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Case Report

Pacemakers and Anaesthesia in a Low Resource Setting: A Case Report

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Abstract

Cardiac implantable electronic devices such as pacemakers are increasingly encountered in patients presenting for non-cardiac surgery. Their presence poses significant anaesthetic challenges, particularly in low-resource settings where access to device specialists and advanced monitoring may be limited. Careful perioperative planning is therefore essential to minimize complications related to haemodynamic instability and electromagnetic interference. We report the successful anaesthetic management of an 81-year-old male with a permanent pacemaker programmed in DDDR mode who presented for right knee arthrotomy, synovectomy, and washout for septic arthritis. The patient had multiple comorbidities including hypertension, type 2 diabetes mellitus, end-stage renal disease on thrice-weekly haemodialysis, and retroviral disease on highly active antiretroviral therapy. Preoperative evaluation included cardiology consultation, echocardiography demonstrating borderline left ventricular systolic function (ejection fraction 45–52%), and perioperative coordination with a pacemaker technologist who reprogrammed the device to an asynchronous pacing mode. Anaesthesia was conducted using a combined spinal-epidural technique with a low-dose spinal block consisting of 7.5 mg of hyperbaric bupivacaine and 25 µg fentanyl. Standard ASA monitoring was employed, and special precautions were taken to minimize electromagnetic interference from electrocautery by appropriate placement of the diathermy grounding pad. Surgery lasted approximately one hour and was completed without haemodynamic instability, pacemaker malfunction, or other perioperative complications. Postoperative analgesia was provided via the epidural catheter, and the pacemaker was subsequently restored to its original programming. This case highlights the importance of multidisciplinary collaboration, thorough preoperative assessment, and adherence to perioperative safety precautions in managing geriatric patients with pacemakers. It also demonstrates that low-dose spinal anaesthesia can provide adequate surgical conditions with stable haemodynamics for lower limb surgery in selected patients with limited cardiac reserve in resource-constrained settings.

Keywords

Geriatric, Pacemaker, Low-Dose Spinal, Cardiac, Surgery

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1. Introduction

Cardiac patients with pacemaker presenting for noncardiac surgery pose a considerable challenge to the anesthesiologists, more so in a low resource setting [1]. Depending on the type of surgery and patient age, the prevalence of various cardiovascular diseases in patients undergoing non-cardiac surgery ranges from <5% to 70% [2]. The presence of cardiac disease in the geriatric age group poses greater challenges to the anaesthetist because they are at increased risk of perioperative morbidity and mortality. Normal aging is associated with decreased reserve and function of all major organ systems limiting the available response to acute stress [3].

In modern times, with the advent of pacemakers, the treatment of patients with arrythmia have improved. More than three million people in the United States have a pacemaker and more than 300,000 have an implantable cardioverter-defibrillator (ICD), usually with pacing capabilities. In our practice, we seldom see patients with pacemakers however with an increase in cardiac labs across the country, we are seeing an increase in the number of patients with pacemakers with the main indication for implantation being complete third-degree Atrioventricular block (AVB) with or without symptoms [4]. There is no current database of the number of patients with pacemakers or implantable cardiac devices in Nigeria.

Therefore, it is important that anaesthetist understand how these pacemakers function, how it affects the choice of anaesthesia and prepare to manage these patients preoperatively, intraoperatively and post operatively.

2 Case Report

An 81-year-old man who was scheduled for right knee arthrotomy, synovectomy and washout on account of septic arthritis of the right knee. He had a cardiac pacemaker placed about 18months prior to our review and placed on DDDR mode. He was hypertensive on monitored care and placed on tabs amlodipine 10mg daily and tabs indapamide 10mgs daily, a known diabetic patient on glucose control with pre-meal subcut soluble insulin 10iu twice daily and had end-stage renal disease (ESRD) on dialysis 3 times a week, with background retroviral disease on highly active antiretroviral therapy (HAART).

