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ASSESSING THE KNOWLEDGE OF NURSES REGARDING THE COMPLICATIONS AND MANAGEMENT OF TEMPORARY PACEMAKER CARDIAC DEVICES: A CROSS-SECTIONAL STUDIES

Original Research

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ABSTRACT

Background: Temporary cardiac pacemakers (TCPs) are essential, life-saving devices used to stabilize patients with conduction abnormalities, arrhythmias, or post-operative cardiac complications. Their management requires a high level of nursing competence to prevent adverse events such as lead dislodgement, pacing failure, or infection. Evidence has shown that nurses often demonstrate variability in knowledge and skills, with deficiencies concentrated in technical and complication-related areas. Structured assessment of knowledge is therefore crucial to guide targeted training interventions and improve patient safety in high-risk cardiac units.

Objective: To assess the knowledge of nurses regarding complications and management of temporary cardiac pacemaker devices in a tertiary cardiac care setting.

Methods: A descriptive cross-sectional study was conducted at the Punjab Institute of Cardiology, Lahore, between February and June 2025. A total of 169 registered nurses working in ICU, CCU, cath labs, and emergency departments were recruited through purposive sampling. Eligibility required at least one year of clinical experience. Data were collected using a structured 20-item questionnaire rated on a 5-point Likert scale (range: 20–100). Knowledge scores were categorized as poor (20–49), moderate (50–74), and good (75–100). Data were analyzed using SPSS version 25, with descriptive and inferential statistics including chi-square tests for subgroup comparisons. Ethical approval was obtained, and informed consent was secured from all participants.

Results: Out of 169 participants, 132 nurses (78.11%) demonstrated good knowledge, 36 (21.30%) had moderate knowledge, and 1 (0.59%) showed poor knowledge. Nurses with bachelor's degrees performed significantly better than diploma holders ($\chi^2 = 7.98$, $p = 0.018$). Although knowledge improved with greater experience and older age, these differences did not reach statistical significance. Item-wise analysis revealed highest scores in patient education (mean = 4.34), infection control (mean = 4.28), and confidence in care (mean = 4.34), while lowest scores were noted in pacing thresholds (mean = 3.80) and cardiac tamponade recognition (mean = 3.80).

Conclusion: Most nurses demonstrated satisfactory knowledge of temporary pacemaker management, yet important gaps persisted in technical and complication-related areas. The findings highlight the need for structured training and standardized protocols to enhance nursing competence, ensure patient safety, and improve outcomes in cardiac care units.

Keywords: Age Factors; Cardiac Pacing, Artificial; Cross-Sectional Studies; Education, Nursing; Knowledge; Nurses; Patient Safety.

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INTRODUCTION

Temporary cardiac pacemakers (TCPs) are widely recognized as life-saving devices that provide essential rhythm support in patients experiencing bradyarrhythmias, atrioventricular blocks, or conduction abnormalities, particularly in critical care and post-operative cardiac settings. Unlike permanent pacemakers, TCPs are short-term solutions designed to stabilize patients until the underlying pathology is treated or a long-term pacing device is implanted (1). Arrhythmias such as atrial fibrillation, which remain a frequent complication in ischemic stroke patients, further highlight the clinical need for rhythm stabilization strategies including pacemaker support (2). Their use is especially prevalent following cardiac surgeries such as coronary artery bypass grafting or valve replacement, or in emergencies where acute rhythm stabilization is required. In these contexts, nurses are at the frontline of care, responsible for continuous monitoring, identifying early complications, and ensuring the safe operation of these devices. Despite their importance, TCPs are associated with significant risks, including lead dislodgement, infection, failure to capture, oversensing, and life-threatening arrhythmias if not adequately managed (3). Evidence suggests that inappropriate monitoring, poor device handling, and lack of knowledge among healthcare providers contribute to these complications (4). Nurses, being the primary caregivers in intensive and cardiac care units, are expected to interpret ECG changes, monitor pacing thresholds, and respond rapidly to malfunction or patient deterioration. This requires not only technical expertise but also confidence and preparedness in managing acute complications (5). However, multiple studies have consistently demonstrated gaps in knowledge and practice among nurses managing TCPs. Research conducted in Egypt showed that fewer than 60% of nurses demonstrated competent practice, and less than half could recognize key complications or perform emergency interventions appropriately (6,7).

