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Perioperative anesthesia management for elderly patients with permanent pacemakers undergoing retropubic prostatectomy in Ethiopia East Africa: a case report and review of the literature

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Abstract

Backround Perioperative anesthesia management for elderly patients with permanent pacemakers is complex, particularly in low-income countries. Preoperative pacemaker assessment and adjusting to asynchronous mode are crucial to avoid adverse events. Positioning electrocautery below the umbilicus and planning anesthesia to minimize pacemaker interference can reduce perioperative complications. This case involves an elderly male undergoing retropubic prostatectomy with a permanent pacemaker in dual-chamber, rate-modulated mode, without changing it to asynchronous mode, highlighting a rare anesthetic challenge in such settings**.**

Clinical presentation A 78-year-old male from the Amhara region, Ethiopia, with a permanent pacemaker for complete heart block was scheduled for retropubic prostatectomy. Preoperative assessments by the anesthetist and cardiologist recommended reprogramming the pacemaker to asynchronous mode to reduce risks related to its dual-chamber, rate-modulated mode setting. However, the patient could not afford reprogramming and opted to proceed with the existing perioperative plan. Informed consent was obtained, and case report publication permission was obtained after operation. The patient received combined epidural–spinal anesthesia with 2.50 ml of 0.5% isobaric bupivacaine and 50 µg fentanyl at the L3–L4 interspace. Standard American Society of Anesthesiology monitoring was applied, with a focus on cardiac stability. The patient remained stable with minimal vital sign fluctuations and maintained adequate blood pressure using isotonic saline. Postoperatively, the patient was transferred to the postanesthesia care unit, receiving analgesia after 4 hours and an epidural top-up. After 6 hours, he was transferred to the ward in stable condition. Epidural analgesia was continued for 72 hours, and the patient was discharged on the 88th postoperative hour in stable condition.

Conclusion Elderly patients with permanent pacemakers undergoing noncardiac surgery require thorough preoperative assessment and careful anesthesia management. In this case, financial constraints led to the decision not to reprogram the pacemaker, necessitating meticulous planning and monitoring during surgery. Using combined

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epidural–spinal anesthesia can enhance safety and outcomes, especially in low-resource settings where alternative anesthetic and resuscitative options may be limited.

Keywords Pacemaker *in situ*, Perioperative anesthesia management, Spinal anesthesia, Combined epidural–spinal anesthesia, Elderly patients

Introduction

An artificial pacemaker is an electrical battery-operated device that acts permanently with the replacement of the natural heart's pacemaker at the sinoatrial node to regulate heart rhythm because the natural pacemaker (PM) is slowed or electrical conduction is blocked [1]. This device contains three major parts: a generator, wires, and sensors; however, the newer PMs are wireless. Currently, an artificial PM has become an increasingly popular medical treatment for patients with rhythm disturbances or heart blocks since the development of implantable pacemaker devices in 1960 [2]. Although it has been used for all age groups, the elderly population most frequently uses this device with different indications [3].

Elderly patients with permanent pacemakers require careful perioperative management for noncardiac surgeries. A comprehensive preoperative evaluation of their physiological status, coexisting conditions, and pacemaker indications is essential. Information about the pacemaker, including device details and identification cards, should be provided. Clinical signs and radiological findings help assess pacemaker functionality, but consultation with a cardiologist or pacemaker technician is crucial for ensuring proper battery status, determining the need for reprogramming, and assessing pacemaker dependence during preoperative evaluation [4, 5]. Furthermore, a detailed history, physical examination, investigations, patient cardiovascular status review, pacemaker device function and setting, and overall health condition of the patient are the tasks of greatest concern for anesthetists in terms of preoperative evaluation and optimization [6, 7]. Despite these considerations, cardiac surgery is not widely practiced in Ethiopia, and few physicians are involved in cardiac surgery. The first open cardiac surgery was performed in Addis Ababa, Ethiopia, in June 2017 by young Ethiopian surgeons [8]; since then, cardiology services have been delivered in Ethiopia with the continuous assistance of equipment resources and medical mentors in collaboration with developed countries. The aims of this case report and review will provide insight into the necessary preoperative evaluation and perioperative anesthesia management that patients with permanent pacemakers present for noncardiac surgery in low-volume setting areas.

