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Original Research Article

Experience of Temporary Permanent Pacing: Indications, complications and outcomes

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Abstract

Objective: Temporary permanent pacing (TPP) remains an underutilized yet crucial procedure involving active fixation leads connected to a pulse generator affixed to the patient's skin surface. We aim to conduct a retrospective study to examine the indications, duration, procedural complications, and outcomes of TPP interventions conducted at our center over a 2-year period.

Methods: This is a retrospective, single-centre observational study done in the Department of Cardiology & Electrophysiology, Sri Jayadeva Institute of Cardiovascular Sciences & Research (SJICSR), a tertiary care medical centre in Bengaluru, Karnataka. This retrospective study examines the indications, duration, procedural complications, and outcomes of TPP interventions conducted at our centre over a 2-year period from December 2021 to December 2023.

Results: Seventeen patients underwent TPP, with 64.6% necessitating pacing during the post-explant/extraction period due to device-related infections. Additionally, 11.8% presented with complete heart block (CHB) and sepsis, while another 11.8% were post-aortic valve replacement patients experiencing sepsis with transient atrioventricular block. Singular cases comprised a CHB patient with stroke (5.9%) and a pre-operative CHB patient (5.9%). The mean TPP duration was 18.5±6.7 days (range: 10 to 30 days). Complications included superficial skin infection (11.9%) and lead dislodgment (5.8%), with no recorded mortalities.

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Conclusion: Our findings, in conjunction with existing literature, affirm TPP as a safe and reliable pacing method for up to a one-month period. Encouraging education and broader adoption of TPP among emergency care providers and cardiologists is imperative.

Keywords: Temporary permanent pacing(TPP), Active fixation leads, pulse generator

,complete heart block, post-aortic valve replacement

Introduction

Temporary pacing may become imperative in both emergency and elective medical scenarios. Indications encompass symptomatic bradycardia or atrioventricular block with hemodynamic instability, often observed during acute ischemia or metabolic disorders. It serves as a bridge to permanent pacing in degenerative or infiltrative conduction system disorders, facilitates overdrive pacing during bradycardia-induced ventricular arrhythmias, and acts as a perioperative backup (1). Despite its expediency, temporary pacing is susceptible to frequent dislodgements, prompting the adoption of temporary permanent pacing (TPP) when prolonged pacing is requisite.

TPP involves the fluoroscopic-guided implantation of a pacing lead, preferably an active fixation lead, into the right ventricle and/or right atrium. This lead is then connected to a pulse generator positioned externally on the skin surface, ensuring reliability and stability in pacing. The device can be easily removed once pacing is no longer needed or when the patient undergoes permanent pacing.

Despite its simplicity and well-established nature, TPP remains underutilized. In this retrospective analysis, we examine patients who underwent TPP at our center, sharing insights into the procedure, indications, complications, and outcomes.

Methods

This is a retrospective, single-centre observational study done in the Department of Cardiology & Electrophysiology, Sri Jayadeva Institute of Cardiovascular Sciences & Research (SJICSR), a tertiary care medical centre in Bengaluru, Karnataka. This retrospective study examines the indications, duration, procedural complications, and outcomes of TPP interventions conducted at our centre over a 2-year period from December 2021 to December 2023, upon obtaining clearance from the institutional ethics committee. Follow-up data until the removal of TPP was also collected. The analysis encompassed indications for TPP, duration of TPP, procedural complications, and outcomes.

The TPP procedure

The right internal jugular vein (IJV) was accessed preferably using the Seldinger technique, with the left IJV considered as a secondary option. Subclavian vein access was omitted due to its

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encroachment on the subsequent subclavicular permanent pacemaker pocket area. A 6F peel-away sheath was introduced over the access wire. An active fixation lead was then advanced through the sheath into the right atrium or ventricle, as clinically indicated. Right atrial pacing was favoured in instances where overdrive pacing was needed to suppress ventricular arrhythmias, provided atrioventricular nodal conduction remained intact.