Another study revealed that 92.5% of nurses displayed unsafe practice levels due to inadequate knowledge, with none having received formal structured training on TCP management (8). These findings highlight the absence of standardized educational programs, the lack of institutional guidelines, and the limited clinical exposure nurses receive in handling these devices (9,10). As a result, patient safety is compromised, and adverse outcomes such as pacing failure or cardiac tamponade remain prevalent. In regional contexts such as Pakistan, the challenges are further amplified by high workloads, inconsistent departmental policies, and the absence of TCP-specific protocols. Studies have found that less than half of critical care nurses demonstrated sufficient knowledge of temporary pacing, and many reported feeling unprepared to manage associated complications (11,12). The lack of structured education and supervised training opportunities contributes directly to unsafe practice, despite the rising need for temporary pacing in aging populations with increasing rates of arrhythmia and cardiac surgery (13). Addressing this gap requires structured assessments of nursing knowledge and performance, followed by tailored educational interventions that strengthen competency in TCP care. Evidence demonstrates that targeted training programs significantly improve nurses' knowledge, clinical practice, and confidence, with lasting benefits for patient safety (4,6). The present study is therefore designed to identify the knowledge and practice deficiencies of nurses in managing temporary cardiac pacemakers, with the objective of supporting evidence-based educational initiatives that enhance patient outcomes and improve the quality of cardiac care.

METHODS

The study employed a descriptive cross-sectional design to assess the knowledge of nurses regarding the complications and management of temporary cardiac pacemaker (TCP) devices. This design was deemed appropriate because it enabled the collection of data at a single point in time, providing an overview of the existing knowledge levels within a specific population without any manipulation of variables. The study was conducted at the Punjab Institute of Cardiology (PIC), Lahore, a tertiary cardiac care facility where temporary pacemakers are frequently inserted, thus providing a relevant setting with a diverse nursing workforce actively engaged in managing such patients. The target population included registered nurses working in the critical care units, intensive care units, catheterization laboratories, and emergency floors of PIC, where patients with TCPs are routinely managed. Nurses were eligible for participation if they had at least one year of clinical experience and provided written informed consent. Nursing interns, students, those in administrative or non-clinical roles, and individuals unwilling to consent were excluded from participation. A purposive non-probability sampling technique was adopted because the study specifically sought to recruit nurses who had direct exposure to TCP patient care. The duration of the study spanned four months (February 2025–June 2025), encompassing phases of data collection, entry, analysis, and preparation of results.

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Knowledge assessment was conducted using an adapted questionnaire designed to evaluate understanding of TCP indications, functioning, potential complications, and related nursing management. The instrument included 20 items scored on a 5-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). Scores for all items were summed, with a minimum possible score of 20 and a maximum of 100. Knowledge levels were categorized as poor (20–49), moderate (50–74), or good (75–100). This scoring system provided a clear operational definition of knowledge levels among the participants. Data were collected after obtaining ethical approval from the Institutional Review Board of the Punjab Institute of Cardiology, Lahore. Eligible participants were informed about the study objectives, assured of confidentiality, and asked to sign written informed consent prior to participation. Questionnaires were distributed and completed on-site, then reviewed for completeness and coded before analysis. Participation was voluntary, and respondents were informed that they could withdraw at any stage without any consequences. Confidentiality was maintained by ensuring anonymity, and all data were stored securely and used solely for research purposes.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 and Microsoft Excel. Responses on the Likert scale were coded numerically from 1 to 5. Data were cleaned for completeness and accuracy, with incomplete or invalid questionnaires excluded from analysis. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize demographic characteristics and knowledge levels. Inferential statistical tests, such as chi-square tests for categorical data and independent-sample t-tests where appropriate, could be applied to examine associations between socio-demographic variables and knowledge scores, although this was not explicitly stated in the initial plan. Ethical principles were strictly observed throughout the study. Approval from the ethical committee ensured adherence to institutional and international research guidelines. Written informed consent was obtained from all participants, and they were informed of their rights, including confidentiality, anonymity, and the freedom to withdraw without penalty. The study posed no direct risks to participants, and no disadvantages were associated with participation.