Case report

An elderly 78-year-old patient from the Amhara region of Ethiopia, who has had a permanent cardiac pacemaker for 7 years, was scheduled for retropubic prostatectomy due to benign prostatic hyperplasia (BPH). This condition developed following a previous transurethral resection of the prostate 3 months earlier. The patient in the preoperative anesthesia evaluation was fully evaluated, and all the routine investigations required for the proposed surgery, which were within normal limits, were investigated. The patient presented with a history of frequency, urgency, nocturia, and dribbling for the past 2 months. Additionally, the patient had been known to have hypertension for the past 16 years and was taking amlodipine 5 mg orally daily, enalapril 10 mg orally twice daily (BID), and atorvastatin 10 mg orally daily. He had also been known to have type II diabetes mellitus for the past 25 years and was on metformin 500 mg orally BID and neutral protamine Hagedorn (NPH) 20 IU and 10 IU. He was admitted to a hospital for further evaluation, and complete bundle branch block (BBB) was detected via electrocardiogram (ECG), as shown (Fig. 1). In an electrophysiology study, the patient was diagnosed with left ventricular hypertrophy secondary to hypertensive heart disease, mild diastolic dysfunction, and an ejection fraction of 62%. Abdominal ultrasound revealed an enlarged prostate size of 82 ml; anterior–posterior (AP) chest X-ray revealed a normal chest region with a left-side pacemaker *in situ*, and all the other blood parameters, including electrolytes and serum troponin levels, were within normal limits.

A cardiologist was involved preoperatively as a multidisciplinary approach and risk determination tool for cardiac risk assessment. The patient had a frailty score of 5.5 with a poor functional cardiopulmonary reserve of metabolic equivalent (MET) = 3.4 and Revised Cardiac Risk Index (RCRI) class III, which accounts for 10.1% of major cardiac adverse events (myocardial infarction [MI], cardiac arrest, or death) within 30 days of the postoperative period [9], and intermediate risk on the basis of surgery type and patient risk factors. After preoperative evaluation and risk disclosure regarding the un-reprogrammed pacemaker and the associated complications during anesthesia and surgery, the patient was unable to afford the necessary health coverage for pacemaker reprogramming. This is because the cardiac surgery was performed in Addis Ababa, Ethiopia, which has a long

