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Pacemaker Syndrome in an Individual with a Bi-Ventricular Pacemaker

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Abstract | **Case Report**

Pacemaker syndrome adversely impacts atrioventricular synchrony. It is associated with different types of pacemakers. Individuals with this condition may be symptomatic or asymptomatic. Generally, pacemakers should be interrogated every 3-12 months, and this can help determine if the device is at risk of progressing to "elective replacement indication" or "end of life" status. When there is a concern for such a status, it is important to change the pacemaker's generator. We present the case of a 75-year-old male who had a bi-ventricular pacemaker in place. He presented to the hospital due to shortness of breath, chest pain and pressure, and lower extremity edema. His electrocardiogram was concerning for high output pacemaker spikes, complete heart block, and a ventricular paced rhythm. This led us to suspect pacemaker syndrome. Pacemaker interrogation revealed that the device had reached "end of life" several months prior. He successfully underwent pacemaker generator replacement prior to transfer to a different facility for further evaluation of his underlying cardiac disease.

Keywords: Pacemaker Syndrome, bi-Ventricular Pacemaker, Electrocardiogram.

INTRODUCTION

Pacemaker syndrome refers to a situation in which atrioventricular synchrony is absent or inadequate [1]. While most frequently seen with single-chamber pacing capabilities, the condition can be associated with devices of different pacing capabilities [2]. Symptoms of pacemaker syndrome can include fatigue, confusion, memory disturbances, shortness of breath, palpitations, reduced activity level, and syncope [3]. These symptoms can range from being mild to severe, with some individuals not identifying symptoms until the atrioventricular synchrony is returned [1]. Findings on physical examination may include rales, edema of the lower extremities, and prominence of veins in the neck [3]. Other findings can include low blood pressure, tachypnea, decreased pulse pressure, encephalopathy, and confusion [3]. Findings on electrocardiogram include pacemaker spikes but loss of relationship between P waves and QRS complexes [3]. Treatment may include upgrading from a single chamber pacemaker to a dual chamber pacemaker [3]. If detected and treated, the prognosis is generally positive; however, failure to detect the condition can lead to ventricular dysfunction and arrhythmias [3]. We present a case of pacemaker syndrome, associated with bi-ventricular pacemaker battery depletion. This case is unique since there is only one previously reported case of pacemaker syndrome associated with a bi-ventricular pacemaker [4].

CASE PRESENTATION

A 75-year old male with history of ST-segment myocardial infarction with stents placed, multi-vessel coronary artery disease, heart failure with preserved ejection fraction, complete heart block with bi-ventricular pacemaker placed five years prior, peripheral vascular disease, hypertension, hyperlipidemia, and type 2 diabetes mellitus presented to the emergency department due to chest pressure and tightness which was progressively worsening over the course of three days. The pain and pressure, located in the central and substernal regions, did not radiate elsewhere and was not present at the time of our examination. He also reported increasing dyspnea and lower extremity edema.

On presentation, his blood pressure was 115/66 mmHg, heart rate was 65 beats per minute, and oxygen saturation was 99% while on 2L of supplemental oxygen via nasal cannula. Physical examination was notable for hepatojugular reflux up to the angle of the jaw, bibasilar

rales up to the middle of the lungs, and bilateral 2+ lower extremity edema up to the knees. His initial electrocardiogram (ECG) revealed high output pacemaker spikes, complete heart block with a ventricular paced rhythm, and previously recorded diffuse ST-segment depressions and aVR elevations (Figure 1). These findings indicated that the pacemaker was in ventricle-ventricle-inhibited (VVI) mode and may have reached its end of life. Chart review indicated that the pacemaker was last interrogated 21 months prior to presentation. At that time, the expected remaining life of the pacemaker was approximately 8 months. The patient did not follow-up with cardiology in the interim.