RESULTS

A total of 169 registered nurses participated in the study, all of whom were working in critical care units, intensive care units, catheterization laboratories, and emergency departments at the Punjab Institute of Cardiology, Lahore. Among them, 151 participants (89.35%) were between 20–35 years of age, while 18 (10.65%) were older than 35 years. Most of the nurses, 142 (83.98%), had 1–10 years of clinical experience, whereas 27 (16.02%) reported more than 10 years of experience. Regarding educational qualifications, 79 nurses (46.75%) held a diploma in nursing and 90 (53.25%) possessed a bachelor's degree. The assessment of overall knowledge revealed that 132 nurses (78.11%) demonstrated good knowledge, 36 (21.30%) had moderate knowledge, and only 1 participant (0.59%) fell within the poor knowledge category. These results indicate that while the majority of nurses displayed adequate competence, a considerable proportion remained within the moderate category, highlighting variability in knowledge levels. Analysis of individual questionnaire items showed mean scores ranging between 3.80 and 4.34. The highest scores were observed in patient and family education (mean = 4.34), confidence in caring for temporary pacemaker patients (mean = 4.34), and infection control practices (mean = 4.28). In contrast, lower scores were noted for technical aspects, including understanding pacing thresholds and outputs (mean = 3.80) and recognition of cardiac tamponade symptoms (mean = 3.80). Most other domains, such as knowledge of indications, complication recognition, and immediate nursing actions, scored consistently above 4.0, reflecting generally good performance across critical areas.

Subgroup analysis demonstrated that nurses with a bachelor's degree achieved better knowledge outcomes than diploma holders, with 77 in the good category compared to 55, whereas one diploma holder had poor knowledge. In terms of experience, nurses with more than five years of service showed higher proportions of good knowledge, with 25 in the good category compared to 107 among those with less experience. Similarly, older nurses (>35 years) demonstrated exclusively good knowledge, while younger nurses showed a broader distribution across good, moderate, and poor categories. When subgroup differences were further analyzed using chi-square tests, a statistically significant association was observed between education level and knowledge scores ($\chi^2 = 7.98$, $p = 0.018$). Nurses holding bachelor's degrees demonstrated better knowledge compared to diploma holders, with 77 classified as having good knowledge versus 55 in the diploma group. No significant association was identified between years of experience and knowledge levels ($\chi^2 = 3.96$, $p = 0.138$), although nurses with more than five years of experience showed a higher proportion of good knowledge compared to those with fewer years. Similarly, the difference in knowledge levels by age group did not reach statistical significance ($\chi^2 = 5.65$, $p = 0.059$), but a trend was evident, as all nurses older than 35 years demonstrated good knowledge while variability persisted among younger participants. These findings suggest that educational background plays a stronger role in predicting knowledge adequacy than clinical experience or age.

