Case Report

Anaesthetic management of a patient with deep brain stimulation implant for radical nephrectomy

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ABSTRACT

A 63-year-old man with severe Parkinson's disease (PD) who had been implanted with deep brain stimulators into both sides underwent radical nephrectomy under general anaesthesia with standard monitoring. Deep brain stimulation (DBS) is an alternative and effective treatment option for severe and refractory PD and other illnesses such as essential tremor and intractable epilepsy. Anaesthesia in the patients with implanted neurostimulator requires special consideration because of the interaction between neurostimulator and the diathermy. The diathermy can damage the brain tissue at the site of electrode. There are no standard guidelines for the anaesthetic management of a patient with DBS electrode *in situ* posted for surgery.

Key words: Anaesthesia complications, deep brain stimulation, Parkinson's disease

INTRODUCTION

Parkinson's disease (PD) is a disorder of the extrapyramidal system characterised by rest tremor, rigidity, bradykinesia, and gait impairment.[1] This syndrome is due to deficiency of dopamine in the basal ganglion. The symptoms are progressive and may become severe enough to debilitate many patients. Deep brain stimulation (DBS) is rapidly becoming the preferred surgical choice for treatment of advanced PD. In view of the ageing population, we are likely to encounter more patients for DBS implantation or who already have a system implanted. There is little information available on the management of patients with DBS implant, who present for surgery. Potential problems include thermal injury to brain tissue, reprogramming, and damage of the device and its leads. These patients require careful management, as DBS can interfere with monitoring and therapeutic devices such as electrocardiography, short wave diathermy, electrocautery, peripheral nerve stimulators, pacemakers, external and implantable cardioverters, and defibrillators.[2] However, with careful management these serious complications can be avoided. We summarize a case of advanced PD with DBS implant *in situ* posted for radical nephrectomy for renal cell carcinoma.

CASE REPORT

A 63-year-old man suffering from PD with implanted DBS electrode [Figure 1] was scheduled for radical nephrectomy for renal cell carcinoma. He had been suffering from PD for the past 18 years and his disease progressed to severe immobility in spite of being on medical treatment. He underwent bilateral DBS implantation surgery 2 years ago after which he had marked improvement in his symptoms. The patient was on a combination of carbidopa (10 mg) and levodopa (100 mg) 4 times a day and trihexyphenidyl 1 mg thrice a day, orally.

At the preoperative visit, patient was able to walk, with mild tremors and mild muscle rigidity, which was tolerable. On examination of the cardiovascular

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system and respiratory system, no abnormality was detected. On the morning of surgery, his usual medication for PD (carbidopa, and levodopa and trihexyphenidyl) was given. Inside the operating room IV line was secured and then neurostimulator was switched off in the presence of the treating neurologist. This resulted in exacerbation of muscle rigidity and tremors. Anaesthesia was induced with thiopentone sodium 250 mg, pethidine 30 mg, while intubation of the trachea was facilitated with vecuronium bromide 8 mg. Maintenance was with isoflurane, 70% nitrous oxide in oxygen, and intermittent top ups with vecuronium bromide with IPPV. Monitoring consisted of electrocardiography, noninvasive blood pressure, pulse oximeter and end tidal $C0_2$. The duration of surgery was 3 h and the blood loss was 300 ml. Patient was haemodynamically stable throughout the surgery. Bipolar cautery was used, with cautery plate placed under the buttock. At the completion of the surgery after the abdominal closure was over, the neurostimulator was switched on. At the end of the procedure, neuromuscular block was antagonized with neostigmine 2.5 mg and glycopyrrolate 0.5 mg. The patient emerged from anaesthesia smoothly. His vital signs were normal; blood pressure - 120/70 mm Hg, heart rate - 98 bpm, respiratory rate - 20/min and SaO_2 98%. No respiratory difficulty was noted.

DISCUSSION

Parkinson's disease is an important cause of morbidity in the elderly. The use of DBS is gaining popularity for the treatment of PD and various other neurological disorders DBS is effective in controlling essential tremors and symptoms of PD who are not adequately controlled with medications.[1] It improves all the cardinal features of PD and reduction of daily levodopa requirements. With increasing numbers of DBS procedures, anaesthesiologists are more often likely to face the patients carrying brain pacemakers. There is little information on the management of the patients with implanted DBS who require some surgical procedure.

