws our attention to a rare and devastating complication following a widely and commonly accepted procedure. Furthermore, it urges us to take into account our strategy when dealing with TEPWs today.

BACKGROUND

The case presented calls for background discussion regarding the epidemiology of *Enterococcus faecalis* and the history of two retained temporary epicardial pacemaker wires (TEPWs).

Enterococcus, derived from the French 'enterococque' used in an 1899 publication, are Gram-positive cocci of intestinal origin with an ability to survive harsh environmental conditions.^{1 2} Currently, there are more than 15 identified species within the *Enterococcus* genus, with *E. faecalis* and *Enterococcus faecium* being the major isolates from clinical sources.³ Enterococci frequently cause urinary tract infections (UTIs), being recovered from up to 15–20% of UTIs in the hospital setting.^{4 5} Intravenous and intra-arterial lines may serve as entry vectors into the bloodstream for *Enterococcus*.⁶ Enterococci are becoming increasingly prevalent among immunocompromised and elderly patients.^{6 7} Enterococci are the third most common aetiological agent of infective endocarditis worldwide, causing 10–15% of cases; of these, approximately 90% are attributable to *E. faecalis*.⁸

Since the 1960's, TEPWs have been used routinely in cardiac surgery, with the reported incidence of major complications being a mere 0.4%.⁹ The purpose of TEPWs is arrhythmia suppression and maintenance of optimal haemodynamic function in the postoperative period by providing

CASE PRESENTATION

A 52-year-old man presented in the emergency room reporting of sudden onset dizziness, right frontal headache and left-sided weakness while driving home from work. He reported to have been feeling generally unwell for the past few weeks with a low-grade fever, but he did not seek medical attention. On reaching home, his wife noticed that he was ataxic, staggering and had noticeable weakness on the left side.

On examination in the emergency room, the patient's vitals were as follows: blood pressure: 162/92, pulse: 97, temperature: 98.8, respirations: 20, O₂ saturation: 99% on room air. The patient answered questions appropriately and was oriented to person, place and time. He reported of severe right-sided headache. Pupils were 2–3 mm, round, equal and briskly reactive to light. There was a left gaze palsy with neglect to the left side. Neurological examination revealed a left-sided facial droop and grade 0/5 motor strength of the upper and lower left extremities with flaccid paralysis. Remaining review of systems was non-contributory apart from occasional acid reflux. There was significant family history of coronary artery disease, with three of the patient's siblings having suffered from acute myocardial infarctions in the past. The patient had no pre-existing valvular

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abnormalities and denied any history of smoking, drinking or illicit drug use.

The patient's medical history consisted of hyperlipidaemia and hypertension being controlled with amlodipine, hydrochlorothiazide and simvastatin. He had no known allergies.

Of significant importance was his visit to the emergency room 3 months prior with unremitting chest pain; he was noted to have ECG changes and positive troponins at that time. He was subsequently diagnosed with a non-ST elevation myocardial infarction. Workup with coronary angiography demonstrated an ostial high grade left anterior descending artery lesion and high-grade lesions in the diagonal and circumflex marginal systems (ie, severe 2 vessel coronary artery disease). The patient was admitted to the hospital at that time and scheduled for urgent coronary artery bypass graft (CABG). During the procedure, he underwent placement of two atrial TEPWs and two ventricular TEPWs. He had a successful surgery and was discharged home 10 days later on aspirin and clopidogrel. There was complete healing of the surgical wound and no perioperative or post-operative complications or infections were subsequently reported. At the patient's 2-week follow-up appointment, two of the four TEPWs were removed with ease. On attempted removal of the remaining two wires, resistance was encountered. Thus, these two wires were subsequently cut flush with the skin and left in, as is sometimes done in clinical practice.