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Table1: Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age Group	20–35 years	151	89.35%
	>35years	18	10.65%
Experience	1–10 years	142	83.98%
	>10 years	27	16.02%
Education Level	Diploma in Nursing	79	46.75%
	Bachelor's Degree	90	53.25%

Table 2: Knowledge Score Classification

Knowledge Level	Frequency (n)	Percentage (%)
Good (75–100)	132	78.11%
Moderate (50–74)	36	21.30%
Poor (<50)	1	0.59%

Table 3: Item-wise Mean Scores of Knowledge Questions

Question	Topic Summary	Average Score
Q1	Cardiac conduction system	4.18
Q2	Indications for temporary pacing	4.24
Q3	Components of pacemaker system	3.95
Q4	Criteria for initiating pacing	3.90
Q5	Effect of pacemaker on rhythm	4.12
Q6	Interpreting pacing spikes on ECG	4.05
Q7	Normal pacemaker functioning	4.15
Q8	Understanding sensing/output/threshold	3.80
Q9	Identifying pacemaker malfunction	3.90
Q10	Nurse's role in pacemaker adjustments	4.24
Q11	Complications: lead dislodgement, infection	4.15
Q12	Symptoms of cardiac tamponade	3.80
Q13	Signs of patient deterioration	3.95
Q14	Oversensing/undersensing responses	4.16
Q15	Immediate nursing actions for failure	4.18
Q16	Infection control practices	4.28
Q17	Documentation accuracy	4.20
Q18	Patient and family education	4.34
Q19	Ethical awareness	4.18
Q20	Confidence in caring for TPM patients	4.34

Table 4: Knowledge Level by Education

Education Level	Good	Moderate	Poor
Diploma (1)	55	24	0
Bachelor's (2)	77	12	1

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Table 5: Knowledge Level by Experience

Experience (Years)	Good	Moderate	Poor
1–5 years (1)	107	34	1
>5 years (2)	25	2	0

Table 6: Knowledge Level by Age Group

Age Group	Good	Moderate	Poor
20–35 yrs	114	36	1
>35yrs	18	0	0

Table 7: Association of Demographic Variables with Knowledge Levels

Variable	Good (n)	Moderate (n)	Poor (n)	χ^2 Value	p-value
Education				7.98	0.018*
Diploma	55	24	0		
Bachelor	77	12	1		
Experience				3.97	0.138
1–5 years	107	34	1		
>5 years	25	2	0		
Age Group				5.65	0.059
20–35 years	114	36	1		
>35 years	18	0	0		