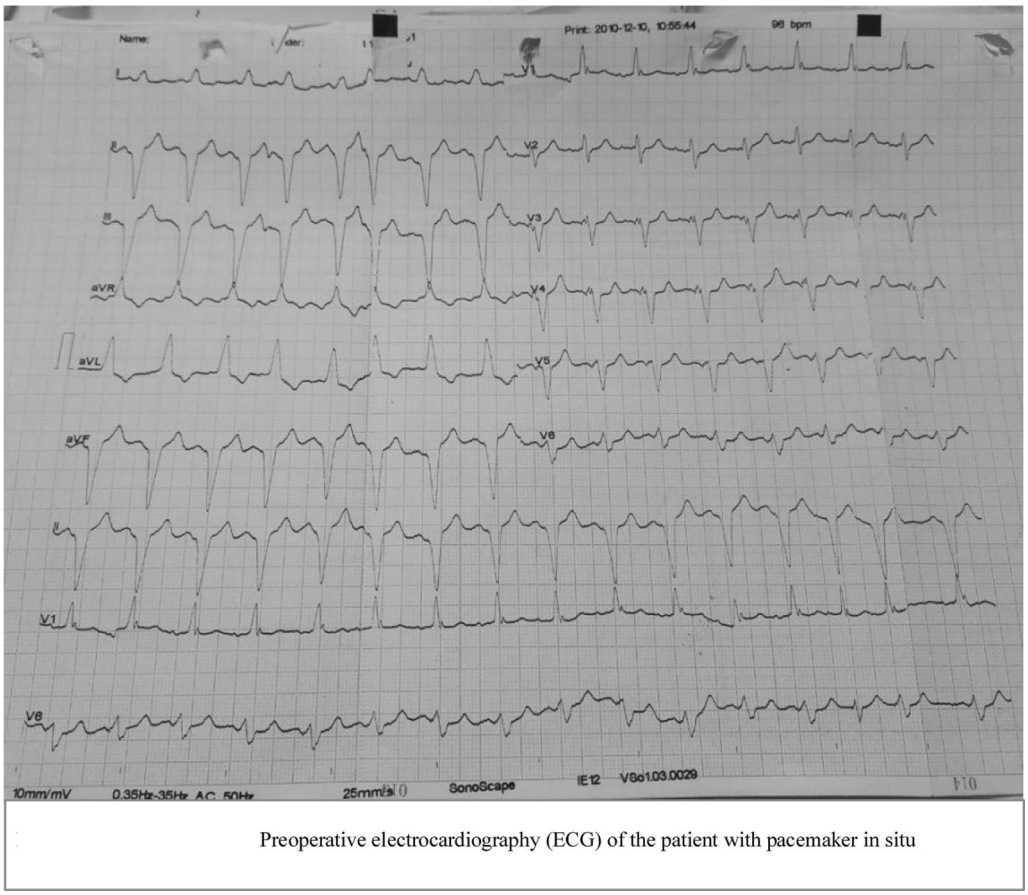

Fig. 1 Preoperative electrocardiography of the patient with pacemaker *in situ*

waiting list with few cardiac surgeons for millions of people [10] and is a considerable distance from the patient's home institution, and there is a period of monitoring after pacemaker reprogramming for considerable post-reprogramming complication. As a result, the patient chose to proceed with the surgery, accepting the potential risks and harm associated with the situation. Continuous cardiac monitoring during the intraoperative period is highly advocated. Despite these factors, the patient did not experience cardiorespiratory failure, and he was stable. The patient continued on medication until the day of surgery, which included amlodipine, enalapril, atorvastatin, and a morning lower dose of two-thirds of the NPH. He also took 5 mg of diazepam orally for anxiolytics at midnight before the day of surgery.

On the day of surgery, the patient's random blood sugar (RBS) was measured, and sliding scale glycemic control was implemented. Communication among the anesthetist, surgeon, and nurses was emphasized, ensuring that the cautery pad was placed away from the pacemaker, and that emergency drugs and a defibrillator were ready. The patient was premedicated with dexamethasone for nausea prophylaxis and paracetamol for pain relief as preemptive analgesia. American Society of Anesthesiology (ASA) standard monitoring was applied, and baseline parameters were recorded. Combined epidural–spinal anesthesia was administered via 0.5% isobaric bupivacaine (12.5 mg) and 50 µg fentanyl at the L3–L4 interspace. The block achieved anesthesia up to the umbilicus, and the sensory block was performed at T7. The surgery involved a midline incision below the umbilicus, with monopolar cautery used at low voltage (20 mA). Hemostasis was achieved through bipolar low-voltage cautery. Throughout the procedure, the patient's vital signs remained stable (Fig. 2). The patient's vital signs did not change by more than 10% from the baseline vital signs. The intravenous fluid was resuscitated intraoperatively. During the postoperative period, the patient was transferred to the postanesthesia care unit (PACU) with vigilant monitoring, and 10 ml of 0.125% epidural top-up analgesia was given. Postop investigations were within normal limits. The patient was observed in the PACU for 12 hours and later transferred to the ward in stable condition with regular follow-up with the cardiology team.

Fig. 2 Intraoperative hemodynamic status of the patient

After 88th day of postsurgery the patient was discharged and advised to have regular checkups for pacemaker's *in situ* status.

Discussion

Permanent pacemakers are the most effective treatment for symptomatic bradycardia, particularly in elderly patients with complete heart block or sinus node dysfunction. With advancements in pacemaker technology, including dual-chamber devices and rate response algorithms, special preoperative evaluation and management are needed for patients undergoing noncardiac surgery. Anesthetists and cardiologists play key roles in assessing perioperative risks and optimizing anesthesia and surgical care [11]. Additionally, special consideration of anesthesia management in the principle of geriatric anesthesia is indispensable to the anesthetist's perioperative geriatric health care [12]. Similarly, our elderly patient who underwent surgery with a permanent pacemaker *in situ* had to undergo a preoperative evaluation, physical examination, investigation, and review of appropriate documentation about the pacemaker.