Upon successful placement of the lead, typically in the right ventricular apex, and the confirmation of satisfactory pacing parameters, the sleeve was securely sutured to the skin using non-absorbable sutures. Only bipolar leads were deemed suitable for Temporary Permanent Pacing (TPP). The pulse generator was connected and affixed in the supraclavicular area (**Fig. 1a and 1b**) using transparent, sterile dressing. Additionally, suturing the pulse generator to the skin with non-absorbable sutures was deemed necessary to provide adequate support.

Results:

Table 1 illustrates that a total of 17 patients underwent Temporary Permanent Pacing (TPP) during the specified timeframe. The mean age of the cohort was 65.6±10.6 years, comprising 12 (70.6%) males and 5 (29.4%) females.

Eleven (64.6%) patients had a history of device infections, necessitating TPP following device explantation or extraction. Two patients (11.8%) experienced complete heart block (CHB) complicated by severe sepsis, while an additional two patients (11.8%) developed transient atrioventricular (AV) block following aortic valve replacement (AVR) surgery, accompanied by prolonged sepsis post-procedure. A singular case (5.9%) involved a patient with altered sensorium, an ischemic cerebrovascular accident, and CHB, while another (5.9%) presented with a large pituitary macroadenoma requiring urgent surgery, where CHB was diagnosed during pre-operative assessment.

The mean duration of TPP was 18.5±6.7 days, ranging from 10 to 30 days. Complications occurred in three patients (17.6%): 2 (11.8%) with superficial skin infections at the site of lead insertion (right internal jugular vein region) and 1 (5.9%) with lead dislodgement. No mortalities were recorded. All patients underwent successful TPP removal and subsequent permanent pacemaker implantation by the end of the follow-up period.

Table 1. Profile, indications and complications among patients on temporary permanent pacemakers

Patients	Total	17
	Males	12(70.6%)
	Females	5(29.4%)

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	Mean age	65.6±10.6 years
TPP access site	Right Internal Jugular Vein	17(100%)
Mean duration of TPP		18.5±6.7 days (10 to 30 days).
Indications	Device infections	11(64.6%)
	CHB with Sepsis	2(11.8%%)
	Post AVR transient AV block with sepsis	2(11.8%)
	CHB with CVA	1(5.9%)
	CHB awaiting pituitary surgery	1(5.9%)
Complications	Lead dislodgement	1(5.9%)
	Superficial skin infection	2(11.8%)
	Sepsis	0 (0%)
	Mortality	0 (0%)

CHB- complete heart block, CVA-cerebrovascular accident, AVR-aortic valve replacement

Fig 1a. A case of TPP done after infected device explantation, images at Day 10 post TPP. The lead was stable due to proper suturing of the sleeve, device was stabilized by a suture and transparent dressing.

