

CASE REPORT

ANAESTHETIC MANAGEMENT OF ELDERLY PATIENT WITH PERMANENT PACEMAKER FOR EXCISION OF SUSPECTED ADRENAL MASS – A CHALLENGING CASE

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ABSTRACT: Pacemakers and the underlying pathophysiologies leading to their implantation present challenges to the anesthetist¹. Patients with an implanted cardiac pulse generator often have significant co-morbid disease in addition to their cardiac rhythm disturbance. Our ability to care for these patients requires attention to both their medical, psychological and surgical problems. We present the case of a 60 year old man with a permanent pacemaker posted for excision of a suspected adrenal mass.

KEYWORDS: Pacemaker, pulse generator, adrenal mass.

INTRODUCTION: Artificial pacemaker is indicated for the treatment of symptomatic bradycardia of any origin, e.g. acquired AV block (second/third degree), after myocardial infarction, bifascicular or trifascicular block, sinus node dysfunction and hypertensive carotid sinus and neurocardiac syndromes. Modern day pacemakers are programmable into one of the three modes, namely asynchronous or fixed rate pacing, single chamber demand pacing and dual chamber AV sequential pacing². The surgical environment presents several opportunities for disturbing pacemaker function and presents a threat to homeostasis of patients under anesthesia. The patient with a permanent cardiac pacemaker may have other pathologic processes which further add to the complexity of their anesthetic management.

CASE REPORT: A 60 year old, 65 kg male presented with a lump in left hypochondriac region since 2 years. On the basis of serum and urinary cortisol, renin, VMA levels and computerized tomography, he was diagnosed to have a non-secreting adrenal tumor, and was posted for laparotomy and resection of the same. He was a known hypertensive since 5 years and was on tablet Amlodipine 5 mg twice daily. He had permanent pacemaker inserted for complaints of syncopal attacks which was diagnosed as third degree AV block, five years back. The mode was DDD. He had no history of any other medical or surgical illness.

Routine investigations which included complete blood count, liver function tests, kidney function tests, serum electrolytes, coagulation profile, blood sugar level, chest X-ray and urine routine and microscopy were within normal limits. His baseline blood pressure was 130/80 mm Hg controlled on tablet Amlodipine. Electrocardiogram showed pacemaker rhythm with rate of 80/min. 2 D Echocardiogram was within normal limits. His serum cortisol levels were 147 ng/ml (normal 9.66-120.6 ng/ml), serum renin level was 45.5 Miu/ml (normal 44-46 mIU/ml), Urine VMA level were 2.99 ng/24 hrs. (normal 0-15 ng/24 hrs.) and CEA levels were 1.9 ng/ml, suggestive of non-secreting adrenal tumor.

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On preoperative day, pacemaker technician was called to evaluate working of pacemaker. Patient had DDDR type of pacemaker inserted with rate set at 80/ min. Dual chamber pacing is indicated when ventricular pacing cannot maintain adequate cardiac output and atrial pacing alone cannot be done, as in third degree heart block³. There was no intrinsic rhythm checked by applying magnet. Rate responsiveness was deactivated by applying programmer. On preoperative night, tab Ranitidine 150mg and tablet amlodipine was advised. On the day of surgery, injection Pantoprazole 40 mg IV and maintenance fluids in the form of Ringer Lactate (through an 18G intracath) were started. Defibrillator with external pacemaker was kept ready. A Cardiologist was kept available in the OT. Surgeon was advised to use bipolar cautery instead of monopolar, to minimize electromagnetic interference. Inotropes, vasodilators and other cardiac drugs were kept ready.

Combined thoracic epidural with general anesthesia was planned. An 18 G thoracic epidural catheter was placed at the level of T9-10 space with a 5cm segment within the epidural space. Test dose was given to confirm the proper placement of the catheter. Epidural was activated with total bolus dose of 10 ml of bupivacaine 0.125%. General anesthesia was induced with injection Propofol 100mg, Inj. Vecuronium 5 mg and Inj. Fentanyl 100 mcg and maintained with Oxygen, N₂O (nitrous oxide) and isoflurane with intermittent positive pressure ventilation (IPPV), after intubation with portex cuffed endotracheal tube no. 9. There was a sudden rise in systolic and diastolic blood pressure during intubation which was treated with esmolol 300 mcg bolus and fentanyl 50 mcg. Right internal jugular vein was cannulated with triple lumen catheter and central venous pressure monitored continuously. Left radial artery was cannulated for invasive blood pressure monitoring.

