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CASE REPORT

Cardiac Pacing Using a Guidewire in Emergency Situation

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ABSTRACT

Trans venous pacing catheter (TVPC) placement is a potentially life-saving procedure involving placing a catheter-based electrode within the right ventricle via central venous access and stimulating the heart with an external pacing generator to optimize cardiac output. In the emergency department, the procedure can be performed either blindly or with ECG guidance and recently with USG guidance. In this case report, we describe an interesting case of an elderly patient with a complete heart block (CHB) received in the emergency department (ED) with cardiogenic shock in a life-threatening situation, which was successfully managed by cardiac pacing by initially using a J Tip guidewire (JTG) due to non-availability of temporary transvenous pacing catheter (TVPC) and later on using TVPC once available. The patient was discharged in a stable condition after the insertion of a permanent pacemaker.

INTRODUCTION

Temporary cardiac pacing (TCP) may be a lifesaving procedure in several patients with life-threatening bradycardia in the Emergency Department (ED) or critical care setting. TCP aims to artificially generate cardiac electrical activity, resulting in effective myocardial contractility. This is important to achieve adequate cardiac output and hemodynamic stability. Various cardiac pacing modalities exist like epicardial, transesophageal, transcutaneous (TCP-C), and transvenous endocardial (TCP-V). Each has better applicability in different situations, such as epicardial pacing in cardiac surgeries. The latter two methods are pacing of choice in the emergency department (ED). We described a patient with degenerative complete heart block (CHB) received in the ED with the cardiogenic shock, which was successfully managed by cardiac pacing, initially using a J Tip guidewire (JTG) in an emergency situation.

CASE PRESENTATION

A 70-year-old female patient was brought to our ED by her relatives in a semi-conscious state. On examination, her heart rate (HR) varied between 20-30 beats/ min; BP was not recordable by auscultatory method, and her GCS score was 12 (E3, V4, M5) with cold peripheral extremities. ECG showed a complete heart block (CHB) (Fig 1). The patient was in CHB with accompanying cardiogenic shock. Initially, pharmacologic therapy and TCP-C were tried for CHB, but there was no improvement in HR. After that, it was decided to do cardiac pacing by implanting a temporary transvenous pacing catheter (TVPC) in the right ventricle (RV) to achieve a target HR of 60-70 beats per minute (BPM) and hemodynamic stability.

After explaining the procedure and obtaining proper consent, a 6 Fr introducer sheath catheter (transparent sheath, Newtech Medical Devices, India) was successfully inserted in the right internal jugular vein (RIJV) using the Seldinger technique and a 6 Fr, 110 cm, transvenous cardiac bipolar pacing catheter (TVPC) (Parcel, St Jude Medical, MN, USA) was opened for placement. However, on visual inspection, it was found to be defective and therefore discarded; Unfortunately, no alternative TVPC was available in the ED at that time. It takes a few minutes to arrange TVPC from the cardiology department. The patient's critical condition needed urgent cardiac pacing to stabilize the hemodynamic status.

At that time, in the emergent life-threatening situation, we were left with no option and decided to take a chance by directly pacing the RV using a guidewire as an ad-hoc arrangement till an alternative TVPC became available since it was a case of degenerative CHB with life threatening cardiogenic shock. The J – tipped Guidewire (0.038-inch, 70 cm, transparent sheath, Newtech Medical Devices, India) used to introduce the sheath was passed through the existing 6 Fr Sheath till resistance was met and the sheath was removed. The outer end of JTG was attached to the positive terminal of the pacing cable.

A 21 G 1.5-inch Green colour needle was passed through the skin to connect to the negative terminal of the line. Another cable end was attached to the pacemaker (Medtronic, INC, Minneapolis, MN, USA) to complete the electrical circuit (Fig 2).

After that, the pacing was initiated with Medtronic single Chamber pacemaker at a rate of 60 BPM, at an output of 10 mA, on asynchronous mode (VOO) to achieve a target paced HR of 60 (Fig 3); pacing with JTG successfully continued for few minutes. Once the TVPC was available, JTG was disconnected from the pacing cable. A 6 Fr Sheath was reinserted over guidewire inside the RV, and TVPC was passed through the sheath. During the procedure subcostal, 4- chamber transthoracic echocardiography (TTE) view was used to adjust and secure the position of TVPC in the RV. After that, the pacing was reinitiated at the previous setting. Post-procedure portable anteroposterior (AP) chest radiography (CXR) was performed to verify the position of TVPC and exclude complications such as pneumothorax etc. Gradually on 3rd day of admission, she recovered from cardiogenic shock and associated multiple organ dysfunction syndromes (MODS). On the 7th day of access, she was discharged in a stable condition after Permanent Pacemaker Implantation (PPI).

