Indian Pacing and Electrophysiology Journal 23 (2023) 17–20

Contents lists available at ScienceDirect

Indian Pacing and Electrophysiology Journal

journal homepage: www.elsevier.com/locate/IPEJ

Original Research Article

Clinical profile and outcomes of semi-permanent pacing in a tertiary care institute in southern India

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ARTICLE INFO

Article history:
Received 14 April 2022
Received in revised form
8 October 2022
Accepted 4 November 2022
Available online 11 November 2022

Keywords:
Semi-permanent pacing

ABSTRACT

Background: Semi-permanent pacing (SPP) includes the placement of a permanent lead through the internal jugular vein and connection to a pulse generator on the skin outside the venous access site.
Aim: To evaluate the clinical profile and outcomes of semi-permanent pacing in a tertiary care institute in Southern India.
Methods: This is a retrospective observational study. All patients admitted and requiring management with semi-permanent pacing from January 2017 to June 2020 were included.
Results: From January 2017 to June 2020, 20 patients underwent semi-permanent pacing (SPP) with a median age of 54 (21–74) years. Males comprised a majority of the patients (55%). Hypertension was noted in 50% of patients and 30% were diabetic. The right internal jugular vein was the most common access in 95% of patients. The most common indication for semi-permanent pacing was pocket site infection in 30% of patients. There were no procedural complications. The median duration on SPP was 7 (5–14) days and the median duration of hospital stay was 13 (8–21) days. Permanent pacemaker implantation was done in 55% of patients. Mortality in our study group was 15% with 10% dying due to cardiogenic shock (post resuscitated cardiac arrest) and 5% dying due to non-cardiac cause (Epidural hematoma).
Conclusion: In our study, semi-permanent pacing was noted to be a safe procedure and was more commonly indicated in emergent conditions with complete heart block secondary to underlying reversible causes and in the management of pocket site infection.

1. Introduction

The implantation of pacemakers has increased over the recent years. An increase of permanent pacemaker implantations from 19% to 60% was noted between 1997 and 2004 in the United States [1]. This number has increased further since 2004 and the rate of complications has also increased.

Patients who have undergone permanent pacemaker implantation can develop complications such as a pocket site infection, or endocarditis. This precludes a Class I indication for complete removal of the leads and the device as there is a high recurrence rate of infection with antibiotic therapy alone [2]. The course is further complicated if the patient is pacing dependent, which would indicate the need for temporary pacing. Other conditions where temporary pacing has been found to be useful include complete heart block secondary to myocarditis where recovery of AV conduction can be expected with treatment. Chien et al. studied patients suffering from complete heart block secondary to myocarditis and noted that 77% of patients studied required temporary pacing [3].

Temporary pacing (TP) commonly involves the use of leads with no or passive fixation. This has a high risk of lead dislodgement and subsequent hemodynamic compromise of the patient which can be fatal. The risk factors for dislodgement such as inadvertent movement of the limb, site of venous access, inadequate positioning of the lead are modifiable while other risk factors are non-modifiable such as ventricular contraction, anatomy of the right heart, nature of the lead [4]. Hynes et al. studied 1022 patients who required conventional temporary pacing and noted that lead dislodgement occurred in 17.9% of patients [5]. Other complications that can occur

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Peer review under responsibility of Indian Heart Rhythm Society.

https://doi.org/10.1016/j.ipej.2022.11.001

during TPP include failure to establish venous access, failure of lead placement, sepsis and arrhythmias [6].

Semi-permanent pacing (SPP) was first used by researchers in 1973 [7]. This method includes the placement of a permanent lead through the internal jugular vein and connection to a pulse generator on the skin outside the venous access site. This strategy is useful as a bridge to recovery or PPI in conditions such as myocarditis and in conditions such as cardiac implanted electronic device (CIED) associated infection in pacing-dependent patients. SPP is also used as a bridge to recovery or PPI post structural intervention procedure such as Trans catheter aortic valve implantation (TAVI) [8]. For patients with CIED, the first stage includes complete explantation of the lead and pulse generator with implantation of a semi-permanent pacemaker system through the internal jugular vein. After an adequate course of antibiotics, the SPP system is removed and a new permanent pacemaker implantation (PPI) is implanted. Modaff et al. studied the outcomes following SPP versus TP and noted that major complications such as capture failure, lead repositioning, cardiac perforation, carotid puncture, and induction of ventricular arrhythmia were significantly more common in the SPP group when compared with the TP group [9]. Kornberger et al. studied 59 patients requiring SPP as a bridge to recovery or PPI and noted that only 1.7% of patients have a lead dislodgement post-implantation, 8.3% of patients died after SPP which was attributed primarily to the underlying condition [10].

