

Emergent Transvenous Cardiac Pacing in the Emergency Department: A Case Series

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Abstract

Study Objective: We describe 5 patients who underwent transcutaneous cardiac pacing followed by ultrasound-guided transvenous cardiac pacing (TVCP) in which ultrasonography was used to assist and confirm the placement of electrode catheters within the right ventricle.

Methods: We retrospectively considered consecutive patients with complete heart block who received emergency ultrasound-guided TVCP by the same team of trained and certified emergency clinicians at an Emergency Department (ED) of a tertiary care corporate urban hospital in India.

Results: Ultrasound-guided TVCP was successful in 4 (80%) of the 5 patients studied. In one patient, there was failure-to-capture. Subsequent successful repositioning of pacing catheter in the patient was done by a cardiologist in the Catheterization Lab. 3 (60%) of the 5 patients had a good outcome, and were discharged from the hospital. 2 (40%) of the 3 patients required permanent pacemaker insertion (PPI). 2 of the 5 patients died.

Conclusion: Most emergency clinicians in India often have limited exposure to TVCP in their careers; however, it is well within their scope of practice. TVCP can appear particularly valuable in hospitals where Catheterization Labs are unavailable. Our attempt is to advocate a bridge to the interdepartmental gap, for successful use of this critical procedure in the ED.

Keywords: Transvenous cardiac pacing; Emergency department; Cardiology; Heart block; AV nodal dissociation.

INTRODUCTION

Although there are many indications for emergency cardiac pacing, bradycardic

patients in unstable condition represent those with the greatest benefit from rapid treatment without delays. Emergency clinicians are often called on to diagnose complete heart block and perform temporary cardiac pacing on an emergency basis. Such patients cannot be realistically transported to the Intensive Care Unit (ICU) or radiology suite. We present our experience with 5 patients who underwent ultrasound-guided transvenous cardiac pacing (TVCP) performed at the bedside in the Emergency Department (ED) by the same team of emergency clinicians.

TVCP can be a time-sensitive, life-saving procedure. The placement of a temporary transvenous pacing wire within the heart with successful cardiac capture has been reported to be as low as 10% in the ED. However, another retrospective study found that emergency clinicians

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had a 95% success rate in placing a transvenous pacemaker and obtaining capture; complication rate was 23%.¹ Literature suggests reduced mortality and improved prognosis in patients with early re-establishment of normal hemodynamics that are acutely compromised in this setting.^{2,3}

Why trans-venous cardiac pacing (TVP) in the Emergency Department?³

- A bridge to permanent cardiac pacing.
- Time-sensitive.
- Restores effective cardiac depolarization and myocardial contraction.
- Generates adequate cardiac output.
- Avoids hypo-perfusion to vital organs until definitive therapy.

Indications for TVCP in the Emergency Department are:

- Profound symptomatology
- Shock
- High degree atrio-ventricular nodal block
- Sick sinus syndrome

The accepted consideration of cardiac pacing in an emergent situation lies with trans-cutaneous pacing (TCP). However, the following challenges persist with TCP 4,5:

- 40- 50% ventricular capture rate
- Patients are often diaphoretic
- Most sedatives cause additional hypotension
- Might need airway protection

Where do Tintinalli, and Rosen stand? Tintinalli's Emergency Medicine describes TVP as time consuming. Rosen's Emergency Medicine describes both TCP and TVP as emergent pacing options, but doesn't weigh in on the timing. Recent studies show average time for TVP insertion in ED to be between 15-45 minutes depending on the number of complexities.⁶

Transvenous pacemaker placement is an integral component of therapy for severe dysrhythmias and a core skill in emergency medicine.

CASE STUDY

Five patients with a mean age of 63-years (range 47-71 years) were treated by the same team of trained and certified emergency clinicians within a six-month period of presenting to a tertiary care corporate hospital in a tier urban city in India, during the year 2023. Presenting symptoms included syncope with associated high degree AV nodal dissociation. 12-Channel ECGs were used to identify the degree of heart block (Fig. 1).

All patients were treated with transcutaneous pacing followed by temporary transvenous pacing. A standard ultrasound-guided approach was utilized to insert the cordis through the right internal jugular vein, and a sub-xiphoid assisted ultrasound view to guide the tip of the pacing wire into the right ventricle. Ventricular capture was documented by repeating a 12-channel ECG (Fig. 2).