For anaesthesia, the characteristics of the disease as well as the respective long-term medication have to be considered. In addition, the rules for handling patients with pacemakers need to be followed to avoid both dysfunction of the generator and tissue damage due to overheating of the electrodes.[3] DBS can interfere with medical equipment such as electrocardiography, short wave diathermy, electrocautery, peripheral nerve stimulators, pacemakers, external and implantable cardioverters and defibrillators.[2] Safety of DBS implant in patients requiring MRI and electroconvulsive therapy is also to be looked for.

We turned off the neurostimulator in the presence of the neurologist, before induction of anaesthesia as diathermy was required during surgery. Energy during diathermy could be transferred through implanted system and damage the brain at the site of implanted brain electrode.

Bipolar cautery is preferred in these cases as it reduces the potential for electromagnetic interference. If monopolar cautery is to be used, it should be used in low voltage mode and with the lowest power settings. The ground plate should be kept as far from the neurostimulator, extension and lead as possible. There has been a case report of diathermy causing significant brain damage in patients with DBS.[4] Diathermy can also damage the DBS system whether neurostimulator is turned on or off. Therefore, diathermy plate was kept below the buttocks in the present case, far from pacemaker. Turning off the neurostimulator resulted in muscle rigidity and tremors. Hence, the system was turned on prior to completion of surgery in order to facilitate smooth extubation and recovery of the patient.

Respiratory dysfunction is common in symptomatic patients of PD and multiple causes of respiratory dysfunction have been noted including abnormal control of respiratory muscles, excessive secretions, decrease in chest wall compliance and upper airway obstruction.[5,6] Respiratory function may be compromised by bradykinesia and muscle rigidity. Therefore in refractory patients of PD who are symptomatically controlled with insertion of DBS, turning the neurostimulator off can precipitate sudden respiratory dysfunction. Vincken *et al*.[6] implicated the upper airway as the primary site of involvement. The direct visualisation of upper airway in patients with extrapyramidal disorder revealed oscillations due to involuntary movement of glottis and supraglottic structures causing intermittent obstruction. Upper airway dysfunction presenting with respiratory distress should be considered in symptomatic patients with severe rigidity and tremors. Switching on the neurostimulator after completion of surgery could avoid the development of rigidity and tremors. This case report highlights the perioperative care of the patient with advanced PD with DBS electrode *in situ*.

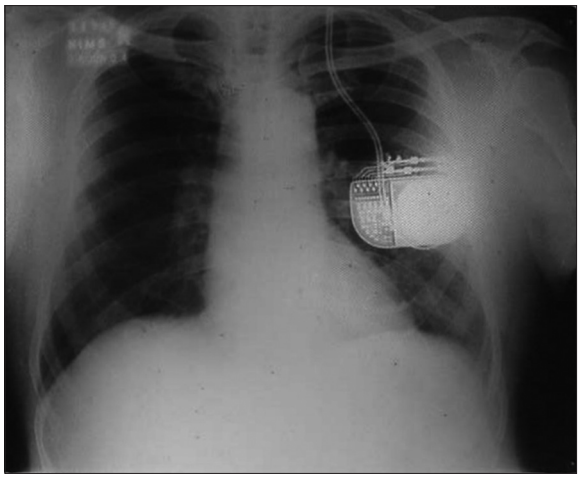

Figure 1: X-ray showing neurostimulator implanted in fifth intercostal space (the placement of electrode was done in subthalamic nucleus)

Very little data is available in the literature regarding anaesthetic management of a case of PD with DBS electrode *in situ*.

CONCLUSION

Deep brain stimulation has become increasingly common treatment of PD. Care is required in the management of patients who already have a DBS implanted, as it can interfere with other monitoring and therapeutic devices, sometimes with severe consequences. However, with proper planning most of these patients respond well on turning the neurostimulator on before emerging from anaesthesia avoiding serious complications.

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