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Epicardial Pacemaker Causing Cardiac Strangulation

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Abstract

Cardiac strangulation is a rare but potentially lethal complication of epicardial pacemaker insertion. We present the case of a 9-year-old girl who was identified as having cardiac strangulation on routine follow-up for an epicardial pacemaker inserted on day 1 of life for congenital complete heart block (CCHB). The potential clinical presentations and risk factors for pacemaker strangulation are then discussed.

Keywords: Congenital heart disease, Pacemaker, Cardiac strangulation

1. Past medical history

Our patient was born weighing 2.3 kg. An antenatal diagnosis of complete heart block was made and on day 1 of life she had an epicardial pacemaker inserted via a supxiphoid approach. Bipolar, steroid eluting leads were inserted on to the right ventricle (35 cm, Model 4968, Medtronic Inc, Minneapolis, Minnesota USA), to provide VVIR pacing (See Fig. 1).

The pulse generator was placed in the left rectus sheath. She had an uneventful post-operative recovery and was discharged home.

2. History of presentation

She remained well and continued to attend the paediatric cardiology clinic. When she was reviewed at the age of nine years, other than some symptoms of increased fatigue she remained well. She had a normal cardiac exam and her ECG demonstrated a ventricular paced rhythm.

3. Investigations

An Echo demonstrated new mitral stenosis, with increased inflow velocity of 1.9 m/s

(See Fig. 2) A Chest Radiograph (CXR) (PA and lateral) was performed which demonstrated evidence of the medial lead encircling the heart at the atrioventricular (AV) groove (Fig. 3). CT angiography confirmed cardiac strangulation (Fig. 4). On the CT, one of the epicardial leads was seen to pass along the base of the heart then up and around the left AV groove before implanting in the anterior wall of the right ventricle inferolateral to the right ventricular outflow tract (RVOT). There was evidence of extrinsic compression of the mitral valve orifice related to the lead on CT.

4. Management/follow up

The pacemaker leads and pulse generator were promptly removed via a midline sternotomy. Following removal, new leads were inserted on the right atrium and left ventricular apex and a new pulse generator was implanted in the rectus sheath (Fig. 5). Acceptable thresholds were recorded following insertion of the leads. The patient had an uneventful recovery and was discharged home. At follow up in clinic she remains well, her symptoms of fatigue have improved.

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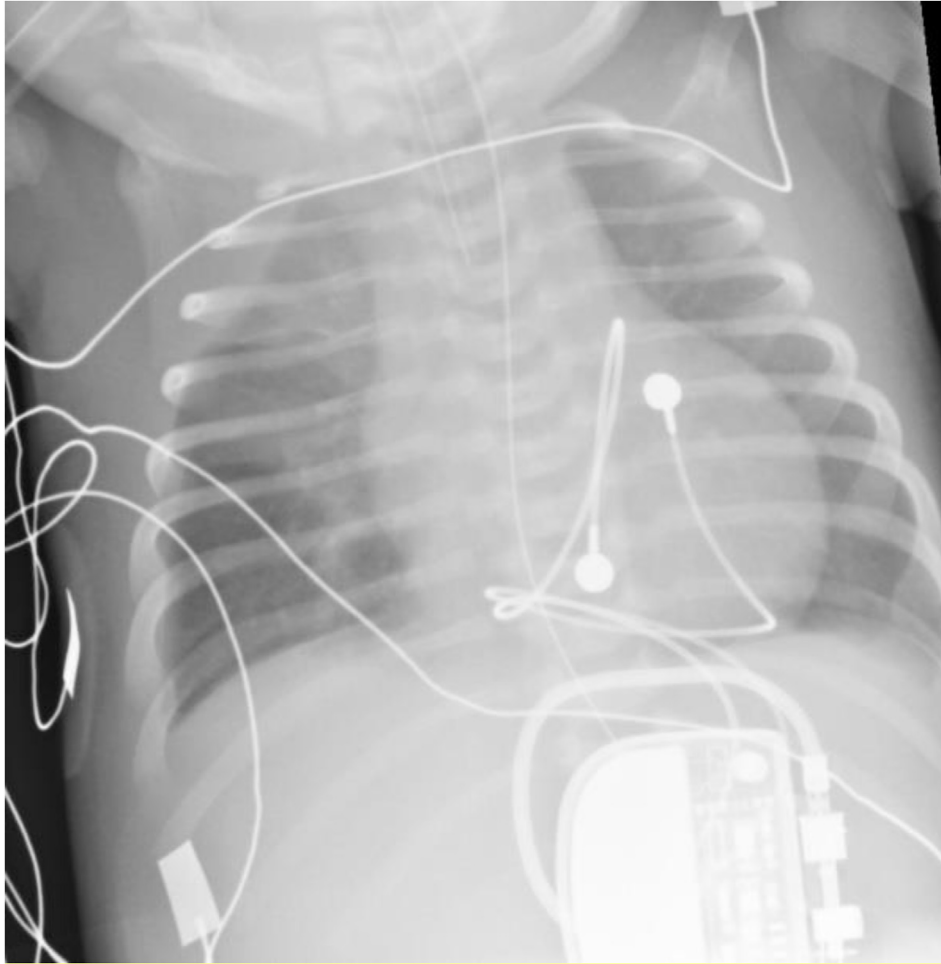