On examination, he weighed 65kg, height was 170cm, had a swelling and scar on the left upper chest region(pacer) and a glucose monitoring device on the left upper arm. He had no features suggestive of heart failure. Investigation results were as follows

Full blood count – WBC- 7.28 x 10^7/ul, neu – 76%, lymph, 11.1%, Hb conc – 10.1g/dl, HCT- 31.5%, PLT- 355x 10^9/L.

Biochemistry urea – 94.2mg/dl, creatinine 4.54mg/dl, K^+ - 4.88mmol/l, Na^+ - 134mmol/L, Ca^{2+} - 9.76mg/dl, CRP-116.56 mg/dl.

ECG report- ventricular paced rhythm, left axis deviation, widened QRS and prolonged QT interval.

Echocardiography showed - normal left ventricle with borderline systolic function. Ejection fraction between 45-52%, mildly dilated right ventricle, and degenerative aortic valve disease with aortic regurgitation.

Airway examination didn't show anything significant. We made an assessment of ASA IV and referred him to the cardiologist for further review and cardiac risk stratification. The cardiac device technician was also contacted and informed about the procedure with a view to reprogram the cardiac device. The cardiologist advised for strict cardiac monitoring intraoperatively. Special attention was given to diathermy pads placed away from the device. Consent for surgery and anaesthesia was obtained, patient was counselled on fasting guidelines, to take his antihypertensive medications on the morning of surgery and skip morning dose of insulin.

On the morning of surgery, a fasting blood glucose done showed a result of 7,1mmol/l, the pacemaker was reprogrammed to a safe mode paced at 60b/m. Patient was then wheeled to the operating room. All (standard ASA) monitors were attached, and baseline vital signs recorded. A size 18G intravenous cannula was secured on the dorsum of the right hand. Preoperative antibiotics prophylaxis 1g IV ceftriaxone was administered. He was positioned in a sitting position, asepsis observed and the combined-spinal-epidural instituted at L4/L5 intervertebral space, 25G spinal needle was used and 1.5ml (7.5mg) of 0.5% heavy bupivacaine and 0.5ml (25mcg) of fentanyl citrate injected into the subarachnoid space. The level of block was ascertained to be at T-10, and quality of block was deemed to be complete. The diathermy pad was placed under the left thigh (>30cm from the pacer). The right knee arthrotomy, synovectomy and washout was done successfully. The diathermy was used intermittently with no disturbances or changes noticed to the pulse rate. The duration of surgery was about an hour and no significant change was noticed in the blood pressure (BP) or mean arterial pressure (MAP) to warrant the use of vasopressors intraoperatively. At the end of surgery 10mls of 0.125% plain bupivacaine was administered through the epidural catheter for postoperative analgesia. He was wheeled back to the recovery room, pacemaker was reprogrammed to the DDDR mode, observed for about an hour and then transferred to the ward in a stable condition and adviced of regular follow-up with his physicians.

3 Discussion

A pacemaker is a small device that helps the heart beat at a regular rate and rhythm. Permanent pacing is the therapy of choice for treating severe bradyarrhythmia [5]. The number of very elderly patients receiving pacemakers is increasing which makes it necessary for the anesthesiologists to be aware of the potential for electromagnetic interference and the

perioperative management of pacemakers, including the indications for magnet use and device reprogramming. Common indications for pacemakers include symptomatic bradycardia, complete 3rd-degree atrioventricular (AV) block, advanced 2nd-degree AV block (Mobitz type II), neurocardiogenic syncope, congenital complete AV block, hypertrophic cardiomyopathy and long QT syndrome [6]. For which our patient's indication for a pacer was a complete 3rd -degree av block. There are 3 basic kinds of pacemakers - Single chamber (One lead attaches to the upper or lower heart chamber), Dual-chamber (Uses 2 leads, 1 for the upper and 1 for the lower chamber), and Biventricular pacemakers (used in cardiac resynchronization therapy) [7]. Our patient pacemaker was on the DDDR mode, which meant that both atrium and ventricle was sensed, paced, inhibited or triggered with a rate response. This mode fully adapts to intrinsic heart rhythm and mimics normal conduction as much as possible.