There is a scarcity of data from India regarding the outcomes of semi-permanent pacing. This method has shown promising outcomes in other studies and the data from this study will help understand the characteristics of Indian patients requiring semi-permanent pacing.

2. Materials and methods

This is a retrospective observational study carried out in a tertiary referral center, a university-level hospital, Sri Chitra Institute for Medical Sciences and Technology (SCTIMST). Institutional ethics clearance was obtained. All consecutive patients admitted and requiring management with semi-permanent pacing from January 2017 to June 2020 were included.

Patients with a pacing indication were assessed by the authors. The decision to offer SPP was based on hemodynamic parameters, patient's clinical condition and the likely duration of pacing for more than 5 days. Semi-permanent pacing was done through the right internal jugular vein access. An active screw-in lead was placed in the right ventricle. The lead is then sutured to the skin. A pulse generator is placed external to the skin (unlike permanent pacemaker implantation where the pulse generator is placed in a skin pocket) (Image 1). The pulse generator is then programmed and dressing is done to fix the pulse generator to the site to prevent it from being displaced.

Details of clinical characteristics, the course in hospital, and outcomes were studied with the help of electronic medical records.

3. Statistics

Categorical variables were expressed as frequencies or percentages. Continuous variables were expressed as either mean standard deviation or median [inter-quartile range] depending on the overall variable distribution.

4. Results

From January 2017 to June 2020, 20 patients underwent semi-permanent pacing (SPP) with a median age of 54 (21–74) years.

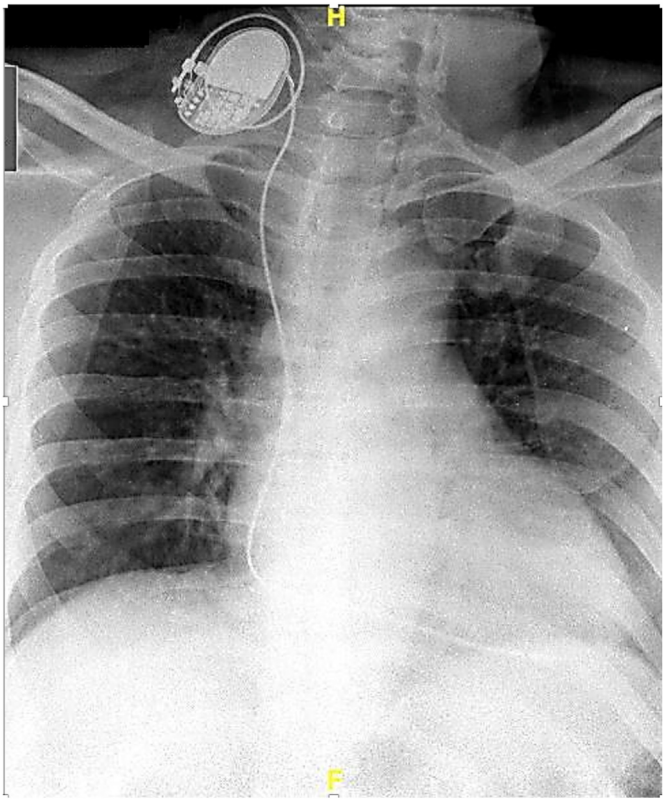

Image 1. Semi permanent pacing with active fixation lead in right ventricle and pulse generator placed outside the skin.

Males comprised of 55% of patients. Hypertension was noted in 50% of patients and 30% were diabetic. The right internal jugular vein was the most common access in 95% of patients (Table 1).

The most common indication for semi-permanent pacing was pocket site infection in 30% of patients. Other causes included transient indications for semi-permanent pacing in 15% of patients. This included 2 patients with myocarditis with associated CHB and one patient had an episode of asystole with syncope lasting >5 s after amiodarone infusion.

Other indications for semi-permanent pacing included 15% patients had an acute myocardial infarction (AMI), one patient had an aortic root abscess, one patient had systemic lupus erythematosus (SLE) as the cause for CHB. One patient had resuscitated cardiac arrest with CHB and one patient was status post aortic valve replacement developed CHB with syncope and subsequent epidural hematoma. Among the remaining patients who required SPP, and one patient underwent SPP prior to modified radical mastectomy (Table 1). There were no procedural complications.

