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Case report

Choice of sedative for deep brain stimulation in Parkinson's disease: Our experience and comparison of two cases

Mridul Dhar *, **Deepak Kumar Sreevastava** [1], **Nitish Gupta** [2], **Somya Mishra** [3]

Department of Anaesthesiology and Critical Care, Army Hospital (Research & Referral), New Delhi, India

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KEYWORDS

Parkinson's disease;
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Abstract *Introduction:* Parkinson's disease (PD) is a severe, debilitating disease of the extra pyramidal central nervous system, which has a significant effect on lifestyle and day to day living of the affected population. Statistically, more of the elderly are now going to present with this disease. Moving ahead from older procedures such as cingulotomy, pallidotomy and thalamotomy which had irreversible side effects, deep brain stimulation (DBS) has emerged as a new, safer and more attractive option for such patients. Anaesthetic concerns for such procedures mainly incorporate principles of awake craniotomy, for which the basic requirement is a cooperative patient. Although Propofol was somewhat of a gold standard for this purpose until a few years back, Dexmedetomidine has emerged as the new drug of choice.

Case: While conducting two surgeries for DBS over two days, we had an obverse experience with these drugs. We describe the pre-operative assessment and intra-operative management of the two cases and a discussion of the factors which might have contributed to this contradiction.

Conclusion: The choice of sedation for DBS in PD should take into consideration factors such as patient cooperation, 'drug off' state due to pre-op medication stoppage, GABA versus non-GABA mediated mechanism of drugs, amount of dependence on PD drugs, severity of disease and finally requirement of the testing team. No drug can be singled out to be better and must be chosen based on individual merits of the patient and disease.

* Corresponding author at: Department of Anaesthesiology and Critical Care, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.
E-mail address: mriduldhar@hotmail.com (M. Dhar).
[1] Present address: Department of Anaesthesiology and Critical Care, Command Hospital, Pune, Maharashtra, India.
[2] Present address: Department of Anaesthesiology and Critical Care, Andaman & Nicobar Islands Institute of Medical Sciences, Port Blair, India.
[3] Present address: Department of Anaesthesiology and Critical Care, Tata Memorial Hospital, Jamshedpur, Jharkhand, India.

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1. Introduction

Parkinson's disease (PD) is a severe, debilitating disease of the extra pyramidal central nervous system, which has a significant effect on lifestyle and day to day living of the affected population. Statistically, more of the elderly are now going to present with this disease [1,2]. Moving ahead from older procedures such as cingulotomy, pallidotomy and thalamotomy which had irreversible side effects [1,3], deep brain stimulation (DBS) has emerged as a new, safer and more attractive option for such patients. Anaesthetic concerns for such procedures mainly incorporate principles of awake craniotomy, for which the basic requirement is a cooperative patient. Most common mode employed is conscious sedation or monitored anaesthesia care (MAC) supplemented with local anaesthesia (LA). Although Propofol was somewhat of a gold standard for this purpose until a few years back, Dexmedetomidine has emerged as the new drug of choice [1,3–5]. While conducting two surgeries for DBS over two days, we had an obverse experience with these drugs. Describing the peri-operative evaluation and management of the two cases and a discussion of the factors might have contributed to this contradiction.

2. Case 1

A 45 year old, 50 kg male was listed for deep brain stimulation for his Parkinson's of 5 years duration. On pre anaesthetic evaluation and history there were no other co-morbidities. Airway examination was essentially normal with adequate mouth opening and neck movements. His medication list included oral Carbidopa-Levodopa (CL) 25/100 mg TDS, Ropinirole 5 mg TDS and Trihexyphenidyl 2 mg TDS, with history of good compliance. Although his symptoms were relatively well controlled with the medication, his drug requirement was increasing. This was chosen for DBS surgery, in an effort to tone down the medication. He was evaluated and counselled by the anaesthesiologist and the surgeon along with a psychological evaluation to rule out claustrophobia and other issues which might affect the intra-operative course. He seemed motivated and enthusiastic about the procedure. He was advised about pre-operative fasting and aspiration prophylaxis and asked to omit the PD medication. He was planned for a bilateral electrode placement and pulse generator placement in a single sitting.

On the morning of surgery, the difference in symptoms due to omission of drugs was quite striking as he was almost bed ridded compared to his mobility of the previous evening. But he was able to cough and maintain his airway. He was first taken to the MRI suite where a stereotactic frame was applied with local anaesthetic infiltration. He was later wheeled into the theatre, while continuously explaining the whole process and encouraging him for the long procedure which lay ahead. After applying standard monitors in the form of ECG, pulse oximetry and non invasive blood pressure, the neurologist tested the baseline tone and power of the muscles, following which an infusion of Propofol was initiated (25 mcg/kg/min) aimed at conscious sedation. A burr hole was created after local anaesthetic infiltration and electrode placement was localized using neuro-physiological testing. 10–15 min before clinical testing the propofol infusion was stopped and the patient awakened. The same was repeated on the contra-lateral side with the patient following a sleep-wake-sleep cycle. Through out the whole process patient was given oxygen via nasal prongs, and there were no airway related incidents. Although a long and tedious procedure lasting almost 6 h, the patient was quite comfortable. Finally general anaesthesia was induced with endo-tracheal intubation for tunnelling of pulse generator. The patient was extubated on table after adequate clinical and neuro-muscular recovery and shifted to ICU for monitoring.