Fig. 1. Post-operative Chest Radiograph on day 1 of life.

5. Discussion

Cardiac Strangulation by epicardial leads causes symptoms due to external obstruction of structures including the atrioventricular (AV) valves, coronary arteries or the great arteries resulting in heart failure and/or ischaemia [1]. Symptoms can be absent, mild or severe with reported cases of ventricular arrhythmia and cardiac arrest [2]. Symptoms may only become apparent in times of increased myocardial demand or stress such as exercise or on induction of anaesthesia [3]. Strangulation incidence is likely under-reported, factors including lack of awareness and the need for a detailed post-mortem being potential confounders [2].

Identified risk factors include pacemaker insertion before six-months of age, low weight at time of

insertion, absence of postpericardiotomy syndrome and absence of post-operative infection [4]. With regards to insertion of epicardial pacemakers a balance needs to be struck between the risk of lead fracture and strangulation. Excess lead insertion is vital to ensure that there is sufficient lead length to allow for linear growth. Lead length of 35 cm is designed for adults and not neonates or children.

Surgical technique as to placement of excess lead length is variable [2] and different strategies have been advocated for the excess lead, the lead being placed in the anterior mediastinum outside the pericardium or anterior to the myocardium [4], or the diaphragmatic surface of the pericardium [1,3,5]. Careful attention to coronary anatomy and avoidance of the Left anterior Descending (LAD) artery is particularly important when placing leads