INVESTIGATIONS

The following investigations were performed in chronological order on the day of admission

1. Blood cultures revealed 4/4 (bottles) positive results for *E. faecalis* bacteraemia without high-level aminoglycoside resistance (HLAR).
2. CXR revealed no evidence of congestive heart failure and/or fluid overload.
3. CT of the head without contrast revealed right frontal lobe 2.7×4.1 cm parenchymal haemorrhage in the transverse and anteroposterior dimensions ([figure 1](#)). There was surrounding white matter oedema. There was mass effect on the overlying cortical sulci. There was some mass effect on the anterior falx, but no evidence of uncus herniation and no significant shift of the midline structures.
4. CT angiogram of the head and neck with contrast revealed right frontal parenchymal haemorrhage. No occlusive thrombi were seen of the arteries at the base of the skull. No large artery or vein to the right frontal lobe was identified to suggest an arteriovenous malformation. No carotid stenosis was demonstrated. Both vertebral arteries were well-defined. Lower images included the aortic arch; of particular significance was the presence of a curvilinear density within the ascending and descending aorta.
5. Transthoracic echocardiogram revealed possible vegetations on the aortic valve. In addition, a linear density was seen in the aortic root. Linear densities were also seen in the right ventricle and left ventricle. In view of the echodensities seen, further imaging was required for additional detail (6 and 7).
6. CT of the chest with contrast revealed an epicardial pacer wire left over from the prior CABG. It entered through the subxiphoid region and then circled on the under-surface of the heart in the pericardial space. A second wire was visualised beginning at the level of the inferior portion of the right atrium and coursing apparently in the right atrial wall and then perforating the superior wall of the right atrial appendage and coursing along the right anterolateral aspect of the ascending aortic wall ([figure 2](#)). It then entered the

Figure 1 CT of the head without contrast showing right frontal lobe 2.7×4.1 cm parenchymal haemorrhage.

Figure 2 Arrow is pointing to retained temporary epicardial pacemaker wire as seen on chest CT.

Figure 3 Arrow is pointing to retained temporary epicardial pacemaker wire as seen on chest CT.

Figure 4 Arrow is pointing to aortic valve vegetation as seen on transoesophageal echocardiogram.

lumen of the ascending aorta in its mid-portion along the right anterolateral aspect, and then coursed intraluminally into the mid-descending thoracic aorta (figure 3).

7. Transoesophageal echocardiogram (performed 3 days after admission) revealed the following:
 - ▶ Aortic valve vegetation (figure 4) on the left coronary cusp. The aortic valve had no signs of perforation, cord rupture, perianular complications or malformation.
 - ▶ TEPW was seen coursing through the tip of the right atrial appendage into the ascending aorta 3 mm above the aortic valve, across the transverse aorta and down into the descending aorta, ending at a level even with the aortic valve. There was a 3 mm vegetation on the wire at the level of the distal portion of the aortic arch.
 - ▶ 3+regurgitation of the aortic valve (figure 5).

DIFFERENTIAL DIAGNOSIS

1. Retained TEPW which migrated via an intracardiac course into the lumen of the aorta.
2. *E. faecalis* infective endocarditis.
3. Haemorrhagic right frontal cerebrovascular accident (CVA) possibly secondary to septic emboli from infective endocarditis.
4. Other differential diagnoses include hypertensive stroke complicated by dual antiplatelet therapy.

TREATMENT

On admission to the hospital, the patient was placed on levetiracetam and nicardipene drip to titrate his systolic blood pressure between 130 and 140 mm Hg.

The final blood culture on admission reported 4/4 bottles positive for *E. faecalis* without HLAR. The patient was evaluated by cardiothoracic surgery with regard to the unusual malpositioned pacing wire. He was then referred to a tertiary centre for further evaluation and intervention for possible retrieval of this pacing wire. At the tertiary centre, a cardiothoracic surgeon, interventional cardiologist and interventional radiologist evaluated him. Removal of the wire was considered, as it may have been the source of the bacteria that seeded the aortic valve and led to the stroke. Percutaneous wire extraction by itself was considered too risky for fear of further vegetation dislodgement. It was felt by the surgeon and interventionalists that wire removal would best be performed in a more controlled fashion in the setting of aortic valve replacement (in view of his aortic valve endocarditis and moderate to severe aortic insufficiency). The patient's recent intracranial haemorrhage served as a relative contraindication to anticoagulation and thus he was deemed an unsuitable surgical candidate at that time. As such, the decision was made to treat the endocarditis for 6 weeks with antibiotics, with planned sterilisation of the vegetations, and to delay surgery and wire extraction until anticoagulation was considered safe.