Intraoperatively, pacemaker function was continuously monitored by monitoring ECG. The artifact filter on the ECG monitor was disabled in order to detect pacing spikes. In addition, mechanical evidence of cardiac contraction was continuously monitored by palpation of pulse, pulse oximetry and continuous invasive blood pressure monitoring. There was huge 15 x15 cm mass involving whole of the left kidney. During dissection of tumor there was blood loss of around 1.5 litre. Fluid replacement was done with adequate amounts of crystalloids and colloids, and later blood to maintain CVP in range of 10-12 mm Hg. After removal of tumor there was a sudden fall in blood pressure upto 70/40 mm Hg. It was treated with a single bolus of epinephrine and later dopamine infusion was started at 10 mcg/kg/min.

Later Dobutamine infusion was added 10mcg/kg/min. Blood pressure was maintained at systolic 90 mm Hg and diastolic 60 mm Hg with the vasopressors. Later there appeared tachycardia with stacking of impulses which was due to overlapping of pacemaker with intrinsic cardiac rhythm; so magnet was applied over pulse generator. Intrinsic cardiac rhythm was due to inotropes started for hypotension. Pacemaker mode was changed to VVI mode in which pacemaker will generate impulse only when intrinsic heart rate falls below the set rate. Pacemaker was programmed to VVI mode with rate fixed at 60/min. There was no significant effect of bipolar cautery other than the momentary disturbances in the ECG tracing.

Post operatively patient was shifted with endotracheal tube in situ and on inotropic support, to critical care unit for further management. Epidural top ups were withheld during the period of hypotension. Patient was electively ventilated for 10 hours because of hemodynamic instability and blood loss. His postoperative serum electrolytes, urine output and electrocardiogram were normal. Patient was extubated on dopamine support on day two post-surgery. After extubation pacemaker

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was reset to DDDR mode with rate fixed at 80/min. Later dopamine was stopped. Patient was shifted to ward on day three. Biopsy of specimen revealed it to be a renal cell carcinoma.

DISCUSSION: Patients with implanted pacemakers and ICDs can be safely managed for surgery and anesthesia. Anesthetic management of such patients should be planned first according to the patient's underlying medical status with particular emphasis on ventricular function and electrolyte balance³. Magnet application still appears to be the standard management of such patients.

The American Society of Anesthesiologists (ASA) came out with a practice advisory on the management of patients with CIED in 2005⁴. Pacemakers are indicated in any patient with symptomatic sinus bradycardia, atrio-ventricular (AV) block of any etiology, documented periods of sinus arrest more than 3 seconds and following catheter ablation of the AV node. Pacemakers can be temporary or permanent. They can be instituted as external pacing pads, transvenous insertion of temporary pacing wires through a central venous line or permanent implantation of a sophisticated pulse generator. Pacing can take place in a single chamber (atrium or ventricle), dual chambers (atrium and ventricle) or multiple chambers (bi-ventricular pacing). Pacemakers can employ bipolar or unipolar. The clinical relevance of this is that bipolar leads are less susceptible to electromagnetic interference (EMI). Pacemaker devices can be implanted in the atrium, ventricle or as in dual chamber devices, in both atrium and ventricle. Depending on the programming, in a single chamber device, the device can sense the intrinsic electrical activity and either "trigger" or "inhibit" pacing of that chamber. Devices are programmed for specific "escape intervals". If an electrical activity is not sensed during the programmed time interval, the device will trigger depolarization of that chamber. If an electrical activity is sensed within the preset time interval, the device will inhibit itself and wait for a subsequent depolarization during the next preset interval⁵.

The generic PM code, which has been published by the NASPE and British Pacing and Electrophysiology Group (BPEG) is as below⁶:

Position I: Pacing Chamber(s)	Position II: Sensing Chamber(s)	Position III: Response(s) to Sensing	Position IV: Programmability	Position V: Multisite Pacing
O= none	O= none	O= none	O= none	O= none
A= atrium	A= atrium	I= inhibited	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)

NASPE/BPEG Revised (2002) Generic Pacemaker Code (NBG)

Assistance from the cardiologist and the manufacturing representative should be obtained for assessment of pacemaker function. Most of the information about the pacemaker, such as type of pacemaker (fixed rate or demand rate), time since implanted, pacemaker rate at the time of implantation and half-life of the pacemaker battery can be taken from the manufacturer's book kept with the patient. 10% decrease in rate from the time of implantation indicates power source depletion.