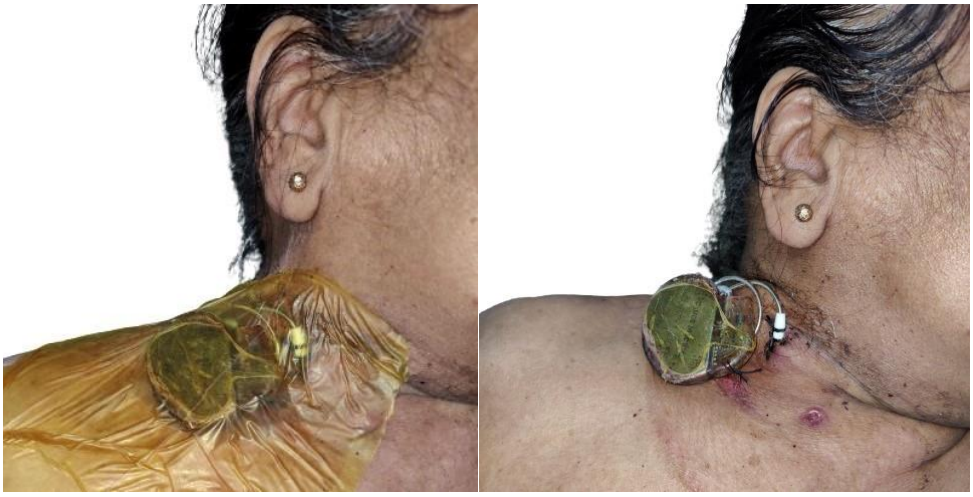

Fig 1b. Fluoroscopic image of the TPP

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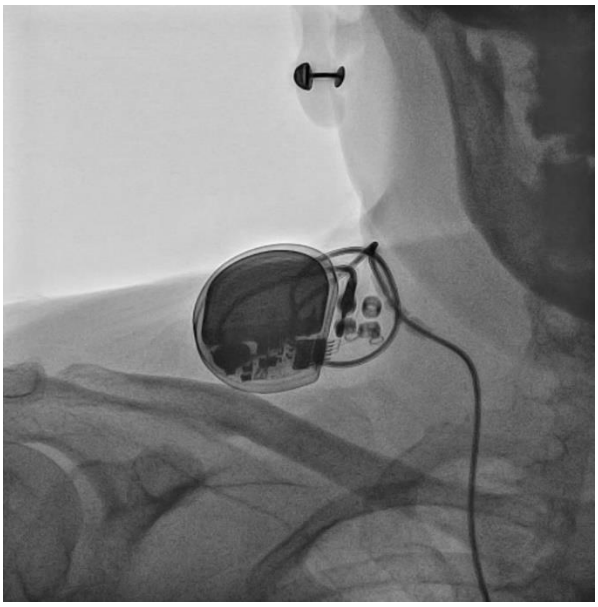

Discussion

All Temporary Permanent Pacing (TPP) leads could be inserted exclusively through the right internal jugular vein (IJV) access in the current study. Opting for IJV access not only allows for patient mobility throughout the TPP course but is also associated with relatively lower rates of infection and deep vein thrombosis compared to alternative femoral access routes (2,3). Importantly, this approach avoids compromising the subsequent placement of a permanent pacemaker in the right subclavicular region.

Bipolar active fixation leads were employed in all cases. Given that the pulse generator is affixed to the skin surface, only bipolar pacing is possible, making bipolar leads mandatory. Active fixation leads were chosen for their stability and ease of explantation, representing a favorable alternative to passive leads (4). The pulse generators utilized for TPP were sterilized with ethylene oxide, aligning with safety and cost-effectiveness considerations for this purpose. Proper placement of the pulse generator in the supraclavicular region, secured with transparent film dressings, was consistently implemented. It is worth noting that there is a rare risk of skin irritation due to residual ethylene oxide on the pulse generator or its by-products with iodine (5). The clavicle provided essential support to the device from below while accommodating neck movements.

Table 2 summarizes the potential indications for TPP. In the present study, majority of the patients (64.6%) underwent TPP due to device infections. Following the explantation of an eroded or infected device, the established protocol involves administering antibiotics for a minimum of 2 to 6 weeks before new implantation on the opposite side (6). TPP becomes an excellent pacing option during this interim period for pacing-dependent patients, allowing mobility and lowering the risk of venous complications.

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Table 2. Indications of temporary permanent pacemaker

1. Cardiovascular implantable device infection
2. Active systemic infection
3. Critical illness/ reduced life expectancy
4. Prolonged perioperative period
5. Ventricular arrhythmias requiring overdrive suppression

Another prevalent indication for employing Temporary Permanent Pacing (TPP) arises in patients requiring pacing for bradycardia concurrent with active infection or sepsis. For instance, individuals with diabetic foot/non-healing ulcers necessitating prolonged antibiotic therapy and debridement, or those with sepsis from resistant microorganisms, may require extended antibiotic courses. Permanent pacing is contraindicated in the presence of active infection. In our study, 2 cases (11.8%) of complete heart block (CHB) were effectively managed with TPP until the resolution of active infection, minimizing the risk of infection before undergoing permanent pacing. Similarly, 2 cases (11.8%) developed transient atrioventricular (AV) block post-aortic valve replacement (AVR) surgery, accompanied by postoperative sepsis. TPP was successfully implemented until sepsis resolution, after which permanent pacing was carried out. In cases of post-surgical AV block, it is recommended to wait for 7 days before opting for permanent pacemaker placement if the AV block persists (7). However, in the presence of post-surgical sepsis, keeping the patient on TPP until sepsis resolves is a prudent approach.