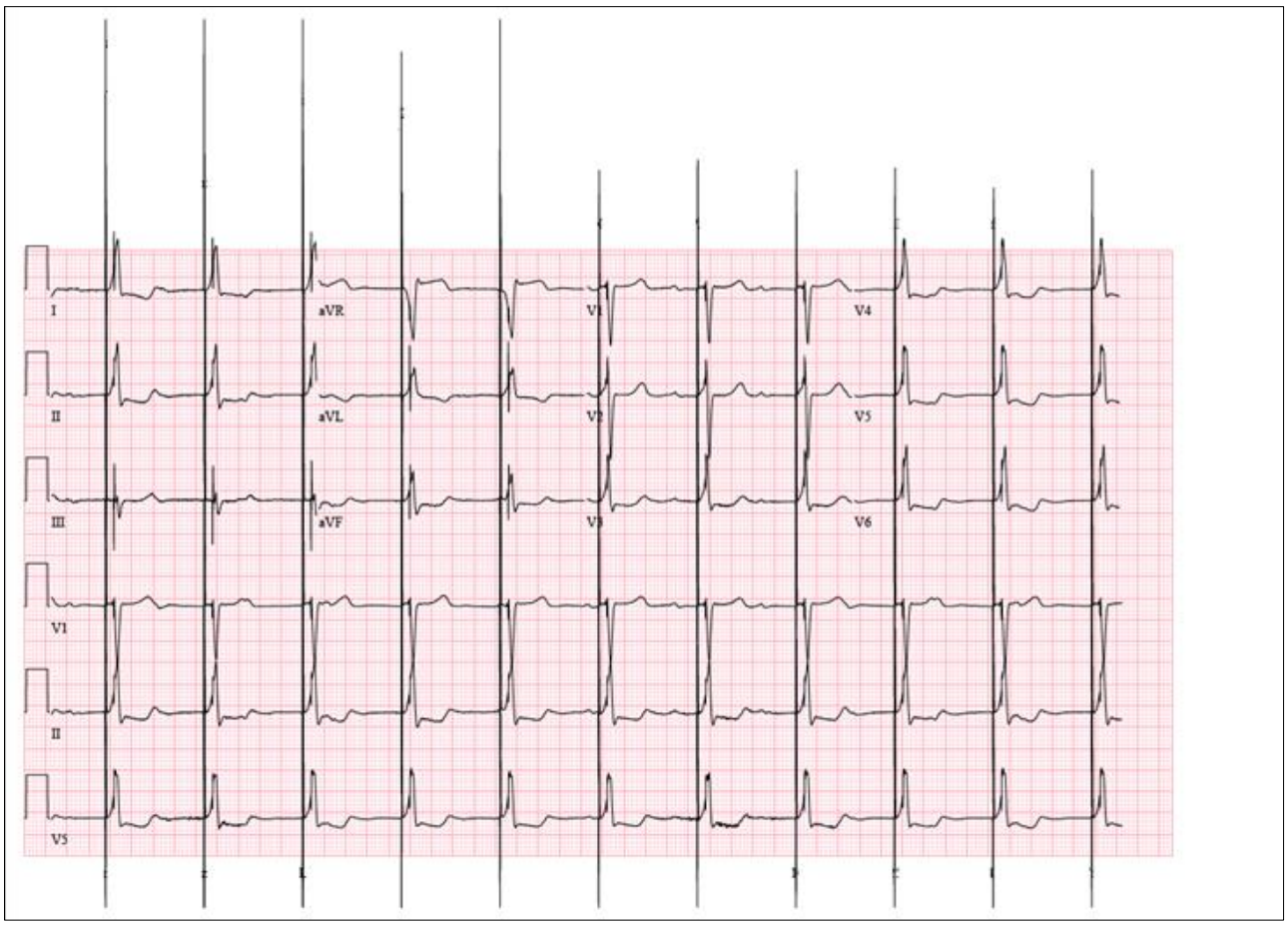

Figure 1: Initial Electrocardiogram

His initial laboratory results were notable for troponin I level of 268.1 ng/L (reference range: 2.7 – 35 ng/L) and B-type natriuretic peptide level of 2098.2 pg/mL (reference range: < 100 pg/mL). His chest radiograph revealed acute congestive heart failure or volume overload with small pleural effusions. He was started on intravenous heparin, nitroglycerin, and furosemide. His outpatient aspirin, clopidogrel, pravastatin, empagliflozin, valsartan-sacubitril, and spironolactone were resumed. Repeat troponin levels during the day were noted at 222.1 ng/L and 222.2 ng/L.

The following day, his device interrogation revealed that the pacemaker had high output from the His bundle lead and that the left ventricular lead was functioning well. The pacemaker reached end of life approximately 10 months prior to presentation. At this time, the His bundle pacing lead was deactivated, while the left ventricular lead was left intact. A repeat ECG is seen in Figure 2.