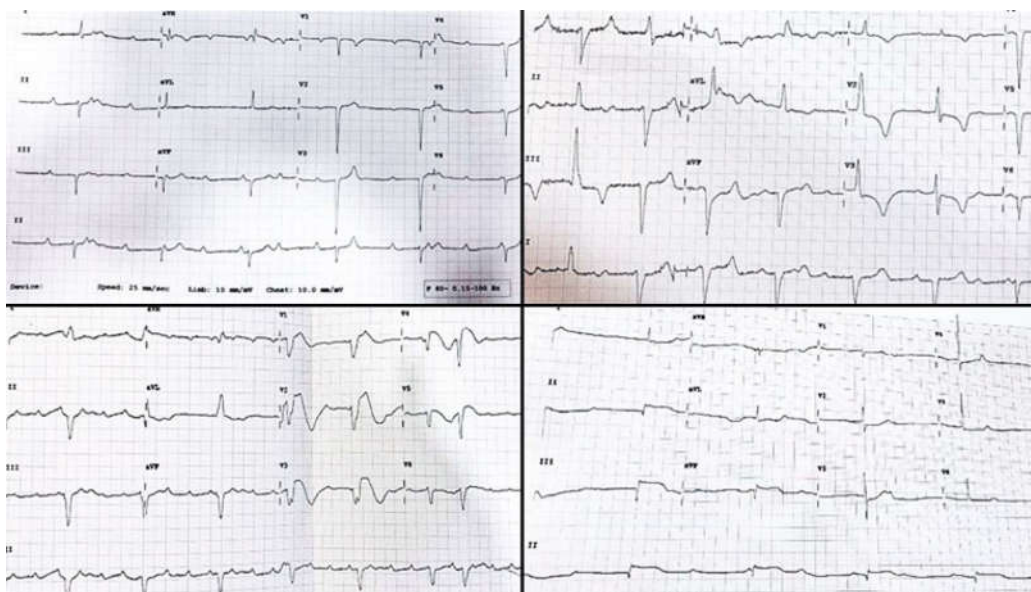


Fig. 1: 12-channel ECGs showing high degree AV nodal dissociation

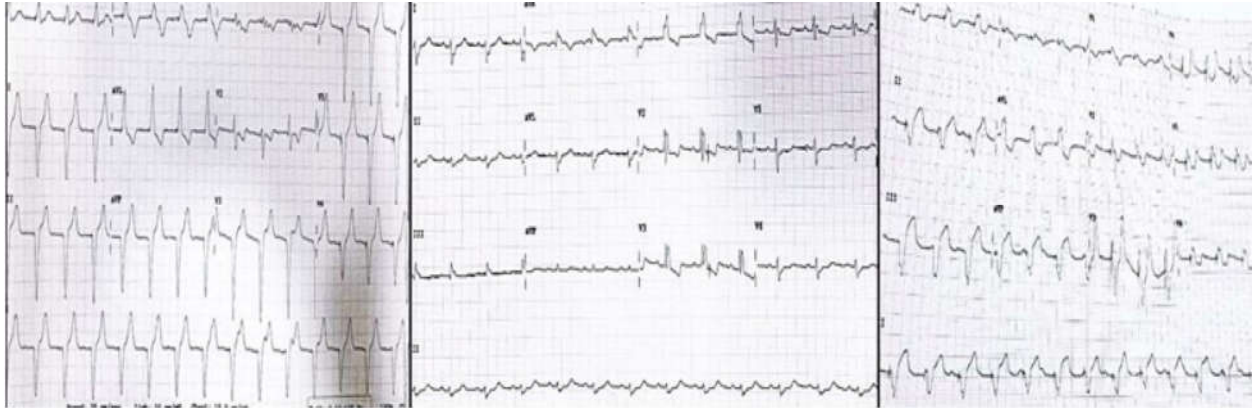


Fig. 2: Adequate ventricular pacing noted in 3 out of 5 patients; in one there was failure-to-capture, whereas in another, the post-capture ECG was lost

Outcome

- All patients were adequately paced, except one in whom failure-to-capture was noted.
- There were no procedure related complications.
- All patients were shifted to either the Catheterization Lab, or Intensive Care Unit (ICU) with hemodynamic stability and secure airway.
- Etiology was heterogeneous like acute myocardial infarction, electrolyte imbalance, and sinus node dysfunction.
- 3 out of 5 patients showed good outcome, and were discharged from the hospital. Of the 3 discharged, 2 of them underwent permanent pacemaker insertion (PPI).

In-hospital mortality was noted in two patients:

- Mortality 1 - PPI withheld in view of financial constraints.
- Mortality 2 - Extensive trans-mural infarction with high degree AV nodal block with ill-sustained ventricular tachycardia.

DISCUSSION

Emergent transvenous cardiac pacing (TVCP) involves stimulation of the endocardial surface of the apex of the right ventricle using an electrode tipped catheter passed through a central vein introducer sheath. Emergency and retrieval physicians may be called upon to manage patients who either need emergent placement of a TVCP catheter due to unresponsiveness to drugs and transcutaneous cardiac pacing or require an inter-facility transfer with a TVCP catheter *in situ*.

Is transvenous cardiac pacing catheter placement within the scope of current emergency medicine practice? In Australia, as per the ACEM curriculum framework, TVCP catheter placement is an emergency procedural skill needing Level 1 mastery.⁷ It is also part of the core procedural skill set of emergency physicians in the USA, with reported success rates of 95-97%.⁸ A US study showed that emergency medicine trainees could perform a TVCP catheter placement under supervision after a brief period of didactic and hands-on training with comparable success and complication rates to that of cardiology and internal medicine trainees.⁹ A review for emergency clinicians conducted in 2024 showed that an understanding of transvenous pacemaker placement for severe dysrhythmias is a core skill in emergency medicine, and essential for emergency physicians.¹⁰

To the best of our knowledge, and based on the literature review conducted by the authors of this study, there have been no systematic reviews in India on the study of emergent transvenous cardiac pacing in the emergency department performed by emergency clinicians. It is our opinion that, this is partly based on the fact that Emergency Medicine itself is a nascent and underutilized medical specialty in the country, and the idea that in India, TVCP is predominantly performed by cardiologists in the Catheterization Lab.

CONCLUSION

Transvenous pacing should find a place in the armamentarium of the Emergency Physician (EP). Most EPs in India often have limited exposure to transvenous pacing in their careers; however, it is well within their scope of practice. With appropriate

training, EPs can be proficient in the skill of prompt recognition of pacing indications, and in providing stable, effective and rapid TVP.

TVP can appear particularly valuable in hospitals where Catheterization Labs are not available. Our attempt is to advocate a bridge to the interdepartmental gap, for successful use of this critical procedure in the ED.

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