*Statistically significant at $p < 0.05$

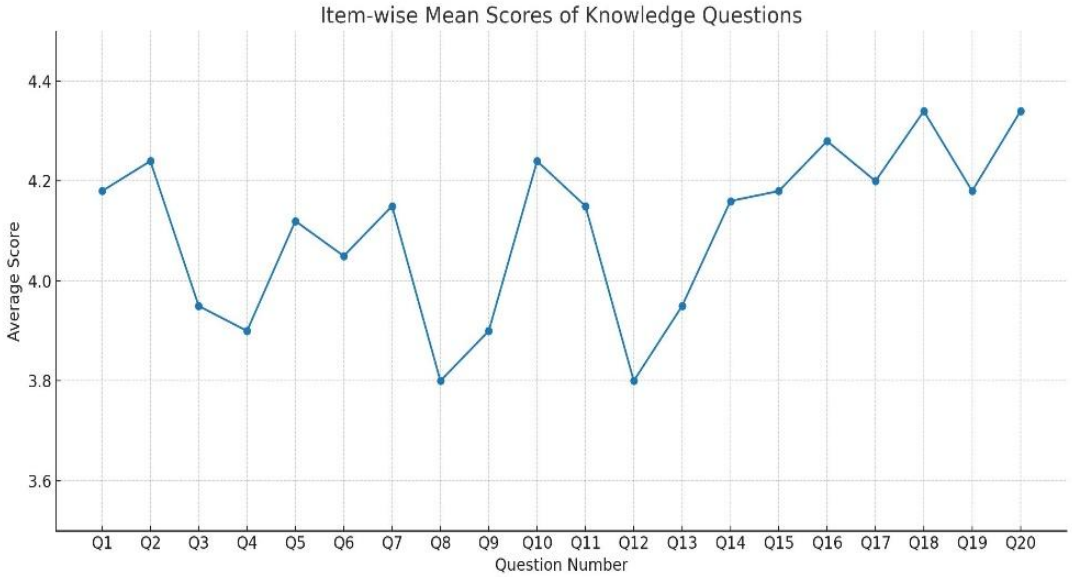

Figure 1 Item-wise Mean Scares of Knowledge Questions

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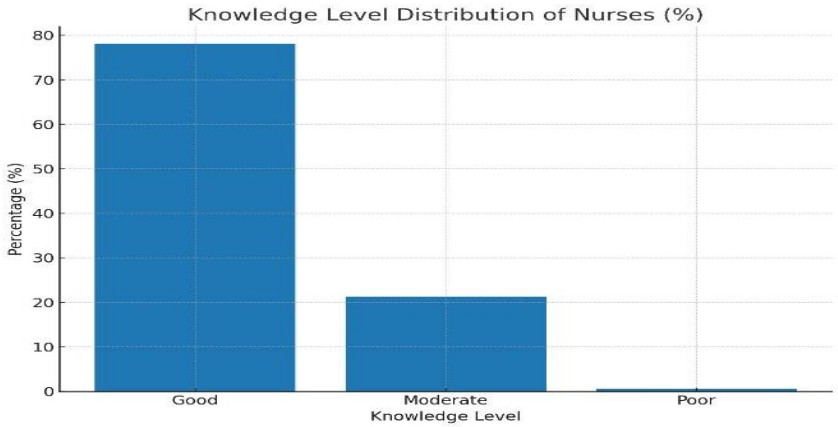

Figure 2 Knowledge Level Distribution of Nurses (%)

DISCUSSION

The findings of this study demonstrated that the majority of nurses possessed good knowledge regarding the complications and management of temporary cardiac pacemakers, with more than three-fourths achieving high knowledge scores. This is a positive reflection of the clinical readiness of nurses working in specialized cardiac care units, where exposure to such devices is common. However, a considerable proportion of nurses displayed only moderate knowledge, and a small fraction demonstrated poor understanding, indicating that knowledge gaps continue to persist. These results are consistent with reports from other regional and international studies, where nurses were shown to have variable competence in pacemaker management, often influenced by education, clinical experience, and access to structured training programs (14). Educational background emerged as a significant predictor of knowledge, with bachelor-trained nurses outperforming diploma holders. This aligns with earlier findings where higher education was associated with improved critical care performance and better interpretation of complex device-related complications (15). Clinical experience also demonstrated a positive influence, as those with more years in practice tended to perform better, though this difference was not statistically significant. The trend observed in older nurses having consistently higher knowledge levels may reflect accumulated clinical exposure, peer mentoring, and the confidence gained through repeated encounters with temporary pacing devices (16,17). Such patterns reinforce the importance of both formal academic preparation and continuous professional development in shaping clinical competency.

The analysis of item-wise knowledge revealed that nurses performed strongest in domains related to patient and family education, infection control practices, and confidence in caring for patients. These areas likely reflect the emphasis placed in nursing curricula and institutional training on patient-centered care and infection prevention protocols (18). In contrast, the lowest scores were observed in technical concepts such as sensing, output, and recognition of life-threatening complications like cardiac tamponade. This gap is clinically significant because deficiencies in technical understanding directly translate into delayed recognition of malfunction, inappropriate device adjustments, or failure to act promptly in emergencies. Similar deficiencies have been reported in studies from other low- and middle-income countries, where the lack of structured, device-specific training remains a barrier to optimal practice (19,20). The implications of these findings are considerable. Given the growing reliance on temporary cardiac pacemakers in post-operative care and acute arrhythmia management, even small deficiencies in nurse knowledge could increase the risk of preventable complications such as lead dislodgement, undersensing, or pacing failure. Health systems therefore need to prioritize targeted training modules focusing on device mechanics, ECG interpretation, and complication recognition (21). Structured competency-based programs, supported by regular refresher sessions and simulation-based training, are likely to enhance preparedness and bridge the knowledge gaps identified. This study contributes valuable insights as it focused specifically on temporary pacemaker devices, whereas many prior investigations often combined permanent and temporary pacemaker care into a single analysis (22). By isolating the temporary pacemaker context, the study highlighted the acute risks associated with short-term pacing and the particular technical skills required for safe management. The focus on critical care settings such as ICU, CCU, cath labs, and emergency departments further strengthened the study, ensuring that the findings were derived from nurses directly engaged with high-risk patients.