Preoperative device function, interrogation time, battery functionality, and mode type should be known, and the pacing mode should be changed to pacing that does not sense and does not respond. Similar to our patient's device (Medtronic Inc., Minneapolis, U.S.A.), an 81-year-old patient with strangulated hernia under general anesthesia developed cardiac arrest after induction [13]. Medication interference of suxamethonium was suggested, and the permanent pacemaker mode did not change. In contrast, a 74-year-old patient with artificial PM for chronic atrial fibrillation underwent carotid endarterectomy with preoperative reprogramming of pacing to ventricle-paced, none sensed, no response (VOO). There was no eventful incident for the patient during the perioperative period except for a slowing heart rate [14]. The Heart Rhythm Society recommends preoperative reprogramming of artificial pacemakers to improve perioperative safety. This requires close monitoring for complications, immediate intervention, and the availability of pacemaker technologists or cardiologists for emergencies [15]. However, this medical practice is a substantial challenge where low- and middle-income countries perform cardiac surgery at few specific centers, and there is a challenge of limited access for permanent pacemaker implantation, reprogramming, and ablation procedures in Africa, including Ethiopia [16]. This is one of the reasons that our patient preferred to determine the explained risks and benefits and accept the probability of experiencing harmful effects of un-reprogrammed pacemaker failure.

Intraoperative electrocautery utilization has hazardous transit short- to long-term effects on artificial pacemakers. Electrocution caused by surgical equipment used for cautery in patients with pacemakers *in situ* results in pulse generator inhibition, electrical burns at the myocardial electrode interface, atrial or ventricular tachycardia and fibrillation, and pulse generator component failure [11]. The electromagnetic interference of cautery is less affected when the surgical site and pad of cautery are below the umbilicus and 10–15 cm away from the pacing site [17, 18], and our patient had a lower risk of interference with his artificial pacemaker. In addition to medication and cautery interference, patients may experience perioperative pacemaker failure due to battery depletion [19], and malposition of the pacemaker pulse generator in the skin pocket [20].

Patients with permanent pacemakers who are under general anesthesia without adjusting pacemaker settings are at risk of adverse events, including muscle fasciculation and myoclonic movements [13, 21, 22], which can disrupt pacemaker function, and these undesired adverse events have been reported in patients in clinical medical practice under surgery and anesthesia. The increase in the pectoral pocket space caused by nitrous oxide anesthesia and intraoperatively controlled ventilation affects the degree of mechanical dislodgement of pacemakers [23, 24], under general anesthesia. Additionally, unreprogrammed pacemakers in surgical patients can cause improper atrial and ventricular contractions, reducing cardiac output and blood return. This leads to hypotension, hypoxia, and neck pulsation [25].

According to previous reports, patients under general anesthesia have hypotensive adverse events that are exaggerated with the use of inhalation anesthetic agents and opioids [26], and under general anesthesia, patients have a high probability of experiencing hypoxia, hypercarbia, and electrolyte abnormalities, which increase the risk of arrhythmias and lead to interference with

pacemaker capture [18]. Although there is no definitive proven anesthetic medication that involves electromagnetic interference with pacemakers [27], regional anesthesia has a lower risk of adverse perioperative events due to less interference from the physiologic effect [28], and maintaining the hemodynamics of the patient.

Conclusion

Elderly patients with permanent pacemakers undergoing noncardiac surgery require thorough preoperative assessment and careful anesthesia management. In this case, financial constraints led to the decision not to reprogram the pacemaker, necessitating meticulous planning and monitoring during surgery. Using combined epidural–spinal anesthesia (CESA) can increase safety and outcomes, especially in low-resource settings where alternative anesthetic and resuscitative options may be limited.

Abbreviations

ASA	American Society of Anesthesiology
BID	Bis in die (twice a day)
ICU	Intensive care unit
MET	Metabolic equivalent test
MI	Myocardial infarction
NPH	Neutral protamine Hagedorn
PACU	Postanesthesia care unit
PM	Pacemaker
RCRI	Revised Cardiac Risk Index
VOO	Ventricle-paced, none sensed, no response

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Author contributions

EAA conceptualized the study, set an aim, and developed the manuscript. BAA, DCM, MAT, and DGA criticized and reviewed the literature of the manuscript. All the authors participated in the literature review. All the authors approved the final manuscript.

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Availability of data and materials

The corresponding author can provide the materials used in this study upon reasonable request.

Declarations

Ethics approval and consent to participate

The participants provided written informed consent, which included the assurance of his right to decline participation and maintain confidentiality.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. Additionally a copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

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