DISCUSSION

The electrical activity of the heart starts in the sinoatrial (SA) node in the right atrium(RA) and travels through the atrioventricular (AV) node to reach the ventricles. Heart block may occur at any point along the electrical pathway. Heart block of the AV node can be of several types. Usually, third-degree atrioventricular partnership (TDAVB) or CHB presents with life-threatening symptomatic bradycardia and generally can be diagnosed through ECG changes. TDAVB or CHB may be caused by the aging process (degenerative), myocardial infarction (MI), medicines, infiltrative heart diseases (amyloidosis, sarcoidosis), or infectious diseases (endocarditis, Chagas disease). CHB may also occur after heart surgery and can be present from birth (congenital). Once the less invasive means of treatment (e.g., treating the underlying cause, pharmacologic therapies, and TCP -C) have been explored and exhausted, TCP-V is usually performed as a lifesaving procedure. Indications for TCP-V include symptomatic heart blocks or CHB of various etiologies not responding to other therapies; in our case, the most likely reason for pursuing TCP-V was CHB that did not respond to pharmacologic treatment or transcutaneous pacing. Furman and Robinson, in the year 1958, were the first to describe temporary transvenous endocardial pacing. TCP-V artificially restores the missing cardiac electrical activity required for myocardial contractility resulting in the delivery of adequate cardiac output and hemodynamic stability. [1]

Although different types of cardiac pacing modalities exist like epicardial, transesophageal, transcutaneous (TCP-C), transvenous endocardial (TCP-V) and recently, Pawel et al. reported direct rapid left ventricular pacing by a guidewire during aortic balloon valvuloplasty.