The mean R wave sensitivity was 9.9 ± 3.3 mV, the measured median threshold was 0.8 (0.5–0.9) V and the median impedance was 715 (629–800) Ohms. The median duration on SPP was 7 (5–14) days, and maximum duration on SPP was 30 days. The median duration of hospital stay was 13 (8–21) days. Permanent pacemaker implantation was done in 55% of patients. Mortality in our study group was 15% with 10% dying due to cardiogenic shock (post resuscitated cardiac arrest) and 5% dying due to non-cardiac cause (Epidural hematoma) (Table 1).

5. Discussion

This study was done to assess the clinical profile and outcomes of patients who underwent SPP between January 2017 and June

Table 1
Details of patients undergoing semi-permanent pacing.

Patient Characteristics	Data (N-20)
Age (years) [a]	54 (21–74)
Sex Male	11 (55%)
Female	9 (45%)
Hypertension	10 (50%)
Diabetes Mellitus	6 (30%)
Smoking	2 (10%)
Vascular Access	
Right IJV	19 (95%)
Others- Right Subclavian	1 (5%)
Indications for SPP	
Pocket site infection(PSI)	6 (30%)
Transient indications	
• Myocarditis with associated CHB	2 (10%)
• Asystole >5 sec on amiodarone infusion	1 (5%)
Other indications	
• Post Myocardial infarction-CHB	3 (15%)
• Infective endocarditis- aortic root abscess-CHB	1 (5%)
• Systemic Lupus Erythematosus- CHB	1 (5%)
• Post Aortic valve replacement- CHB- Epidural Hematoma	1 (5%)
• Resuscitated Sudden cardiac arrest- CHB	1 (5%)
• Congenital CHB with recurrent polymorphic VT	1 (5%)
• LV non-compaction- high grade AV block with recurrent polymorphic VT	1 (5%)
• Prior to modified radical mastectomy	1 (5%)
• Pulse generator at EOL- Planned for CRT	1 (5%)
Procedural complications	0 (0%)
Sensitivity (mV) [b]	9.9 ± 3.3
Threshold(V) [a]	0.8 (0.5–0.9)
Impedance (Ohms) [a]	715 (629–800)
Duration on SPP(Days) [a]	7 (5–14)
Permanent pacemaker implantation	11 (55%)
CRT implantation	2 (10%)
Discharged without pacing requirement	4 (20%)
Duration of hospital stay (Days) [a]	13 (8–21)
Mortality	3 (15%)
Cardiac- Cardiogenic shock	2 (10%)
Non Cardiac	1 (5%)

CHB – complete heart block, VT – ventricular tachycardia, LV – left ventricular, AV – atrioventricular, EOL – end of life, CRT – cardiac resynchronisation therapy, SPP – semi permanent pacing.
[a] Median (IQR).
[b] Mean (SD).

2020 at our institute. Pocket site infection was the most common indication for semi-permanent pacing in 30% of patients. Other transient indication for SPP was noted in 15% of patients. There were no procedural complications. Permanent pacing was required prior to discharge in 65% of patients.

The median age of patients included was 54 (21–74) years and males comprised 55% of patients. Kornberger et al. reported an eight-year experience with SPP and noted that the mean age of patients in their study was 72.9 ± 10.5 years. Males comprised 73.3% of the patient population in their study [10].

Pocket site infection was the most common indication (30%) for semi-permanent pacing in our study population. This is similar to the study by Kornberger et al. who reported CIED infection as the most common indication for SPP(70%). In the subgroup of patients with CIED infection, pocket infection comprised the majority of indications for explantation. SPP technique is shown to be simple and efficient in multiple studies. In comparison to a single-stage procedure involving complete reimplantation of a new pacing system or a two-stage procedure involving explantation of the pulse generator and pacing through a potentially infected lead, SPP has the advantage of a lower risk of recurrent infection [11]. This is mainly due to the complete removal of all infected and possibly infected material, debridement of the pocket site and only reimplanting a new pacemaker system after the infection is completely treated. Benefits of SPP in patients without CIED infection mainly include greater patient comfort and mobility, lower rates of lead dislodgement and other complications resulting in enhanced patient safety, and an extended array of programming options of pulse generators compared to temporary pacing systems.