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Several limitations must be acknowledged. Being a single-institution study, the findings may not be generalizable to all hospitals in Pakistan, where institutional protocols, resources, and staff training may differ. The use of a self-reported questionnaire introduces the possibility of response bias, as participants may overestimate their competence. Additionally, the cross-sectional design captures knowledge at only one point in time, without assessing retention or long-term improvement following training. The lack of validation or pilot testing of the adapted tool within the local context also poses a limitation, as cultural and linguistic factors may influence how items were interpreted. Future studies should employ multi-center designs, include larger and more diverse samples, and consider mixed methods that combine knowledge testing with direct observation of practice to provide a more comprehensive assessment (22). Despite these limitations, the study had notable strengths. It addressed a clinically significant topic that is underexplored in the local context, used a structured and reliable scoring system to quantify knowledge, and analyzed subgroup differences using both descriptive and inferential statistics. The identification of specific technical gaps provides practical direction for nursing education and policy development. In conclusion, the study confirmed that while the majority of nurses demonstrated good foundational knowledge regarding temporary pacemaker management, critical training needs remain in technical and complication-related areas. Younger, less experienced, and diploma-trained staff require additional support and structured training to ensure consistent safety standards in high-risk cardiac care environments. These findings emphasize the urgent need for institutional policies that mandate continuous professional development, simulation-based training, and the implementation of standardized guidelines for temporary pacemaker care. Such interventions would strengthen clinical readiness, reduce complication risks, and ultimately improve patient outcomes in cardiac care units.

CONCLUSION

This study concluded that nurses working in critical cardiac care units generally demonstrated good knowledge regarding the complications and management of temporary cardiac pacemakers, yet important gaps remain in technical understanding and recognition of high-risk complications. The findings underscore the critical role of structured education, continuous professional development, and standardized protocols in ensuring safe and effective patient care. By highlighting specific areas of deficiency, this research provides valuable direction for targeted training programs that can strengthen nursing competence, minimize risks, and enhance the overall quality of cardiac care.

AUTHOR CONTRIBUTION

Author	Contribution
Arshia Nadeem*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Maryam Mehboob	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sheharyar Ahmed	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

REFERENCES

1. Baloch, N. R., Qamar, F., Fatima, R., & Shaikh, A. A. (2021). Nurses' knowledge and practice regarding temporary pacemakers: An exploratory study. Egyptian Journal of Health Care, 14(1), 738–748.
2. Shaikh BA, Gurbakhshani KM, Muhammad SK. Frequency of atrial fibrillation in patients of ischemic stroke. SZMC. 2017;31:120-6.
3. Mahrous, K., Ismaeil, A., Nasr, M. H., & Mahrous, F. M. (2024). Nurses' Performance for Patients with Implantable Cardiac Devices. 15(1).
4. Mohamed, M. S., Abd, O., Aty, E., Abd, A., & Abd, E. (2023). Nurses' Performance Regarding Care of Temporary Pacemaker among Critically Ill Patient. 14(1), 738–748.

