

Case Report

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# Subclavian Crush Syndrome: A Rare Cause of Symptomatic Bradycardia in a Patient with a Permanent Pacemaker

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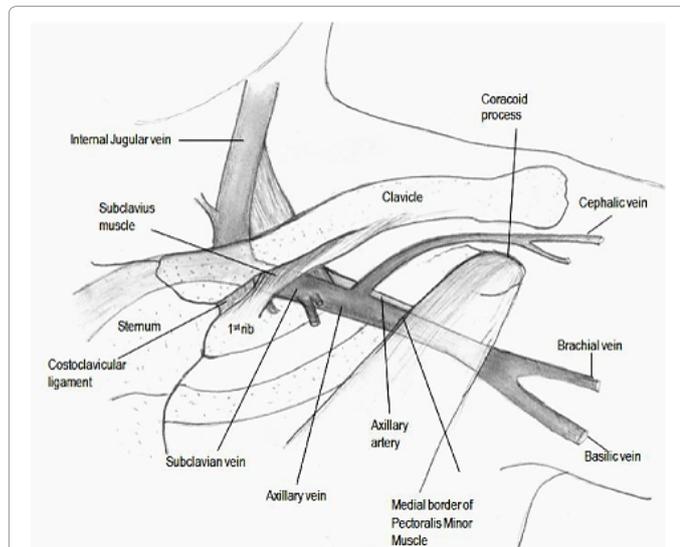
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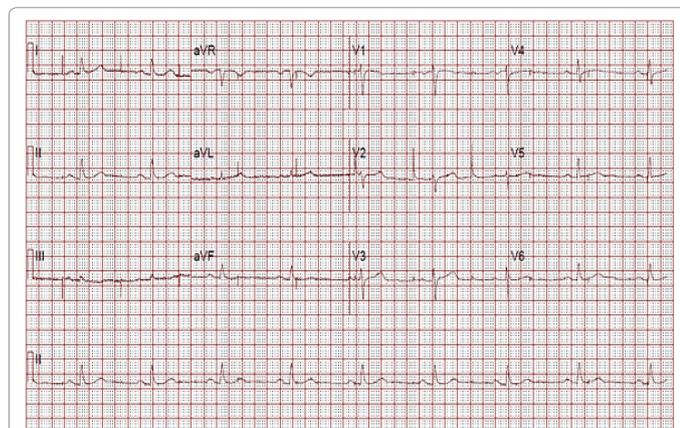
**Keywords:** Subclavian crush; Pacemaker malfunction; Bradycardia

## Introduction

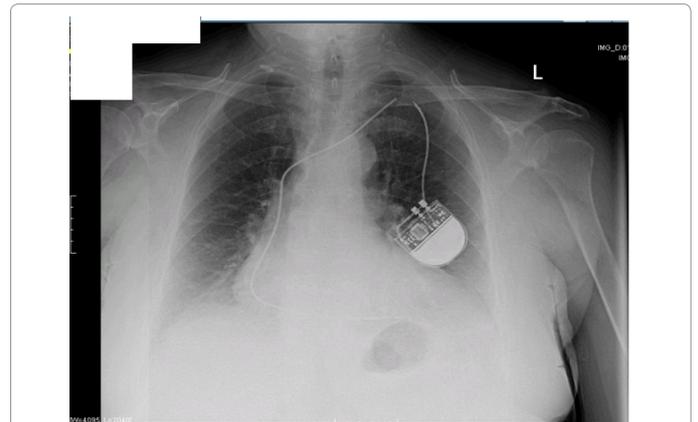
Subclavian crush syndrome is a rare but known complication of pacemaker lead failure due to the compression of the lead between the first rib and clavicle. Access for cardiac pacing through the subclavian vein can be made via a subclavian vein puncture near the apex of the angle formed by the first rib and clavicle, which is defined as the subclavian window. The subclavian vein approach can be responsible



**Figure 1:** This anatomical model outlines the ease by which a lead in the subclavian vein is prone to lead fracture with repetitive arm movement. Source: Hettiarachchi, et al. (2014).