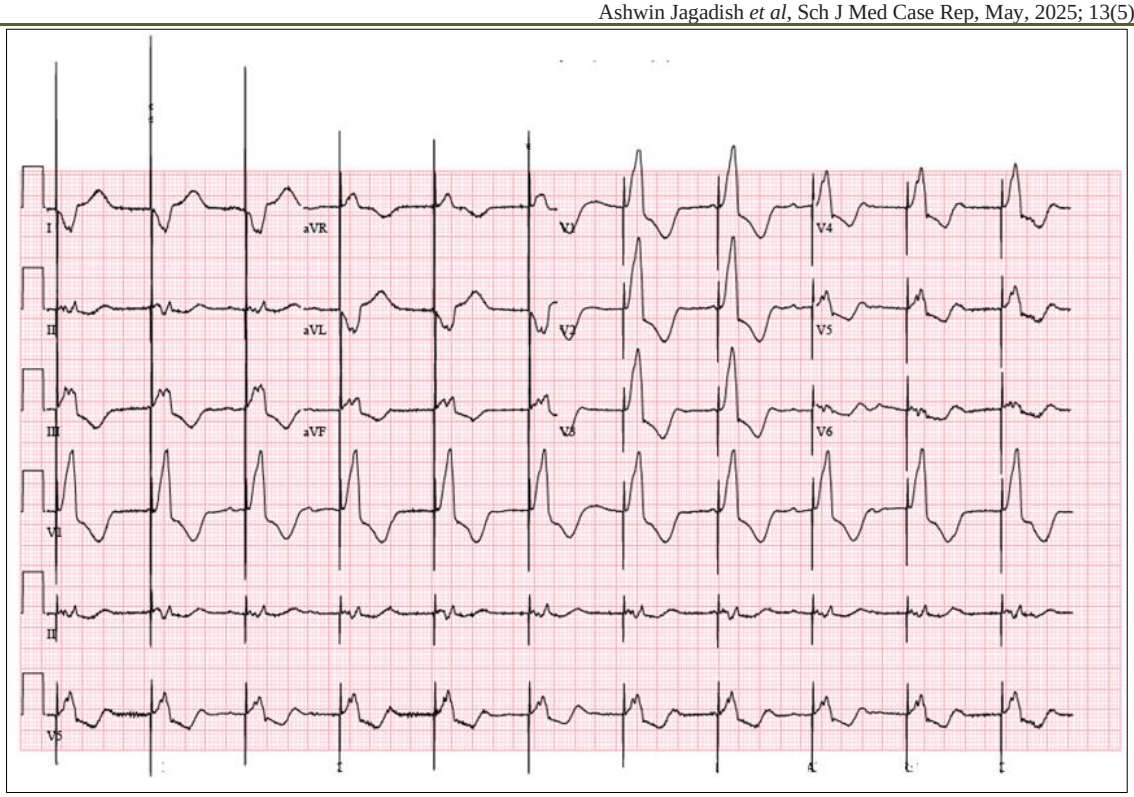

Figure 2: Electrocardiogram after His Bundle Pacing Lead Deactivated

The following day an echocardiogram was performed, revealing a left ventricular ejection fraction (LVEF) of 35-40%. An echocardiogram from six months prior indicated a LVEF of 50-55%. The decrease in LVEF could have been from worsening coronary artery disease or pacemaker syndrome. The patient underwent a cardiac catheterization, which revealed multi-vessel coronary artery disease of the left main coronary artery, ostial left anterior descending artery, and left circumflex. The patient subsequently underwent a generator change for his biventricular pacemaker in addition to left bundle lead placement. An ECG following the generator change can be seen in Figure 3. The patient was transferred to an outside facility with cardiothoracic surgery capabilities and high risk percutaneous coronary intervention capabilities for further evaluation of his multi-vessel coronary artery disease.