TPP emerges as a valuable strategy for patients with comorbidities associated with poor survival outcomes. One patient (6.7%) requiring pacing for intermittent atrioventricular block was placed on TPP before undergoing brain tumor surgery with a high mortality risk. The patient tolerated the surgery well and subsequently underwent permanent pacemaker implantation after 27 days.

Another significant scenario involves patients with sinus bradycardia and prolonged QT requiring pacing to prevent ventricular arrhythmias. While these patients are typically overdrive paced in the right ventricle using a temporary lead, ventricular pacing may increase repolarization heterogeneity and pose arrhythmogenic risks (8). TPP, with an atrial active fixation lead, may present a safer alternative.

In our study, TPP was employed for a maximum duration of 30 days, aligning with the literature where extended TPP use for up to 83 days has been reported (9,10). Extended durations are acceptable with meticulous local site care, including regular dressing changes. Superficial infections occurred in 2 patients (11.8%) in our cohort, healing promptly upon TPP removal. To mitigate infection risks, proper sterilization of the access site and regular dressing changes are

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crucial. The use of absorbable sutures should be avoided due to increased infection and dislodgment risks. One patient (5.9%) experienced lead dislodgement during TPP explant, fortunately with a stable escape rhythm and no adverse symptoms. Properly suturing the sleeve with non-absorbable suture, securing the distal portion inside the puncture site, and ensuring the pulse generator is adequately sutured for support can prevent lead dislodgement.

Importantly, no mortalities occurred during TPP in our study, reaffirming its safety and reliability for prolonged pacing when permanent pacing is unfeasible. Wider adoption of TPP in intensive care settings, when indicated, is advocated.

Finally, there are distinct advantages of using TPP over conventional temporary pacing through the femoral vein: 1) Extended Duration: TPP allows for pacing over a more extended period compared to traditional temporary pacing. While temporary pacing is typically utilized for short-term support, TPP can be employed for up to several weeks or even months when necessary.2) Reduced Dislodgement Risk: The fixation mechanism of the leads in TPP, especially with active fixation leads, reduces the risk of dislodgement. This stability is crucial for patients who require prolonged pacing, preventing interruptions in pacing due to lead displacement. 3) Mobility and Flexibility: TPP, often accessed through the right internal jugular vein, allows patients increased mobility during the pacing period. This is in contrast to femoral access, which may limit mobility and increase the risk of complications like deep vein thrombosis and pulmonary embolism. 4)Ease of Removal: Once the need for pacing diminishes or the patient is ready for permanent pacing, TPP can be easily removed without the need for an additional invasive procedure. 5) Pacing in the Setting of Infection: TPP becomes a valuable option when patients require pacing in the presence of active infections. Traditional pacing methods, in such scenarios, could lead to increased infection risk.

Conclusion

Temporary Permanent Pacing (TPP) stands as an underutilized procedure, and provides a safe and effective alternative to conventional temporary pacing in patients with anticipated prolonged pacing requirement where permanent pacing is not feasible. Our institutional experience, in tandem with existing literature, underscores its safety and reliability as a method of pacing for up to a one-month duration. Predominantly, TPP finds application in scenarios necessitating pacing during prolonged infections. The most frequent complications encountered are superficial skin infections and lead dislodgment. However, both challenges can be effectively mitigated through meticulous implantation techniques and vigilant post-procedure care. Propagating the use of TPP in emergency care is imperative. Educating both emergency care providers and cardiologists on TPP can serve as a preventive measure against inadvertent permanent pacemaker implantation, particularly in the presence of sepsis, which poses an increased risk of device infection. By fostering awareness and understanding of TPP, we can optimize its utilization, providing a valuable alternative in situations where prolonged pacing is essential.

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