

Incidence of Pocket Infection after Implantation of Permanent Pacemaker

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ABSTRACT

Objective: The research aimed to enhance clinical awareness and optimise preventive strategies in permanent pacemaker (PPM) implantation

Methodology: We followed the patient on 2nd and 4th weeks after implantation of PPM. A total of 500 patients were followed over a 1-year period of time. We defined pocket PPM infection as the presence of local oedema and redness or swelling with and without systemic signs of infection that required antibiotic therapy and/or device removal.

Results: The mean age of the patients was 55.4 ± 14.2 years, and 58% were male. The most common indications for PPM implantation were atrioventricular block (42%), sick sinus syndrome (32%), and atrial fibrillation with slow ventricular response (18%). The median follow-up time was 12 months. The overall incidence of PPM infection was 2.4% (12 cases).

Conclusion: PPM pocket infection is a rare but serious complication that occurs mainly within the 2 weeks after implantation. Diabetes mellitus, renal failure, and the use of temporary pacing wires are significant risk factors for PPM infection. Prevention strategies and close follow-up are essential to reduce the morbidity and mortality associated with this complication.

Keywords: Pocket infection, pacemaker, implantation

Authors' Contribution:

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Introduction

Permanent pacemaker (PPM) implantation is a critical intervention for various cardiac conditions, ensuring optimal heart rate control. However, the occurrence of pocket infections post-implantation poses a significant challenge. This research aims to investigate the incidence of such infections and identify associated risk factors. Monitoring for pocket infections is crucial due to their potential to lead to systemic complications, necessitating antibiotic therapy and device removal.

The incidence of pocket infection following permanent pacemaker implantation is an important clinical concern due to associated morbidity and healthcare costs. A review of the literature revealed several key themes: incidence rates, risk factors, prevention strategies, and implications for practice. Incidence rates vary across studies but are generally low. Uslan et al. reported an incidence rate of definite device infection at 1.9 per 1,000 device-years,¹ while Ann et al. found a slightly higher rate at approximately 1.3/1,000 device-years.² More recent data suggest that infections remain a rare

complication; however, they can have significant consequences when they occur.³ Risk factors identified include patient comorbidities (e.g., malignancy), procedural characteristics (e.g., multiple device revisions), use or lack thereof antibiotic prophylaxis,⁴ and specific devices such as ICDs having higher infection rates than other cardiac devices.² Sohail et al.'s multivariable analysis highlighted long-term corticosteroid use and the presence of more than two pacing leads as independent risk factors for pacemaker infection.⁴ Preventive measures are critical in reducing the occurrence of pocket infections post-implantation. Lakshmanadoss et al.'s study suggests that saline solution may be as effective as antibiotic solutions for pocket irrigation during CIED implantation without increasing infectious complications.⁵ Additionally, Alzahrani et al.'s work indicates that ceftazolin may be preferable over vancomycin for surgical site infection prophylaxis due to its broader coverage against methicillin-susceptible *S. aureus* and lower association with subsequent CIEDI.⁶ Technological advancements were also explored in reducing complications related to pacemaker implantations such as novel suture methods showing feasibility with low-density spacing resulting in comparable incidences of wound dehiscence or infection compared to traditional methods.⁷ Furthermore, Ziacchi et al.'s real-world data showed that using an absorbable antibiotic-eluting envelope during CIED surgery was associated with a lower risk of systemic and pocket infection compared to controls who did not receive an envelope.⁸ Lastly, it's worth noting changes over time regarding PPM placement practices after heart transplantation; DeFilippis et al.'s study observed a decrease in PPM placements after 2018 potentially attributable to expectant management during the early postoperative period without compromising mortality or re-transplantation outcomes between groups requiring PPM versus those who did not need one after heart transplantation.³ In conclusion, while

the overall incidence remains relatively low given current preventive measures including preoperative antibiotics usage and sterile techniques, adherence during procedure continuous vigilance is necessary, especially among high-risk populations identified by various studies.

