Cardiac Surgery in a Patient with Implanted Brain Pacemaker: A Case Report

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Abstract
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Parkinson’s disease, a neurodegenerative disorder, affects approximately 1% of population older than 60 years. Patients with Parkinson’s disease with intractable symptoms often require placement of deep brain stimulator, conventionally known as brain pacemaker. Patients implanted with this device pose specific challenges to the anesthesiologist in view of the primary illness, possible drug interactions, risk of cerebral hemorrhage from anticoagulant therapy, and potential for device malfunction by electromagnetic interference during cardiac surgery. The authors describe perioperative management of a patient with implanted brain pacemaker who underwent aortic valve replacement at their institution.

Introduction

Patients with Parkinson’s disease (PD) who have intractable symptoms often require placement of deep brain stimulator, conventionally known as brain pacemaker. Patients implanted with this device pose specific challenges to the anesthesiologist in view of the primary illness, multisystemic involvement, possible drug interactions, risk of cerebral hemorrhage from anticoagulant therapy, and potential for device malfunction by electromagnetic interference during cardiac surgery. We describe anesthetic considerations and perioperative management of an interesting case with implanted brain pacemaker who underwent aortic valve replacement at our institution.

Case Report

A 57-year-old man with bicuspid aortic valve and severe aortic stenosis (aortic valve area 0.7 cm², peak/mean pressure gradients across the aortic valve 89/55 mm Hg) was admitted for aortic valve replacement. He was a known case of PD who underwent bilateral subthalamic nucleus (STN) deep brain stimulator (DBS) implantation (Medtronic Activa RC, Medtronic Hong Kong Medical Ltd.) in 2016 for intractable symptoms resulting from PD. The symptoms at the time of DBS implantation included excessive tremors, dragging of right lower limb while walking, slurring of speech, and sleep disturbance resulting from PD. At the time of current admission, the patient was conscious, well-oriented, with normal power (grade 5/5) in all four limbs, decreased volume of speech with no slurring, no rigidity, and occasional tremors in the right upper limb. Current medications included levodopa, clonazepam, and escitalopram. Neurologic assessment was unremarkable except for the presence of mild tremors. Integrity of the entire system consisting of neurotransmitter/implantable pulse generator (IPG), leads, electrodes, and battery status was checked by placing the programmer over the IPG by the neurologist. Pulmonary function tests were suggestive of mild restrictive pattern. Incentive spirometry and breathing exercises were explained and commenced preoperatively. Chest radiograph showed IPG device in the left infraclavicular region with the leads going toward left side of the neck (► Fig. 1).
Patients with implanted brain pacemaker may need a magnetic field exposure during medical procedures, such as MRI scans, which can interfere with the pacemaker's function. Similarly, electromagnetic interference from devices such as pacemakers and implantable cardioverter defibrillators (ICDs) can affect the DBS system.

Discussion

Achieving effective hemostasis during surgery is crucial. For instance, during the surgery, a doughnut magnet was placed over the IPG device to avoid electromagnetic interference. The use of bipolar cautery is short, infrequent bursts with a minimum energy setting is recommended to prevent heating of DBS electrodes and their risk of activation. If defibrillation is required, the lowest clinically appropriate energy must be used. Better myocardial protection by administering well-timed antegrade and retrograde cardioplegia and prophylactic antiarrhythmic agents can be effective in restoring sinus rhythm spontaneously. Bioprosthetic valve is preferred over metallic valve, which helps in avoiding mechanical valve-related complications.

Postoperative care includes monitoring and bispectral index monitoring were commenced. The IPG device was switched on and re-interrogated to restore original settings in the intensive care unit. Further course of the patient in the hospital, including his neurologic status, was unremarkable. The use of monopolar cautery is helpful to achieve effective hemostasis from sternotomy and intrathoracic sites. It can produce electromagnetic interference with the neurotransmitter, however. Severe neurologic damage resulting from interaction of electrocautery with DBS system is reported in the literature. The use of bipolar cautery in short, infrequent bursts with a minimum energy setting is recommended with keeping the cautery pad as far as possible away from the neurotransmitter. Another option for dissection during cardiac surgery is the ultrasonic scalpel, which does not cause transfer of electrical energy to the tissues and is devoid of harmful effects. Similar to cardiac pacemaker, the DBS device requires use of magnet to reduce electromagnetic interference. Because the device is placed in close proximity to the heart, it may be damaged during cardioversion or internal defibrillation. If defibrillation is required, the lowest clinically appropriate energy must be used. Better myocardial protection by administering well-timed antegrade and retrograde cardioplegia and prophylactic antiarrhythmic agents such as lignocaine/magnesium, may be helpful in restoring sinus rhythm spontaneously. Bioprosthetic valve is preferred over metallic valve, which helps in avoiding mechanical valve-related complications.
phacoemulsification, peripheral nerve stimulator, and electroconvulsive therapy. Device-specific manufacturer's recommendations should always be followed.

In conclusion, with increasing use of DBS system, special care is required in such patients because of potential risk of cerebral hemorrhage with anticoagulant therapy and/or heating of DBS electrodes, and possible interference with monitoring devices, imaging modalities, or therapeutic devices. The anesthesiologist plays an important role to ensure a safe and uneventful intraoperative environment for patients with an implanted DBS device. Relevant issues include identifying the type of device, interrogation of DBS device by a trained physician, turning off the device intraoperatively, implementing precautions when using electrosurgical equipment, and checking the device postoperatively.

Conflict of Interest
None.

References