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Adverse outcomes to be avoided during the perioperative period are damage to the device, leads or site of lead implantation, failure to deliver pacing or defibrillation, changes in pacing behavior inappropriate delivery of a defibrillatory shock or inadvertent electrical reset to backup pacing modes which may lead to hypotension, arrhythmias, myocardial damage and ischemia of the heart or other vital organs. The most common problem that the anesthesiologist is going to face in the perioperative period is electromagnetic interference (EMI). This can be avoided by converting the pacemaker to a fixed rate asynchronous mode by application of magnet. Most pacemakers and ICD's have built-in magnetic reed switches that are designed to switch 'ON' or 'OFF' circuitry in response to magnets. The magnet is placed over the pulse generator to trigger the reed switch present in the pulse generator resulting in non-sensing asynchronous mode with a fixed pacing rate.

Anesthetic techniques or anesthetics do not interfere with CIED (Cardiac implantable electronic device) function; however, the physiological consequences of anesthetic techniques can create occasional problems. The most common of these is the induction of hyperventilation which will rapidly induce hypokalemia. Fasciculation's, shivering and large tidal volumes can result in micro-potentials and are possible sources of EMI.

The ECG as well as peripheral pulse (palpation of the pulse, auscultation of heart sounds, and pulse plethysmography from oximeter or intra-arterial blood pressure tracing) should be continuously monitored during the surgery. The ECG should be displayed, as per ASA standards, through the course of surgery and if necessary continued into the postoperative period. These standards (ECG and pulse monitoring) should apply to all patients with CIED undergoing general anesthesia (GA), regional anesthesia (RA) or monitored anesthesia care (MAC). Peripheral pulse monitoring is mandatory as pulseless electrical activity can go unnoticed in these patients.

Procedures during which EMI, MRI, radiofrequency ablation, radiation therapy can interfere and damage CIED function and need special attention⁷.

Electrocautery interference: The present recommendation regarding the use of electrocautery in patients with CIED include: i) positioning the cautery tool and the cautery return pad, so that the current pathway does not pass through or near the CIED system ii) avoiding proximity of the cautery electrical field to the pulse generator and leads, including avoidance of waving the activated electrode over the generator. iii) using short, intermittent and irregular bursts at the lowest possible energy levels, as well as using more "cutting" than "coagulation" current iv) using bipolar electrocautery systems or harmonic scalpel when possible.

Emergency defibrillation or cardioversion.- Minimize the amount of current passing through the pulse generator or leads. Before attempting defibrillation in a patient with ICD or pacemaker which is magnet disabled, all potential sources of EMI should be terminated and the magnet removed so as to enable anti-tachycardia therapies. The patient should then be observed for appropriate therapy. For the CIED patient whose anti-arrhythmia function has been disabled through programming, attempts should be made to re-program the anti-arrhythmia function. If the above steps do not improve the situation, proceed with emergency defibrillation.

If life threatening arrhythmias continue, follow ACLS guidelines for energy level. If possible reduce the amount of energy passing through the pulse generator and lead systems by i) positioning the defibrillation paddles as far away as possible from the pulse generator ii) positioning defibrillation paddles perpendicular to the major axis of the CIED pulse generator and leads, to the extent possible by placing them in an antero-posterior location.

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Addressing the surgical problem is also of utmost importance. Renal cell carcinoma presents with classic triad of hematuria, flank pain and abdominal mass in 10-15% of patients. Hypertension could be one of the presenting feature especially renin secreting tumor. Adrenal tumor could be from adrenal cortex adrenal cortical adenoma or adrenocortical carcinoma. Tumor from adrenal medulla could be neuroblastoma or pheochromocytoma. Our patient had history of hypertension and abdominal mass, which could be some adrenal tumor or renal cell carcinoma rarely. He had pacemaker inserted for syncopal attacks, one of the reason suggesting of vasoactive tumor or any cardiac pathology. Fluctuations in blood pressure and hemodynamic alterations resulting from handling of vasoactive tumor or following removal of mass were a major concern.

Cardiac rate and rhythm should be continuously monitored during the postoperative period. Back-up pacing facility and cardioversion defibrillation equipment should be available at hand. The CIED device should be evaluated for restoration of function in all cases.

SUMMARY: Anesthesiologists should be fully aware of the functional capabilities of pacemakers and ICD's. The greatest threat during surgery is EMI from electrocautery. Primary principles to avoid EMI during surgery should be known and followed in the operating room. Harmonic scalpel or bipolar electrocautery should be used when possible. ECG and peripheral pulse should be continuously monitored intraoperatively and postoperatively. Facilities for emergency defibrillation should be available in the operating room. Before delivering an external defibrillatory shock, removal of magnet and observation for inherent anti-tachyarrhythmia function of ICD should be observed. ACLS guidelines should be followed.

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