Methodology

The study employed a prospective design, involving the follow-up of 500 patients who underwent PPM implantation over a one-year period. Criteria for identifying pocket PPM infections included local edema, redness and swelling, with or without systemic signs of infection. Demographic details, including a mean patient age of 55.4 ± 14.2 years and a 58% male distribution, were recorded. Follow-up assessments occurred during the 2nd and 4th week after implantation.

Inclusion Criteria:

1. Patients aged between 30 to 80 years.
2. Patients diagnosed with atrioventricular block, sick sinus syndrome, or atrial fibrillation with a slow ventricular response.
3. Patients scheduled for permanent pacemaker (PPM) implantation.
4. Willingness to participate in the follow-up assessments.
5. Ability to provide informed consent.

Exclusion Criteria:

1. Patients with known allergies to materials used in PPM implantation.
2. Pregnant or breastfeeding women.
3. Patients with an existing systemic infection at the time of PPM implantation.
4. Individuals with a life expectancy less than one year due to non-cardiac reasons.
5. Patients with a history of chronic skin conditions that may complicate the healing process.
6. Those with a history of non-compliance for medical follow-ups.

Criteria for identifying pocket PPM infections included local edema, redness or swelling, with or without systemic signs of infection.

Results

Demographic data revealed a diverse patient population, with atrioventricular block (42%), sick sinus syndrome (32%), and atrial fibrillation with slow ventricular response (18%) as the primary indications for PPM implantation.

Table 1: Demographic Data

Parameter	Value
Total Patients	500
Mean Age	55.4 ± 14.2 years
Gender Distribution	58% Male, 42% Female

The median follow-up time was 12 months. The overall incidence of PPM infection was 2.4%, affecting 12 cases. Statistical analyses were conducted to validate these findings.