SPP can be used as a bridge to recovery in patients who have a reversible indication for pacing and also as a bridge to permanent pacing in patients who finally require permanent pacemaker implantation. Drug induced bradycardia usually responds to stoppage of the culprit medication. Initiation of isoprenaline can help to tide over the situation in most instances. However, some patients will be having occult sinus node dysfunction or AV nodal dysfunction which got unmasked with certain medications. In those situations, if drug induced bradycardia is persisting despite stopping medications and not responding to isoprenaline, transient pacing will be needed until sinus nodal or AV conduction recovers or a decision regarding permanent pacing is made. On the other hand, given the transient nature of bradycardia and responsiveness to withdrawal of culprit medication, temporary pacing may not be always essential for managing drug induced bradycardia. The same is the case with hyperkalemia which resolves with stoppage of hyperkalemic medications, anti-potassium drug treatment and dialysis. The advantage of SPP over TPI in these situations in highlighted by the high incidence of lead dislodgement or perforation with the use of TPI even if it kept for a day or two [12]. SPP was successfully used as a bridge to recovery in 20% of patients and bridge to permanent pacing in 65% of patients in our study. This is similar to the study reported by Kornberger et al. where 63.3% of patients required

permanent pacing and 18.3% of patients recovered fully and did not require pacing at discharge [10]. In patients with a pocket site infection or lead associated infective endocarditis the duration of SPP required can be predicted. However, in conditions such as myocarditis where the duration for recovery of AV conduction is unknown, prolonged pacing with SPP maybe required.

In patients who have an ICD implanted and subsequently develop a pocket site infection, SPP can be done with a permanent dual coil ICD lead attached to an epicutaneous ICD pulse generator programmed in a “cold can” configuration. Debski et al. report a case using this ICD SPP in a patient who developed ICD lead infective endocarditis requiring removal of the ICD system and using a SPP until completion of antibiotics and re implantation of a new ICD system [13].

Leadless pacemakers are novel devices which offer an innovative approach to cardiac pacing while avoiding the possible complications from transvenous pacing [14]. However temporary pacing leadless pacemaker may not be a cost-effective option.

There were no intra-procedure or post-procedure complications in our study. The complications reported in multiple studies included intraprocedural complications such as bleeding, lead dislodgement, and postoperative complications such as infection of the SPP system and lead dislodgement requiring repositioning. Concurrent infection of the SPP system is less likely compared to temporary pacing. Most infections in SPP were reported in procedures where transvenous femoral access was used routinely [15]. The likely reasons for why SPP has a lower incidence of infection include reduced manipulation of the lead, the sheath is not left in place so the entry site at the skin is smaller leading to reduced bacterial seeding into the tissue and bloodstream. SPP systems are routinely placed contralaterally to the site where the permanent pacing system is likely to be implanted. The right internal jugular vein is the most commonly used approach in order to protect the subclavian veins which are generally used for permanent pacing [16]. In our study, 95% of patients had a venous access through the right internal jugular vein. Kornberger et al. noted intra-procedure complications in 3.3% of patients with 1 patient experiencing lead dislodgement with a short asystolic phase, postoperative complications in their study was noted in 6.7% of patients with 5% developing an infection of the SPP system and 1 patient had lead dislodgement requiring repositioning [10].

Mortality was noted in our study in 15% of patients, with none of the patients having an SPP-related death. Suarez et al. analyzed 31 studied on SPP and noted that a total of 84 deaths were reported. Most deaths were due to multiorgan dysfunction related to cardiogenic shock, sepsis, or refractory ventricular arrhythmias. Only 0.7% of all the deaths were reported as related to the semi-permanent pacing [4]. This is likely due to the fact that most CIED infections are limited to the pocket site. Noble et al. reported 20 patients who had undergone transcatheter aortic valve implantation requiring SPP and noted that there were two deaths and both were not secondary to the SPP(8).

Limitations of this study include it being a retrospective analysis of the case records to study the baseline characteristics of patients. Non randomisation to TPI is another major limitation of this study. The collection of data depended upon the accurate documentation of the diagnosis, pre procedure, procedural, post procedural evaluation and follow up details. It is a single center study with a small sample size and therefore the results of our study cannot be generalised to a larger population.

6. Conclusion

In our study, semi-permanent pacing was noted to be a relatively safe procedure and was commonly indicated in the management of pocket site infection and in emergent conditions with complete heart block secondary to underlying reversible causes.

Funding

None.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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