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5. Stoyanova, I. A. (2024). The role of the nurse in patients with pacemakers: Practices and interventions in preoperative and postoperative intensive care. 23(03), 2764–2772.
6. Waqanivavalagi, S. W. F. R. (2024). Temporary pacing following cardiac surgery – a reference guide for surgical teams. Journal of Cardiothoracic Surgery, 19(1), 1–5.
7. Oliveira ES, Menezes TMO, Gomes NP, Oliveira LMS, Batista VM, Oliveira MCM, et al. Transitional care of nurses to older adults with artificial pacemaker. Rev Bras Enferm. 2021;75Suppl. 4(Suppl. 4):e20210192.
8. Adams A, Adams C. Transcutaneous Pacing: An Emergency Nurse's Guide. J Emerg Nurs. 2021;47(2):326-30.
9. Mette C, Prost D, Baud J, Taieb J, Marijon E, Piot O. Survey on the paramedical role in the remote monitoring of cardiac implantable electronic devices in France. Ann Cardiol Angeiol (Paris). 2023;72(3):101599.
10. Walker TJ, Bradbury A. A Primer on Pacemakers and Defibrillators for Nurses. Nurs Clin North Am. 2023;58(3):405-19.
11. Wan EY, Rogers AJ, Lavelle M, Marcus M, Stone SA, Ottoboni L, et al. Periprocedural Management and Multidisciplinary Care Pathways for Patients With Cardiac Implantable Electronic Devices: A Scientific Statement From the American Heart Association. Circulation. 2024;150(8):e183-e96.
12. Fraiche AM, Matlock DD, Gabriel W, Rapley FA, Kramer DB. Patient and Provider Perspectives on Remote Monitoring of Pacemakers and Implantable Cardioverter-Defibrillators. Am J Cardiol. 2021;149:42-6.
13. Todd B. Nursing the Patient With an Artificial Pacemaker. Am J Nurs. 2022;122(6):50-2.
14. Palmisano P, Sergi C, Panico V, Chiarillo MV, Chiuri MD, Martella ML, et al. Impact on nurse workload and patient satisfaction of atrioventricular junction ablation performed simultaneously with conduction system pacing using a superior approach from the pocket compared with the conventional femoral approach. Eur J Cardiovasc Nurs. 2024;23(7):746-55.
15. Wilson-Stewart KS, Fontanarosa D, Malacova E, Trapp JV. Impact of dose reducing software on patient and staff temple dose during fluoroscopically guided pacemaker insertion, closure devices implantation and coronary angiography procedures. Phys Eng Sci Med. 2022;45(2):589-99.
16. Gatti P, Nymark C, Gadler F. Health-related quality of life in a large cohort of patients with cardiac implantable electronic devices A registry-based study. PLoS One. 2024;19(12):e0314978.
17. Schrage B, Lund LH, Melin M, Benson L, Uijl A, Dahlström U, et al. Cardiac resynchronization therapy with or without defibrillator in patients with heart failure. Europace. 2022;24(1):48-57.
18. van Stipdonk AMW, Schretlen S, Dohmen W, Knackstedt C, Beckers-Wesche F, Debie L, et al. Better outcome at lower costs after implementing a CRT-care pathway: comprehensive evaluation of real-world data. ESC Heart Fail. 2022;9(4):2518-27.
19. Sheahen B, O'Hagan ET, Cho K, Shaw T, Lee A, Lal S, et al. Barriers and Enablers to Routine Clinical Implementation of Cardiac Implantable Electronic Device Remote Monitoring in Australia Among Cardiologists, Cardiac Physiologists, Nurses, and Patients: Interview Study. JMIR Cardio. 2025;9:e67758.
20. Su SF, Wu MS. Arrhythmia Perception and Quality of Life in Bradyarrhythmia Patients Following Permanent Pacemaker Implantation. Clin Nurs Res. 2021;30(2):183-92.
21. Goodwin E, Fogelson B, Cox JW, Jr., Mahlow WJ. An algorithm for pacing and cardioverting electronic devices undergoing magnetic resonance imaging: The PACED-MRI protocol. Magn Reson Imaging. 2023;96:44-9.
22. Eftekhari H, He H, Lee JD, Paul G, Zhupaj A, Lachlan T, et al. Safety and outcome of nurse-led syncope clinics and implantable loop recorder implants. Heart Rhythm. 2022;19(3):443-7.

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