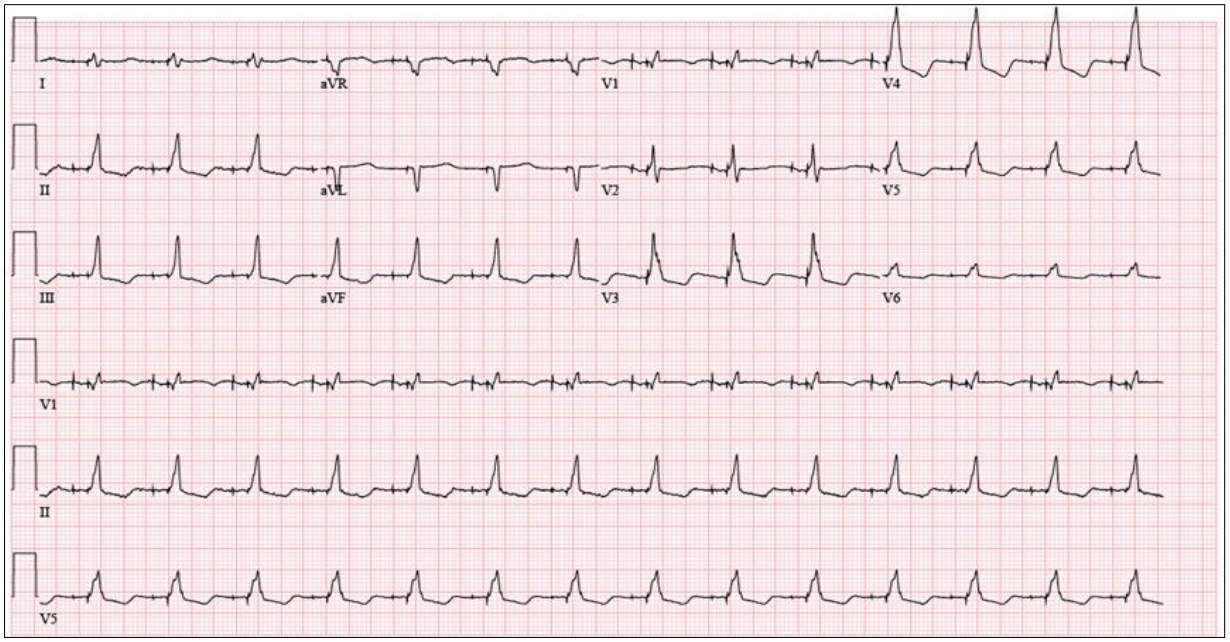

Figure 3: Electrocardiogram after Pacemaker Generator Replaced

DISCUSSION

More than 100,000 generator replacements for anticipated pacemaker battery depletions occur in the United States each year [5]. When the pacemaker's battery has depleted to a certain level, an alert known as "elective replacement indication" (ERI) is activated [6]. At this time, automatic reprogramming generally occurs; this often results in the absence of atrioventricular synchrony, rate response, or both [6]. This reprogramming during the ERI window is meant to deactivate features of the pacemaker that are not instrumental for basic pacing capabilities [6]. ERI can last from three-to-six months before the pacemaker reaches "end of life" (EOL). A pacemaker that reaches a state of EOL eventually ceases functioning [7].