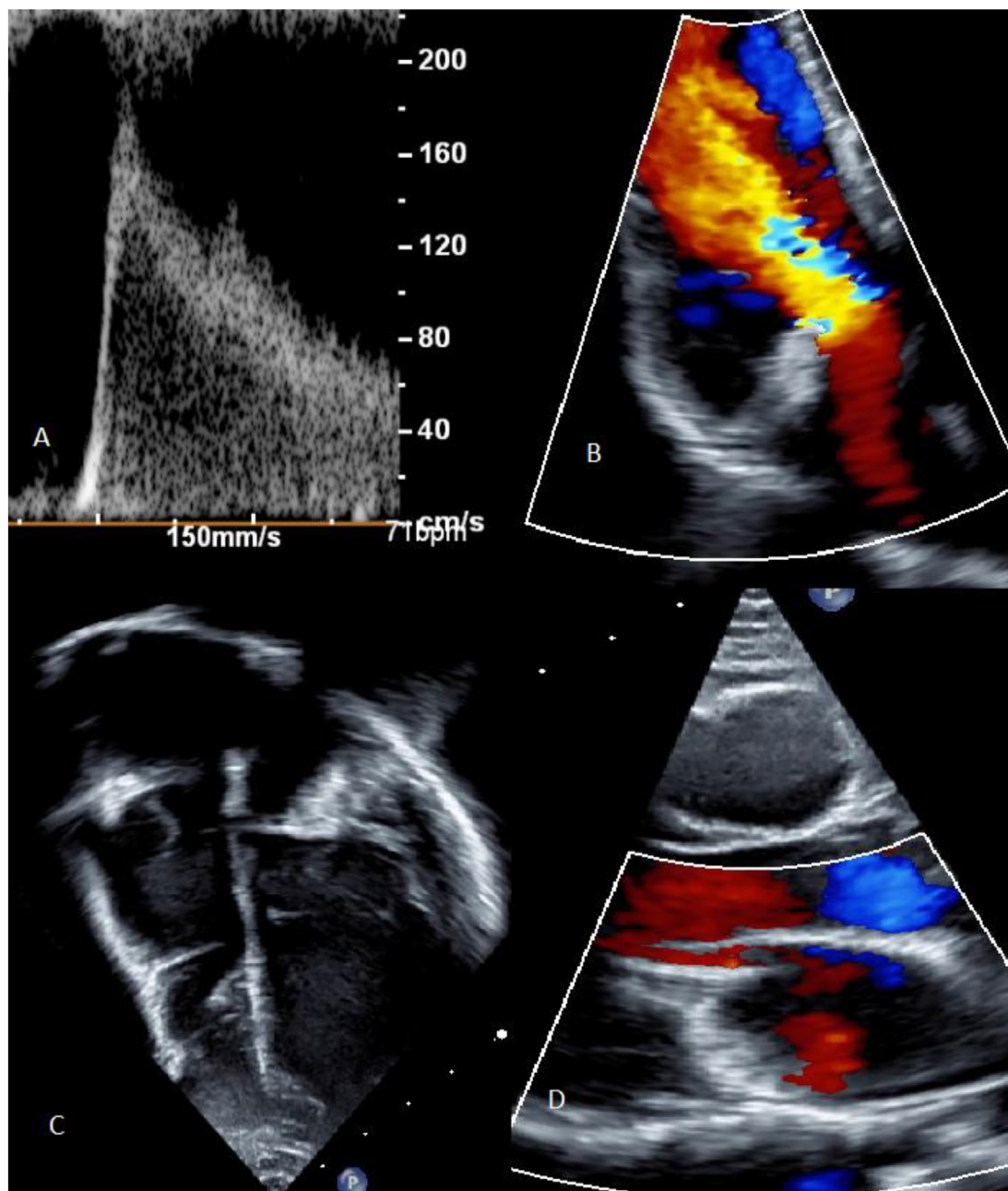


Fig. 2. A) Pulse Wave Doppler with increased velocity noted in mitral E wave (1.9 m/s). B) 3 chamber colour Doppler with evidence of turbulence at mitral inflow. C) 4 chamber 2D image with evidence of epicardial lead causing left AV valve stenosis. D) Long axis parasternal colour image with mitral valve stenosis noted.

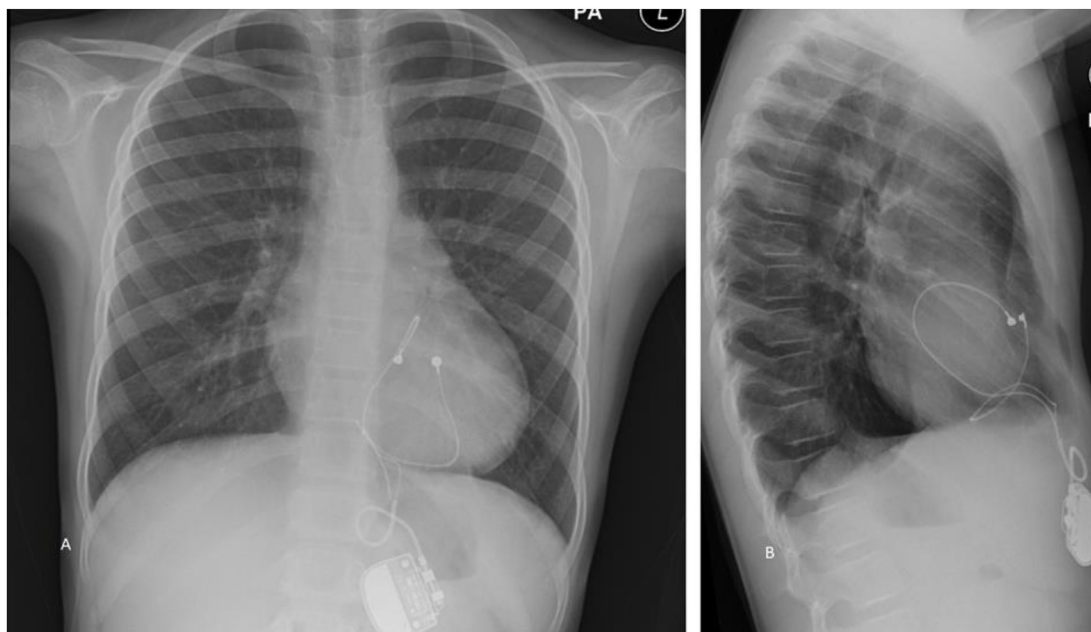


Fig. 3. A) AP CXR B) Lateral CXR Demonstrated Right Atrial lead encircling the heart.