**Figure 2:** A 12-Lead EKG showing sinus bradycardia. Pacer spikes are present, and demonstrate an inability to both capture and to sense intrinsic ventricular activity (arrows).



**Figure 3:** Chest X-Ray demonstrates a single-lead permanent pacemaker with a complete transection of its lead inferior to the clavicle at the level of the first rib (arrow).

for increased lead failure and fracture. The mechanical vice-like mechanism between the clavicle and the first rib is believed to be the mechanism by which leads are transected (Figure 1).

## Case Description

An 81-year-old female presented to the emergency room complaining of a one month history of near syncope, palpitations and weakness. She stated that she had a pacemaker placed in Armenia in 2008, likely due to sick sinus syndrome. The patient's physical exam was significant for bradycardia and mild lower extremity edema and visible pectoral muscle stimulation. A 12-lead EKG demonstrated pacemaker failure to both sense and capture (Figure 2). In the emergency room, the patient received PA and lateral X-Rays of the chest, revealing the completely transected pacemaker lead at the level of the left clavicle (Figure 3). The etiology of her symptoms was presumed to be secondary to a non-functional device due to the non-functional lead. The patient refused repeat implantation, presumably due to a lack of trust of the safety/efficacy of permanent pacemakers as well as a reluctance to have additional hardware implantation.

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## Discussion

Subclavian crush syndrome is a rare cause of symptomatic bradycardia and failed device capture in a patient with a permanent pacemaker. The subclavian approach for pacemaker lead placement has been described as a potential reason for lead fracture, insulation failure, or complete transection of the lead/leads as seen in our case. This method of central venous access continues to be pervasive despite its known risk for collateral lead compromise over time.

In one small observational study, 3 out of 114 patients (2.6%) of patients that were implanted transvenous defibrillators via subclavian approach developed evidence of lead fractures over a mean follow up period of 12.9 months [1]. Lead fracture is believed to occur in 3% to 4% of patients within 5 years [2]. In a larger subset of patients undergoing transvenous defibrillator placement in the late 1980s to early 1990s, of 523 right ventricular leads placed via the subclavian vein, 7 patients had RV lead fractures (0.9%). Six out of those seven had X-ray manifestations of lead fracture. In the same study, of the 221 leads that were placed via the cephalic vein, there were no lead fractures noted [3]. Patients with lead fracture may present with increasing pacer threshold, loss of capture, or inappropriate shocks in presence of a transvenous defibrillator. With a modification of the subclavian approach that involves introducing the lead at the lateral border of the first rib, fewer complications may be seen. In one study of 461 patients undergoing lead implantation via the subclavian approach with this method, no cases of subclavian crush syndrome were seen [4].

Cephalic vein cut-down is the preferred and most common approach in the United States. However, subclavian approach to lead implantation remains popular worldwide. Complete lead transection is not always evident on chest x-ray. Subtle lead transection may be missed. Although rare, subclavian crush syndrome should be entertained in patients with pacemaker/defibrillator malfunction who

have been implanted prior to the mid 1990's in the United States or who have been implanted at any point up until recent times in developing countries. Our case once again highlights the potential life threatening impact of pacemaker lead failure due to complete transection of the pacemaker lead. Cephalic vein cut-down technique or extra thoracic axillary vein puncture provides safer alternatives for central venous access in patients undergoing permanent pacemaker implantation and such be considered as fist line approach [5,6].

The patient's pacemaker was originally implanted in Armenia. The patient did not recall the company, but stated she was certain it was not an American brand, and hence was not compatible with any of our device programmers. Routine device checking play a role in assessing lead function, particularly by measuring lead impedance. A significant increase in lead impedance should prompt concern for pacemaker lead fracture. In our case, lead fracture was evident on chest x-ray, although it may not always be so easily seen on imaging.

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