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Case Report

Anesthetic Management of a Patient with Pacemaker Undergoing Clipping of Intracranial Aneurysm

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Abstract

Pacemaker devices have revolutionized the lives of patients with cardiac arrhythmias and have become increasingly common. Anesthetic management of patients with cardiac pacemakers provides special challenges. We describe our experience of a patient having implanted permanent pacemaker posted for clipping of ruptured intracranial aneurysm.

Keywords
- aneurysm
- cerebral aneurysm clipping
- pacemaker

Introduction

Anesthetic management of patients with implanted pacemaker requires a thorough knowledge of the indication for pacemaker placement, present mode of pacemaker, and extent of dependency of the patient on pacemaker. In patients with pacemakers who are undergoing neurosurgery, the additional considerations include the proximity of operative site to the pacemaker, prolonged duration of surgery, potential for major amount of blood loss, cardiac insults

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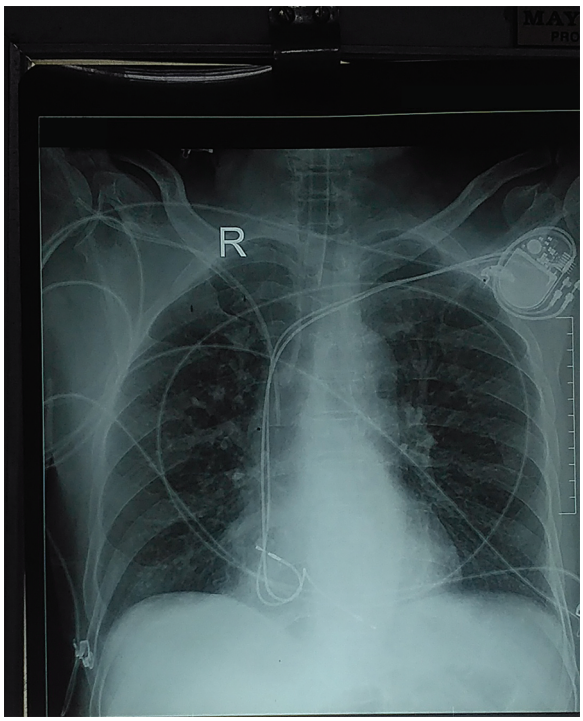

Fig. 1 Chest X-ray of the patient showing pacemaker in left pectoral area.

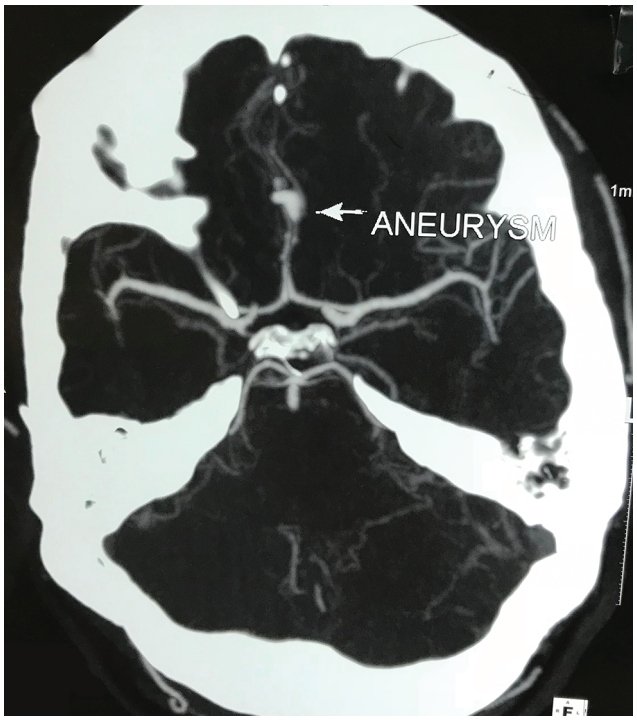

Fig. 2 CT angiography demonstrating DACA aneurysm. CT, computed tomography. DACA, distal anterior cerebral artery.

caused by neurological causes (aneurysmal subarachnoid hemorrhage [aSAH], traumatic brain injury), etc. aSAH affects the cardiac status immensely. Patients with aSAH patients can present with new-onset electrocardiographic (ECG) changes, new-onset wall motion abnormalities, and elevation in cardiac troponin levels. ECG changes are seen in around 40 to 100% of patients with SAH and include sinus bradycardia, sinus tachycardia, atrioventricular dissociation, and ventricular arrhythmias.[1,2] The stimulation caused by increased amounts of catecholamines is considered to be the cause of these cardiac manifestations. These effects can be magnified in patients with implanted pacemaker.

Case Report

A 62-year-old male patient, a case of symptomatic complete heart block who had undergone permanent pacemaker insertion for complete heart block (presently on dual-chamber rate adaptive pacemaker [DDDR] mode) around 6 months back (►**Fig. 1**), suffered from sudden onset of severe headache one morning associated with one episode of projectile vomiting and giddiness. The patient was taken to a nearby hospital, and noncontrast computed tomography (NCCT) of the head was performed, which revealed bilateral sylvian fissure SAH. The patient was then referred to our hospital where a CT angiography was performed, which demonstrated a ruptured left distal anterior cerebral artery aneurysm (►**Fig. 2**). After discussion with the patient and his attendants, a decision to perform an emergency craniotomy and aneurysmal clipping was taken.