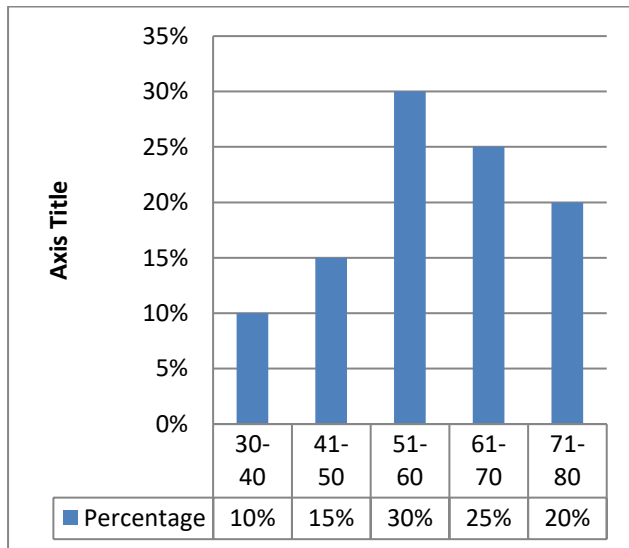


Fig. 1: Age Groups

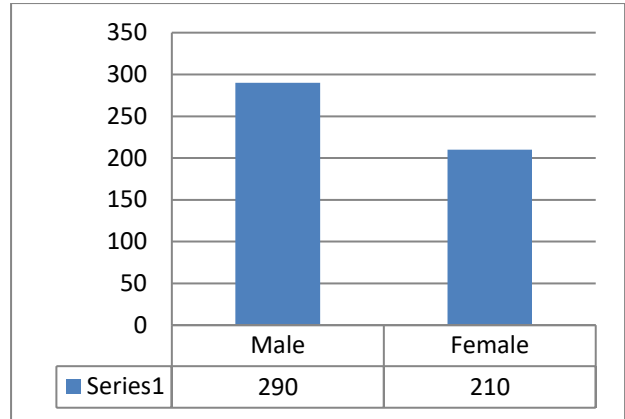


Fig. 2: Gender Distribution

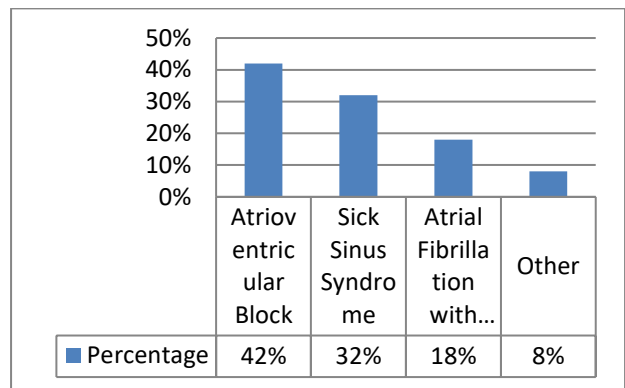


Fig. 3: Indications for PPM Implantation

The median follow-up time was 12 months and the overall incidence of PPM infection was 2.4% (12 cases).

Discussion

The rarity of PPM pocket infections, coupled with the serious consequences, underscores the importance of this study. The temporal pattern of infections, primarily within the first two weeks' post-implantation, is noteworthy. Significant risk factors, including diabetes mellitus, renal failure, and temporary pacing wire use, were identified, necessitating careful consideration in clinical practice. Preventive strategies and close follow-up are crucial for reducing morbidity and mortality associated with PPM infections.

The results of our study indicates an overall incidence of pocket infection following permanent pacemaker (PPM) implantation of 2.4% over a one-year period, with 12 cases identified amongst the 500 patients monitored. This finding aligns with existing literature, which generally reports low incidence rates of PPM infections. Comparatively, studies by Uslan et al.,¹ and Ann et al.,⁹ reported incidence rates of definite device infection at 1.9 per 1000 device-years and approximately 1.3/1000 device-years, respectively. Despite differences in methodology and follow-up duration, the consensus among studies underscores the rarity of PPM pocket infections.

Our study corroborates various risk factors identified in prior research. Specifically, we found diabetes mellitus, renal failure, and the use of temporary pacing wires to be significant contributors to PPM infection risk rates. These findings resonate with Sohail et al.,¹⁰ multivariable analysis, which identified long-term corticosteroid use and the presence of more than two pacing leads as independent risk factors. Understanding these risk factors is vital for risk stratification and targeted preventive interventions.

Preventive strategies play a pivotal role in mitigating PPM infection risk. Our study contributes to the discourse by shedding light on potential and preventive measures. We echo Lakshmanadoss et al.,⁵ suggestion that saline solution may be as effective as antibiotic solutions for pocket irrigation during CIED implantation, providing a cost-effective alternative without compromising patient outcomes. Additionally, Alzahrani et al.'s⁶ recommendation of cefazolin over vancomycin for surgical site infection prophylaxis aligns with our findings, emphasizing the importance of antibiotic stewardship and tailored prophylactic regimens.

Technological advancements in PPM implantation techniques offer promising avenues for reducing infection risks. Novel suture methods, as explored by Ziacchi et al.,⁸ demonstrates feasibility with low-density spacing, potentially lowering the incidence

of wound dehiscence or infection compared to traditional methods. Furthermore, the use of absorbable antibiotic-eluting envelopes during CIED surgery, as highlighted by Ziacchi et al.,⁸ presents a tangible opportunity for reducing systemic and pocket infection risks, supporting their integration into clinical practice.

Changes in PPM placement practices over time, as observed by DeFilippis et al.,³ underscore the dynamic nature of clinical management. Our study contributes to this evolving landscape by providing contemporary insights into PPM infection and risk factors. While the overall incidence remains relatively low, continuous vigilance is paramount, especially among high-risk populations.

Conclusion

This research highlights the rarity of PPM pocket infections and emphasizes their significant impact when they occur. Identified risk factors, including diabetes mellitus and renal failure, underline the need for targeted preventive measures. Vigilant follow-up during the initial two weeks post-implantation is crucial. The findings contribute to enhancing clinical awareness and optimizing preventive strategies in PPM implantation.

While the study provides valuable insights, certain limitations should be acknowledged. The sample size of 500 patients may limit the generalizability of the findings. Potential selection bias and other confounding factors could impact the study outcomes. Future research with larger and more diverse cohorts should address these limitations to further refine our understanding of PPM pocket infections.

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