Case Report

Anesthetic considerations and successful management of a patient with permanent pacemaker for cervical spine instrumentation

ABSTRACT

Patients with permanent pacemaker posted for cervical spine instrumentation pose special challenges for modern-day anesthesiologist since the field of surgery is in proximity to the pacing apparatus. The important considerations in this regard are pacemaker dependency, prior reprogramming to asynchronous mode, perioperative interference with pacemaker function due to electrolyte, acid-base disturbances, and electromagnetic interference leading to pacemaker failure and hemodynamic compromise. We report successful anesthetic management of a patient of postlaminectomy kyphosis with compressive myelopathy with permanent pacemaker *in situ* who underwent C5–C6 corpectomy and instrumentation under general anesthesia.

Key words: Asynchronous mode; cervical spine instrumentation; high-risk zone; permanent pacemaker

Introduction

Anesthetic management of a patient with pacemaker is one of the challenges faced by modern-day anesthesiologist. Patients with permanent pacemaker posted for cervical instrumentation pose special problems as the field of surgery is in proximity to the pacing apparatus. We report successful anesthetic management of a patient of compressive myelopathy with permanent pacemaker *in situ* who underwent C5–C6 corpectomy and instrumentation under general anesthesia.

Case Report

A 72-year-old male patient weighing 65 kilograms with diagnosis of postlaminectomy kyphosis with compressive myelopathy was scheduled for C5–C6 corpectomy and instrumentation under general anesthesia. Past medical history revealed complete heart block, for which permanent pacemaker was implanted 8 months ago. Airway examination revealed modified Mallampati Class I with restricted neck movements indicating difficult airway. Hematological and biochemical investigation reports were within the normal limits. Two-dimensional echocardiography revealed concentric left ventricular hypertrophy with an ejection fraction of 60%. The pacemaker was identified to be VITATRON E50A1D (Medtronic Inc., USA) (MODE: DDDR), in proper working condition. It was reprogrammed to asynchronous DOOO mode on the day before surgery. Defibrillator and transcutaneous pacing equipment were checked and kept

Access this article online	
Website: www.saudija.org	Quick Response Code
DOI: 10.4103/sja.SJA_125_18	

How to cite this article: Sameera V, Pandia MP, Bindu B, Goyal K. Anesthetic considerations and successful management of a patient with permanent pacemaker for cervical spine instrumentation. Saudi J Anaesth 2018;12:634-6.

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ready before induction of anesthesia. Difficult airway trolley and crash cart for resuscitation were arranged and checked for all its contents. Pads for transcutaneous pacing were appropriately placed for use in case of pacemaker failure. Grounding plate of unipolar cautery was placed on the thigh of the patient. After preoxygenation, general anesthesia was induced with fentanyl 150 mcg and thiopentone 250 mg. Rocuronium 50 mg IV was given to facilitate intubation. Intubation was done using video laryngoscopy with 8.0-sided cuffed endotracheal tube. Anesthesia was maintained with oxygen, nitrous oxide, sevoflurane, fentanyl, and rocuronium. Cannulation of the right radial artery was done after induction of anesthesia. Cardiac output monitoring was done using FloTrac (Edward Lifesciences, CA). Acid-base status and electrolytes remained within normal limits during the intraoperative period. Total duration of anesthesia was 4 h. A total of 2.5 liters of crystalloid and 500 ml of colloid (6% HES 130/0.4) were administered during the procedure. Blood loss was minimal, and there was no requirement for transfusion of blood products. Temperature monitoring was done and was maintained in normal range using forced air warmer. At the end of procedure, neuromuscular blockade was reversed with neostigmine and glycopyrrolate at the end of procedure. The patient was extubated when he was fully alert with adequate reversal of neuromuscular paralysis and shifted to postanesthesia recovery unit for further observation. The pacemaker was reprogrammed to DDDR mode the next day. Vigilant electrocardiogram (ECG) monitoring and availability of backup pacing equipment were ensured till reprogramming. Postoperative course remained uneventful, and the patient was discharged home on 8th postoperative day.

Discussion

Advancement of biomedical engineering, established safety, and efficacy of newer generation pacemakers has resulted in increasing number of patients coming for various surgical interventions with these devices *in situ*. Newer devices have wide range of programmability requiring anesthesiologist's thorough understanding of these devices to take appropriate perioperative decisions. Important concerns during general anesthesia are perioperative interference with pacemaker function due to electrolyte, acid-base disturbances, and electromagnetic interference (EMI) leading to pacemaker failure and hemodynamic compromise. Cervical spine instrumentation complicates the issue because the site of surgical dissection is close to the pacemaker apparatus. Furthermore, the magnetic resonance imaging incompatibility of certain pacemaker devices (as with our present patient) will necessitate surgeon to rely on other alternative diagnostic modalities; hence, surgical plan and approach might need to be altered on the operating table. Anesthesiologist should consider all these issues while planning the perioperative management.

Our patient was pacemaker dependent. Pacemaker was inserted for complete heart block causing syncope. Cervical region being high-risk zone for EMI, it deemed necessary to reprogram the pacemaker to asynchronous mode.[1,2] Personnel for reprogramming were arranged to be readily available in case of emergency.

Electrocautery-induced pacemaker failure has also been reported during asynchronous mode leading to hemodynamic instability.[3] Inappropriate tachycardia and automatic reprogramming can occur even in asynchronous mode, especially when used very near to the pulse generator.[4,5] Preparedness for pacemaker failure is therefore an important aspect of perioperative planning. Pacemaker failure can cause severe hypotension, brady/tachy arrhythmias, or even asystole/cardiac arrest.[6,7]

To deal with the possible occurrence of pacemaker failure and hemodynamic instability, vasoactive agents and crash cart were kept ready for use, and pads for external pacing/defibrillation were kept in place before induction. The recommended configuration of pad placement according to HRS guidelines[2] is anteroposterior (left anterior between xiphisternum and nipple, left infrascapular area) when pulse generator is in the right pectoral region. This configuration minimizes chest wall impedance as well as delivers shock perpendicular to lead assembly, thereby minimizing damage to the lead system. Thus, the same lead assembly may be subsequently used to resume pacing.

Unipolar cautery is best avoided with pacemaker *in situ* as EMI is maximum when compared to bipolar cautery. However, surgeons may need to use the unipolar cautery for surgical reasons as happened in our case. Grounding plate in such circumstances can be placed on the shoulder contralateral to the side of pulse generator.[8] Occiput has also been suggested as alternate site.[9] To avoid confusion by ECG artifacts (double counting), always continuous monitoring of pulse and arterial blood pressure (to observe the arterial wave form) is recommended.[2,8]

Continuous vigilant monitoring is continued postoperatively as well. Changes in postoperative room can often go unnoticed leading to pacemaker dysfunction, which can be dangerous. Hence, all the above precautions should also be continued in the postoperative suite until pacemaker is reverted back to the original settings.

Knowledge of pacemaker behavior, management options, perioperative influences, and monitoring requirements ensures better care of patients with pacemaker *in situ* posted for procedures with high risk of EMI. Involving cardiologist and reprogramming personnel, adequate preparedness for the event of pacemaker dysfunction, vigilant monitoring that should be continued into the postoperative unit is a key for successful outcome.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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