The major perioperative concern in patients with pacemakers is the potentially disruption of its functionality by electromagnetic interference (EMI) from electrocautery, peripheral nerve stimulation, transcutaneous electrical nerve stimulation (TENS), radiofrequency ablation, lithotripsy, electroconvulsive therapy (ECT). EMI affects pacemakers by causing pacing inhibition, rapid ventricular pacing (interprets EMI as atrial signals), stimulates the sensor for rate responsiveness, activation of "power on reset" reversing the device to factory setting or total device failure (for older devices). Improved shielding of modern pacemakers has reduced the problems associated with electromagnetic interference [8].

During the preoperative preparation, the knowledge of the type of device, the manufacturer, model of pacing is important. An alternate plan in case of pacemaker dysfunction should be kept in mind. General alternatives include measures like percussive pacing, isoprenaline infusion, invasive transthoracic pacing (through pads placed below the right clavicle and over the apex of the heart in an anteroposterior position) [9]. Other alternatives include transvenous and transesophageal pacing [9].

Table 1. *Generic pacemaker code developed by the North American Society of Pacing and Electrophysiology and the British Pacing and Electrophysiology Group. Adapted from Bernstein et al. Pacing Clin Electrophysiol. 2002; 25(2): 260-4.*

Position I	Position II	Position III	Position IV	Position V
Chamber(s) paced	Chamber(s) sensed	Response(s) to sensing	Programmability/rate response	Multisite pacing
O = None	O = None	O = None	O = None	O = None
A = Atrium	A = Atrium	I = Inhibit	R = Rate Modulation	A= Atrium
V = Ventricle	V= ventricle	T = Triggered		V= Ventricle
D = Dual (A+V)	D = Dual (A+V)	D= Dual (T + I)		D =Dual (A+V

Patients with cardiac disease coming for non-cardiac surgeries pose significant challenges to the anaesthesiologist which limits the options of anaesthesia. The goal of anaesthesia for this category of patients is to avoid myocardial depression, maintain hemodynamic stability, and meeting the requirements of surgery [10]. Our patient had an ejection fraction of 45-52% with a pacemaker, bearing in mind it was a lower limb surgery, we opted for a combined-spinal-epidural anaesthesia with a low-dose spinal and opioid adjunct. A low dose single shot spinal is defined as ≤7.5mg bupivacaine combined with 25µg fentanyl citrate and several studies have demonstrated that low dose single shot spinal anaesthesia (SSA) is associated with stable haemodynamic conditions and lower consumption of vasopressors when compared with standard dose SSA [11, 12].

4 Conclusion

The successful conduct of anaesthesia for a geriatric patient with a pacemaker and multiple comorbid conditions presents dynamic challenges to the anaesthesiologist. These require a multidisciplinary approach to the patient management, adhering to safety precautions and ensuring adequate monitoring during the perioperative period.

Our report shows that low dose single shot spinal anaesthesia may be suitable for geriatric patients with low ejection fraction presenting for lower limb surgeries in low resource settings.

Abbreviations

ASA	American Society of Anaesthesiologist
AVB	Atrioventricular Block
BP	Blood Pressure
ECG	Electrocardiogram
ECT	Electroconvulsive Therapy
EMI	Electromagnetic Interference
ESRD	End-stage Renal Disease
HAART	Highly Active Anti-retroviral Therapy
HB	Haemoglobin

HCT	Haematocrit
LYMPH	Lymphocyte
MAP	Mean Arterial Pressure
NEU	Neutrophil
PLT	Platelet
SSA	Single Shot Spinal
WBC	White Blood Cell

Authors Contributions

Agwu Nnanna Uchechuku: Conceptualization, Data curation, Writing – original draft, Writing – review & editing

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Oguelina Chukwuma: Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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