Pacemakers should initially be interrogated within 2-12 weeks of implantation [8]. Afterwards they can be interrogated every 3-12 months [8]. The frequency of interrogations is dependent upon the device type and indications for device placement [8].

Individuals can have symptoms during the notification window [6]. These symptoms can include shortness of breath, fatigue, swelling, palpitations, presyncope, syncope, palpitations, and chest pain [6]. Individuals may also need inpatient admission for the above listed symptoms, pacemaker syndrome, congestive heart failure, or infections [6].

It is likely that our patient developed symptoms and physical findings following his pacemaker reaching EOL status. This case serves as an important reminder to ensure that individuals with pacemakers have regularly scheduled appointments to evaluate their pacemaker. It is also important to ensure that the pacemaker generator is changed in a timely manner to prevent the device from reaching EOL status.

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CONCLUSION

Pacemaker syndrome is a condition which impact atrioventricular synchrony. Individuals with this conditions can either be symptomatic or asymptomatic. Electrocardiogram findings can include pacemaker spikes and complete heart block. If treated in a timely manner, there is a favorable prognosis.

REFERENCES

1. Ellenbogen KA, Gilligan DM, Wood MA, Morillo C, Barold SS. The pacemaker syndrome -- a matter of definition. Am J Cardiol. 1997 May 1;79(9):1226-9. doi: 10.1016/s0002-9149(97)00085-4.
2. Soto GE. Pacemaker syndrome: Thinking beyond atrioventricular dyssynchrony. HeartRhythm Case Rep. 2024 Feb 4;10(4):273-275. doi: 10.1016/j.hrcr.2024.01.012.
3. Iqbal AM, Jamal SF. Pacemaker Syndrome. [Updated 2023 Aug 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-.
4. Akiyama M, Kaneko Y, Taniguchi Y, Kurabayashi M. Pacemaker syndrome associated with a biventricular pacing system. J Cardiovasc Electrophysiol. 2002 Oct;13(10):1061-2. doi: 10.1046/j.1540-8167.2002.01061.x.
5. Sinha SK, Chrispin J, Barth A, Rickard JJ, Spragg DD, Berger R, Calkins H, Tomaselli G, Marine JE. Clinical recognition of pacemaker battery depletion and automatic reprogramming. Pacing Clin Electrophysiol. 2017 Aug;40(8):969-974. doi: 10.1111/pace.13135.
6. Sinha SK, Carlson D, Chrispin J, Barth AS, Rickard JJ, Spragg DD, Berger R, Love C, Calkins H, Tomaselli GF, Marine JE. The Symptoms and Clinical events associated with Automatic Reprogramming (SCARE) at replacement notification study. Pacing Clin Electrophysiol. 2018 Dec;41(12):1611-1618. doi: 10.1111/pace.13532.
7. Liu J, Wen L, Yao S, Zheng P, Zhao S, Yang J. Adverse clinical events caused by pacemaker battery depletion: two case reports. BMC Cardiovasc Disord. 2020 Jul 23;20(1):344. doi: 10.1186/s12872-020-01622-x.
8. Slotwiner D, Varma N, Akar JG, Annas G, Beardsall M, Fogel RI, Galizio NO, Glotzer TV, Leahy RA, Love CJ, McLean RC, Mittal S, Morichelli L, Patton KK, Raitt MH, Ricci RP, Rickard J, Schoenfeld MH, Serwer GA, Shea J, Varosy P, Verma A, Yu CM. HRS Expert Consensus Statement on remote interrogation and monitoring for cardiovascular implantable electronic devices. Heart Rhythm. 2015 Jul;12(7):e69-100. doi: 10.1016/j.hrthm.2015.05.008.