Figure 5 Aortic insufficiency as seen on transoesophageal echocardiogram.

OUTCOME AND FOLLOW-UP

On the patient's admission and receipt of 4/4 positive blood culture results for *E. faecalis* without HLAR, a 6-week course of ampicillin and gentamycin started. Two weeks into the antibiotic course, blood cultures were again drawn and were negative for *E. faecalis*. The patient continued and finished the remaining 4 weeks of antibiotic treatment successfully. Three weeks later, a follow-up TEE was performed, which showed that the aortic valve vegetation was still present, however, the TEPW vegetation was no longer present. Ten days later, the patient underwent extraction of the wires, aortic valve replacement and redo CABG. On their extraction, the wires were sent for culture, yielding positive results for *E. faecalis*. Blood cultures simultaneously drawn reported negative for *E. faecalis*. The patient was again started on a 6-week course of ampicillin and gentamycin, which he successfully completed. The end of this patient's antibiotic treatment was not associated with any persistent bacteraemia, new embolic events, heart failure or renal failure related to aminoglycoside therapy. Two months later (8 months from initial diagnosis of infective endocarditis), follow-up blood cultures and echocardiogram were performed; the blood cultures were negative and the echocardiogram was noted to be negative for aortic valve vegetations.

The patient also underwent extensive physical therapy and occupational therapy with fair improvement in his left-sided weakness. However, due to the residual effects of the stroke, he was forced to give up work and is now on disability.

DISCUSSION

Our case presented today is original in that it demonstrates a case of TEPW migration causing an infective endocarditis with vegetations on the aortic valve and retained wire; these events are suspected to have ultimately led to vegetation dislodgement and stroke. Another interesting element of this case was the fact that, apart from his previous uneventful 10-day hospital stay for CABG, our patient had no obvious risk factors for *E. faecalis* acquisition. It is important to acknowledge the fact that during his hospital stay, our patient did have an indwelling urinary catheter for the initial part of his admission. It is therefore possible that his genitourinary tract could have been colonised with *E. faecalis* and this could have been a source of occult bacteraemia, which subsequently seeded the indwelling wire. While we were not able to definitively identify the cause, it was considered that the retained wires served as a substrate for the bacteraemia and endocarditis. The patient survived, however, the residual effects on his life have been devastating and merit appropriate discussion within the medical community.

The earliest reports of complications regarding TEPWs date back to 1971.¹¹ Complications relate primarily to insertion, removal and transmyocardial migration of the TEPWs.

In 2004, an epicardial pacing wire was found to have eroded through the right atrium and migrated into the right ventricle resulting in ventricular tachycardia.¹² Two cases were reported in 2008. The first illustrated a patient who suffered from progressive dyspnoea and recurrent pneumonia following an uneventful CABG caused by migration of retained epicardial pacing wires into the right upper lobe of the lung.⁸ The second report involved a pacing wire that migrated via the left atrium and left ventricle into the right carotid artery causing an infective endocarditis of the mitral and aortic valve.¹³ An article published in 2008 queried the use of TEPWs;¹⁴ in 2009, another article questioned whether retained pacing wires were the culprit for the development of a sternobronchial fistula that arose in a patient following coronary surgery.¹⁵ In 2011, a

patient suffered from the development of a right paracardiac mass due to an organised haematoma around retained epicardial pacing wires following aortic valve replacement.¹⁶ In 2012, another case of migration occurred where the lead travelled from the right ventricular myocardium into the pulmonary artery in a patient who had successfully undergone CABG 13 years prior.¹⁷ Another case involved a pregnant woman reporting of abdominal pain that was later attributed to herniation of abdominal contents through a diaphragmatic defect at the site of the abandoned epicardial pacing wire.¹⁸ Lastly, a case with devastating complications involved a young man who had retained an epicardial pacing wire after infant repair of an atrio-ventricular septal defect; this wire was found to have subsequently compressed the left anterior descending artery, leading to his cardiac arrest and death.¹⁹