On examination during preanesthetic checkup, the patient was conscious, cooperative, and oriented, and his vitals were within the normal limits. His preoperative Glasgow coma scale score was E4V5M6. He was classified as Hess and Hunt grade 2, World Federation of Neurosurgeon (WFNS) grade 1, and modified Fischer's grade 4. Airway evaluation was unremarkable. Blood biochemistry was within normal limits. Chest X-ray showed intact leads of pacemaker, and ECG showed sinus rhythm with paced beats. Echocardiography showed good left ventricular systolic function with ejection fraction of 50%. The cardiologist's opinion was taken, who advised changing the pacemaker to asynchronous mode prior to surgery with a heart rate of 75 beats/min. The pacemaker was evaluated, and it was found to be working fine.

The pacemaker was subsequently shifted to asynchronous mode with a heart rate of 75 beats/min on the day of surgery by the pacemaker company representative. The need to avoid use of monopolar cautery and minimize the use of bipolar cautery was discussed with the surgeon.

On the day of surgery, the patient was premedicated with tab ranitidine 150 mg, and 1 mg IV midazolam was given to allay anxiety in preoperative room under monitoring. A 20G arterial cannula was placed in the left radial artery under local anesthesia and baseline arterial blood gas (ABG) analysis was done. After shifting the patient to operating theater, standard monitors including NMT (neuromuscular transmission) monitors were attached. Injection isoproterenol, atropine, and external transcutaneous defibrillator and pacemaker were kept ready. Cardiology backup was taken. Induction was done with fentanyl 200 µg, propofol 130 mg, and vecuronium 10 mg. Endotracheal intubation was done with endotracheal tube of internal diameter of 8.5 mm after the train of four count

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decreased to zero. A right subclavian central venous line was inserted after induction under ultrasound guidance. Anesthesia was maintained with propofol infusion, vecuronium top-ups in 67% nitrous oxide: 33% oxygen mixture. Intraoperative volume status was monitored with central venous pressure (CVP), systolic pressure variation (SPV), and a pulse pressure variation (PPV) value. Intraoperative SPV values were kept below 10 mm Hg. Surgery lasted for 4 hours. The cardiac status of the patient remained stable throughout the duration of surgery, with no abnormal rhythm or hemodynamic instability. Intraoperative blood loss was 1,500 mL, and packed red blood cell (PRBC) transfusion was started when the blood loss exceeded the maximal allowable blood loss of the patient. The pacemaker was evaluated postoperatively and was shifted to DDDR mode. Postoperatively, the patient had to be tracheostomized in view of failure to wean from ventilator. He was discharged to home with E2VTM3 status.

Discussion

The perioperative period for patients with pacemakers poses unique challenges. Effective communication with the physician caring for the pacemaker is imperative for patient's safety. The most common problem intraoperatively is electromagnetic interference due to cautery devices. These devices produce a high energetic electromagnetic field at a frequency that passes through the filters of pacemakers leading to oversensing. This oversensing leads to a pacemaker inhibition and may cause cardiac arrest. Therefore, for surgical procedures using electrocautery devices, pacemaker-dependent patients should be programmed into an asynchronous pacing mode.[3]

Also, aSAH causes multitude of effects on the heart, including arrythmias.[4] It has been documented that 40 to 100% of patients with SAH have new-onset ECG abnormalities, including even ventricular tachycardia and fibrillation; new-onset wall motion changes and depressed left ventricular function are seen in around 13 to 18% of patients. Hence, our patient's cardiac status had suffered a dual insult: due to the conduction disorder that necessitated pacemaker insertion and due to aSAH. Hence, we decided to have a preoperative evaluation of the pacemaker echo in our patient although the present recommendations do not make it compulsory. Another important consideration was whether to insert a subclavian line in this patient or not. Craniotomies can result in excessive blood loss, and need for inotropes may arise. However, during insertion of a central venous line in a patient with a pacemaker, there is a theoretical possibility of pacemaker getting displaced. Also, pacemakers can cause venous complications, making central venous line placement difficult.[5]

Use of nitrous oxide in patients with recently inserted pacemakers has been documented to cause pacemaker dysfunction due to formation of air pockets.[6]

When the patient is on asynchronous mode, occurrence of hypovolemia will not be accompanied with reflex tachycardia, and this must be kept in mind while caring for the patient intraoperatively. Hence, we used dynamic measures of fluid responsiveness such as SPV and PPV in the management of this patient along with measurement of CVP. We could also have used other dynamic predictors of fluid volume status and fluid responsiveness indicators such as FloTrac and inferior vena cava (IVC) distensibility index, to guide intravenous fluid therapy in our patient. However, monetary considerations and limited access to the patient intraoperatively prevented us from employing them to guide fluid administration intraoperatively.

Conflict of Interest
None declared.

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