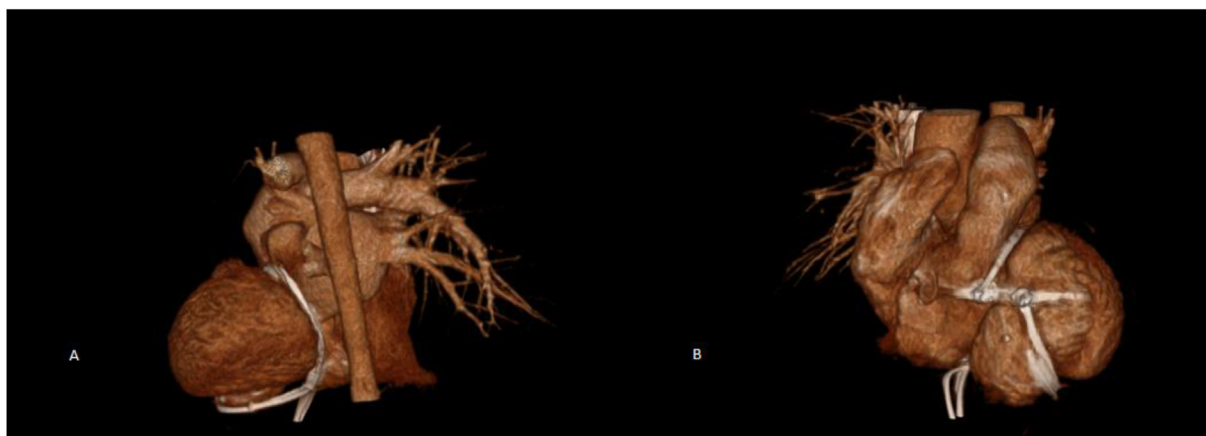


Fig. 4. A) Posterior CT angiography reconstruction demonstrating epicardial lead traversing from base of heart up the AV groove. B) Anterior CT angiography reconstruction demonstrating end course of epicardial lead inferior to the RVOT tract.

anteriorly [1]. Using an expanded polytetrafluoroethylene sheet to separate the heart and leads or circling a tiny counter clockwise loop of lead may be alternative methods to prevent strangulation [6].

With increasing recognition of this potential complication, centres have screened for it prospectively; AP and Lateral CXRs are a convenient screening tool. Classical appearance of leads encircling the heart

(Fig. 3) should prompt consideration of a CT Angiogram. Three yearly CXRs have been suggested as a reasonable interval with the advice that once the patient has reached their adult height these can be discontinued. The first case of an adult strangulation was recently reported in a 31-year-old woman perhaps highlighting the need for surveillance into adulthood [7]. It is important to remember that redundant epicardial leads which have been replaced with a

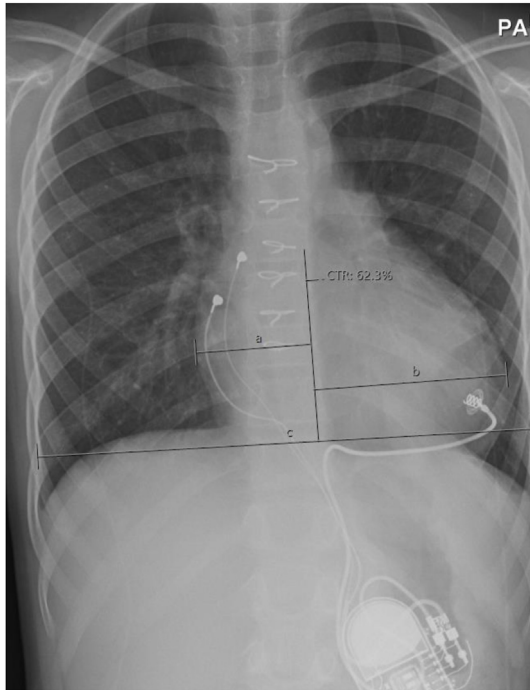


Fig. 5. A) Post-Operative CXR Appearance of new Epicardial pacemaker with generator in the rectus sheath.

transvenous system but are still in situ, have been reported to be substrates for strangulation [1].

6. Conclusion/learning objectives

Cardiac strangulation is an increasingly recognised complication that should be actively screened for in children with epicardial pacemakers. Performance of an AP and lateral CXR 3- yearly is advisable. If strangulation is diagnosed on CT angiography, leads should be surgically replaced without delay to prevent potentially disastrous complications.

Ethical statement

The patient's parent gave informed consent for their inclusion in this paper.

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Author contribution

Conception and design of Study: SK, RA. Literature review: SK, RA, AS, FC. Acquisition of data: SK, RA, AS, FC, LN. Drafting of manuscript: SK. Revising and editing the manuscript critically for important intellectual contents: SK, RA, AS, FC, LN.

Conflict of interest

We have no conflicts of interest to report.

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