Patient's perspective

The past events have had a profound impact on myself as well as my family's well-being, emotionally and physically. I led an incredibly active life before all of this happened. The most frustrating thing for me now is the fact that I am on disability and cannot go out to work and support my family. What happened to me was an extremely rare and unfortunate situation. I am grateful to be alive today and am trying to re-build my life in the best way that I possibly can.

Learning points

- ▶ Although current guidelines regarding the care of patients with infective endocarditis are a valuable resource, clinical variability of individual cases demonstrate that these tools should be used in conjunction with the carefully considered judgement of the attending physicians to ensure the best possible outcomes.³ Furthermore, our case demonstrates Baddour's point, "Decision making regarding the role of surgical intervention to prevent systemic embolisation is complex and must be individualised to the patient."³
- ▶ Clinicians and future patients should be aware of the uncommon, though potentially life-threatening, complications that can occur due to temporary epicardial pacemaker wires (TEPWs).
- ▶ Complications can occur in the paediatric and in the adult population; while some patients have recovered successfully, others have suffered devastating consequences.
- ▶ Cases such as the one presented urge us to take into account our strategy when dealing with TEPWs postoperatively; it requires us to weigh the risks versus benefits when it comes to TEPWs. We suggest complete removal of TEPWs in every patient to avoid possible migration. We also recommend developing more specific guidelines with regard to the patient populations that would benefit from TEPWs the most.
- ▶ Currently, in many cardiac surgery centres, TEPWs are placed routinely in every patient. We raise the issue of whether future studies should be made to examine the incidence of transient conduction disturbances following cardiothoracic surgery procedures in order to identify which subgroups benefit most from TEPWs postoperatively and adjust our management protocols accordingly.

The year of 2013 reported retained TEPWs to have caused an aortic bleed postoperatively²⁰ as well as retroaortic abscess development.²¹ There was also a case of mitral valve endocarditis caused by TEPWs that migrated into the pulmonary artery.²² In April of 2014, a paediatric case was reported in which transmyocardial migration of a TEPW was discovered incidentally in the right ventricular outflow tract 1 year after surgical repair of congenital heart disease. Luckily, the wire was extracted and no further complications ensued.²³

Today, the use of TEPWs continues to be investigated, as does their future within the cardiac surgery world.^{24–26}

Contributors HKD drafted this case report for intellectual content, obtained informed consent and followed up with this patient. She is the guarantor. RS proofread this case report for intellectual content.

Competing interests None.

Patient consent Obtained.