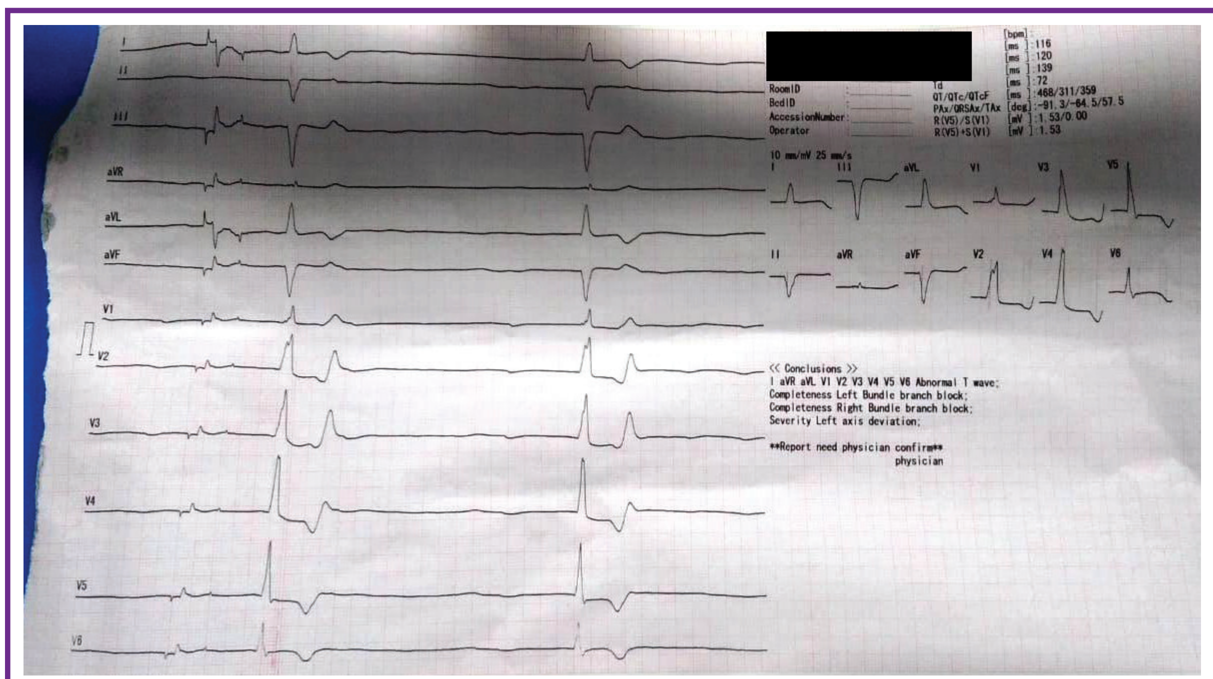

Figure 1: ECG showing complete heart block

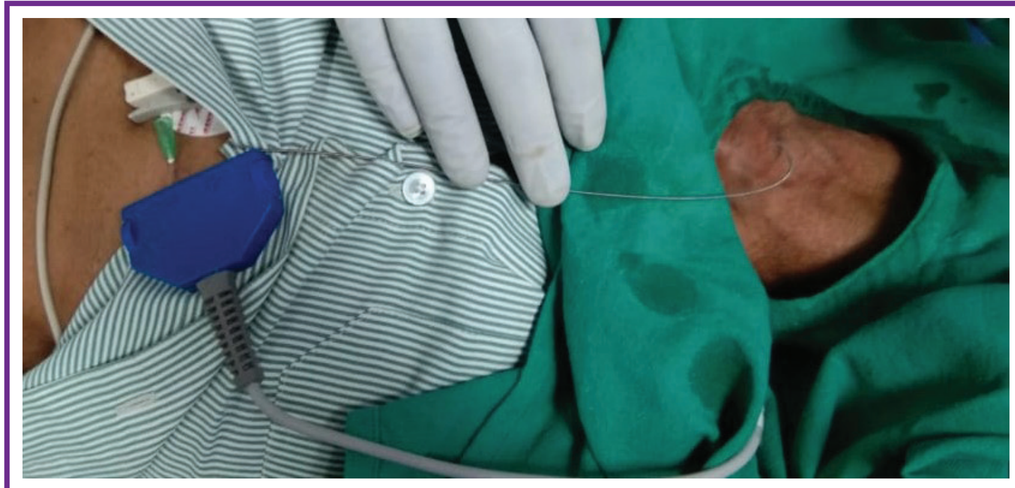

Figure 2: Insertion of JTG through the Rt internal jugular vein

Figure 3: Capture of rhythm as seen by ECG changes post pacing

However, TCP-C, or TCP-V, is the pacing of choice in the ED [2]. In the above-discussed case, initially, we performed TCP-V with a JTG in the emergent life-threatening situation due to the non-availability of TVPC. We later switched to TVPC for pacing once it was available. TCP-V, which involves placing a catheter-based electrode into the right side of the heart, is a two-step procedure: the first step is establishing central venous access, and the second is introducing and directing the electrode through that venous access into the RV

of the heart to pace the endocardium. This is the least complicated approach to reestablishing effective cardiac depolarization. It allows the physician to pace the heart in an asynchronous or demand mode as per the requirement, wherein the temporary pacemaker is inhibited when a native impulse is sensed.

Selecting a central venous access site may depend on the physician's preference, expertise and the patient's availability of central veins. The right internal jugular and the left subclavian veins are the preferred option, having demonstrated the highest rates of proper placement in code situations; these routes allow for smooth and direct placement, taking advantage of the natural curve of the pacing catheter. The right internal jugular vein provides the most direct access to the right ventricle and is associated with minor complications. Other options are femoral or brachial veins. (3)

Nowadays, various catheter types and pulse generators are available for TCP. Different types of insertion aids are available to place the TVPC in the place; an operator can choose to use either fluoroscopic imaging, intracavitary ECG monitoring, blind advancement with surface ECG monitoring or bedside ultrasound guidance (USG) to successfully place the TVPC in the correct position depending upon his expertise. (4)

USG can either be used for real-time visualization of the moving pacing wire or may be used to verify the position of already placed pacing wires in the RV. USG shows pacing wire as a bright linear hyperechoic structure; also, it can demonstrate the contact of pacing wire with the RV myocardium. The subcostal four chambers TTE view is preferred. Most commonly, a 3.5-MHz linear array probe is used in the subcostal position so that excellent views of all four cardiac chambers and cardiac wall motion are captured. It has an added advantage that any procedural complications like interventricular septal perforation, cardiac tamponade, etc., can be ruled out. This position also does not interfere with the operator's activities or hinder monitoring equipment such as transcutaneous pacing pads or ECG leads.

As a practice post-procedure, A-P CXR should be performed to verify the position of TVPC and exclude complications of the procedure. Ideally, the TVPC should be positioned in the RV apex. The catheter tip should be visualized at the anterior-inferior aspect of the cardiac shadow, usually slightly to the left of the thoracic spine. (3, 4). Once the patient stabilizes after TCP, a further treatment plan can be decided.

CONCLUSION

A patient presenting with CHB or other bradyarrhythmia in the ED with hemodynamic instability and accompanying cardiogenic shock is life-threatening. They should be managed promptly; pharmacologic or transcutaneous pacing is initially tried, but transvenous pacing is initiated as early as possible to restore hemodynamic normalcy if they fail. Ideally, TVPC is used for TCP-V; however, in our case, assuming the aging process (degenerative) as a culprit for CHB, after excluding MI, we initially used JTG for cardiac pacing to stabilize the patient during the meantime and immediately switched to TVP once it was available. We recommend not to use JTG for routine use, and it should never be used in MI patients for pacing due to the friable nature of the myocardium.

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