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REFERENCES

- Murray BE. The life and times of the Enterococcus. *Clin Microbiol Rev* 1990;3:46–65.
- Wade JJ. *Enterococcus faecium* in hospitals. *Eur J Clin Microbiol Infect Dis* 1997;16:113.
- Baddour LM, Wilson WR, Bayer AS, et al. Infective endocarditis diagnosis, antimicrobial therapy, and management of complications. *Circulation* 2005;111:e394–434.
- Gross PA, Harkavy LM, Barden GE, et al. The epidemiology of nosocomial enterococcal urinary tract infection. *Am J Med Sci* 1976;272:75.
- Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. *Clin Microbiol Rev* 1993;6:428–42.
- Moellering RC. Clinical Updates in Infectious Disease: Enterococcal Resistance [Internet]. National Foundation for Infectious Diseases; April 1998 [cited 18 December 2014]. Available from: <http://www.nfid.org/content-conversion/ldarchive/enterococcal.html>
- McDonald JR, Olaison L, Anderson DJ. Enterococcal endocarditis: 107 cases from the international collaboration on endocarditis merged database. *Am J Med* 2005;118:759–66.
- Miro JM, Perias JM, del Rio A. A new era for treating *enterococcus faecalis* endocarditis: ampicillin plus short-course gentamicin or ampicillin plus ceftriaxone: that is the question! *Circulation* 2013;127:1763–6.
- Horng GS, Ashley E, Balsam L, et al. Progressive dyspnea after CABG: complications of retained epicardial pacing wires. *Ann Thorac Surg* 2008;86:1352–4.
- Carroll KC, Reeves LM, Andersen G, et al. Risks associated with removal of ventricular epicardial pacing wires after cardiac surgery. *Am J Crit Care* 1998;7:444–9.
- Baldwin BJ, Dorney ER. Acute cardiac tamponade following removal of temporary epicardial pacemaker wires after open heart surgery. *Am J Med Sci* 1971;261:241–3.
- David J, Meier MD, Kamala P, et al. Ventricular tachycardia associated with transmyocardial migration of an epicardial pacing wire. *Ann Thorac Surg* 2004;77:1077–9.
- Juchem G, Golczyk K, Kopf C, et al. Bizzare case of migration of a retained epicardial pacing wire. *Eurospace* 2008;10:1348–9.
- Imren Y, Benson AA, Oktar GL, et al. Is use of temporary pacing wires following coronary bypass surgery really necessary? *J Cardiovasc Surg (Torino)* 2008;49:261–7.
- Sakellariadis T, Arginiriou M, Panagiotakopoulos V, et al. Bilateral sternobronchial fistula after coronary surgery: are retained epicardial pacing wires responsible? *J Cardiothorac Surg* 2009;4:26.
- Kapoor A, Syal S, Gupta N, et al. Right paracardiac mass due to organized pericardial hematoma around retained epicardial pacing wires following aortic valve replacement. *Interact Cardiovasc Thorac Surg* 2011;13:104–6.
- Sheikh M, Bruhl SR, Omer S, et al. Transmyocardial voyage of temporary epicardial lead: an unusual long term complication. *Pacing Clin Electrophysiol* 2012;35:185–6.
- Benson CC, Valente AM, Economy KE, et al. Discovery and management of diaphragmatic hernia related to abandoned epicardial pacemaker wires in a pregnant woman with (S,L,L) transposition of the great arteries. *Congenit Heart Dis* 2012;7:183–8.
- Cohen SB, Bartz PJ, Earing MG, et al. Myocardial infarction due to a retained epicardial pacing wire. *Ann Thorac Surg* 2012;94:1724–6.
- Matsushita T, Fuse H, Tekeuchi K, et al. Aortic bleeding one week after removal of an intraoperative epicardial temporary pacing wire. *Ann Thorac Cardiovasc Surg* 2013;19:231–3.
- Smith DE, DeAnda A, Towe CW, et al. Retroaortic abscess: an unusual complication of a retained epicardial pacing wire. *Interact Cardiovasc Thorac Surg* 2013;16:221–3.
- Bashir A, Mustafa HM, Gunning M, et al. Retained temporary epicardial pacing wires: a rare cause of prosthetic valve endocarditis. *J Coll Physicians Surg Pak* 2013;23:657–9.
- Gayanilo MA, Rosenkranz ER, Sandhu SK, et al. Transmyocardial migration of a temporary epicardial pacing wire: a pediatric case report. *World J Pediatr Congenit Heart Surg* 2014;5:315–17.
- Shaikhrezai K, Khorsandi M, Patronis M, et al. Is it safe to cut pacing wires flush with the skin instead of removing them? *Interact Cardiovasc Thorac Surg* 2012;15:1047–51.
- Lazarescu C, Mertes PM, Longrois D. Temporary epicardial pacing following cardiac surgery: practical aspects. *Ann Fr Anesth Reanim* 2013;32:592–601.
- Alwaqfi NR, Ibrahim KS, Khader YS, et al. Predictors of temporary epicardial pacing wires use after valve surgery. *J Cardiothorac Surg* 2014;9:33.

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