3. Case 2

A 58 year old, 75 kg male PD patient was evaluated in the pre-anaesthetic check-up. He had history of hypertension for the past 5 years on Amlodipine 5 mg BD. He was also on CL 25/100 mg BD, Ropinirole 2.5 mg TDS and Selegiline 5 mg OD for his PD since the past 2 years. His symptoms had been gradually worsening with his current medication with increasing dyskinesia and motor fluctuations. He was thus planned for DBS to control his worsening symptoms. A similar psychological review along with counselling by all the physicians involved was done. The patient although apprehensive initially, after explaining the process in detail, along with the merits and demerits of the procedure agreed to go ahead with it. Air way examination revealed no significant findings or any history suggestive of obstructed sleep apnoea or any respiratory issues, although patient was slightly overweight (BMI = 28 kg/m^2). The patient was asked to take half dose of his PD medication on day of surgery and was advised anxiolysis the evening prior.

The MRI suite and initial theatre procedures were uneventful. As the patient was overweight and there was a slight risk of airway compromise we decided to start Dexmedetomidine (1 mcg/kg slow loading dose followed by 0.5 mcg/kg/min infusion). The drug seemed to work smoothly for the initial part of the procedure with good patient acceptance. But after starting the procedure on the contra-lateral side the patient started to become fidgety and restless. Slight titrated increase in sedation did not improve the situation. As the neuro-physiological testing procedure was almost nearing completion the team decided to go ahead with the procedure and patient was switched to Propofol infusion for the remainder of the time. This time a slightly heavier sedation dose is required (75 mcg/kg/min), as we had almost completely lost the patient's cooperation at the fag end of the procedure. Ultimately the patient was intubated for the last tunnelling procedure and was shifted to ICU after appropriate neuro-muscular recovery and extubation.

4. Discussion

The non-pharmacological treatment of PD has gradually evolved from more gross, destructive procedures such as thalamotomy and pallidotomy to more refined and precise procedures such as DBS and gamma knife surgery [1,3]. DBS was first described in 1987 for PD and is now being used for other movement disorders such as dystonias, essential tremors and also some psychiatric conditions [1,3,6]. The attractive feature of DBS is its reversibility and ability to titrate the dose of stimulation [1]. The target areas of the brain for stimulation in PD mainly include the Subthalamic nucleus and the Globus Pallidus [1,7].

The technique of DBS mainly involves neuro-physiological and clinical testing guided positioning of stimulating electrodes and internalization of the impulse generator either in a single or a staged sitting. The decision of single or staged procedure and unilateral or bilateral procedure is guided by factors such as duration of procedure, expertise of surgeon, availability of associated specialists such as neurologists and most importantly, and patient cooperation [1,3].

Pre-anaesthetic assessment of such patients includes evaluation of disease severity, co-existing diseases especially obesity and sleep apnoea, drug interactions and patient dependence on the drugs [3,8]. Airway assessment is of special importance as on most occasions the airway is inaccessible due to the stereotactic frame which is applied before the procedure for radiological localization of brain areas. Also, there might be associated cranial nerve involvement hampering maintenance of a patent airway under sedation or anaesthesia. Such patients may also have autonomic disturbances. As mentioned above, a thorough multi-disciplinary evaluation and appropriate counselling pre-procedure are prudent.

Intra-operative concerns are regarding the type of anaesthesia to be given which mainly includes conscious sedation (MAC), Total intra venous anaesthesia (TIVA) or only LA. The other aspect involves the choice of anaesthetic agent to be used for this purpose.

General consensus puts Benzodiazepines out of contention due to its established effects on micro electrode recordings (MER) and interference with localization during testing [1,3]. Propofol has been a standard drug for procedures under TIVA, owing to its predictable pharmacokinetics (PK) and clear headed and swift recovery. But its use is slightly tricky in PD patients as its PK is different in this context. Mean infusion rates of 50 mcg/kg/mi have been described for this purpose based on traditional target controlled infusion models [3,9]. Its effect on MER is still doubtful. But it causes dyskinetic effects and also abolishes tremors which is an undesirable feature in such procedures [3]. Dexmedetomidine in a dose of 0.3–0.6 mcg/kg/min seems to a better choice owing to its non GABA-minergic mechanism of action [3–5]. Thus, it adds to the hemodynamic stability, has minimal effect on the MER and allows better clinical testing.

The literature thus suggests a slight upper hand in favour of Dexmedetomidine. In our two cases the first younger patient who was managed with a propofol infusion had a well controlled and stable PD. He did not have any co-morbidities and was extremely cooperative and compliant. The second case managed with Dexmedetomidine, was a more elderly hypertensive patient who was on numerous drugs, was overweight, was slightly apprehensive and had an ill controlled disease. Thus it was advised against complete stoppage of PD drug pre procedure. Propofol, in our cases seemed to be a better choice mostly in terms of patient comfort taking into consideration the described factors. Dexmedetomidine although pathophysiology wise a better choice, was not as effective alone. A few reports have described its use in combination with intermittent propofol, as was done in our second case [10].

A final mention must be made of the importance of having a backup emergency airway plan and related equipments, especially instruments to remove a stereo-tactic frame in case of an airway emergency [3].

5. Conclusion

Propofol has been conventionally used and has the advantage of familiarity of use but unpredictable effect on neurophysiological testing. Dexmedetomidine is theoretically a better option for testing and patient comfort, but may sometimes not be as effective alone. The choice of sedation for DBS in PD should take into consideration the factors such as patient cooperation, 'drug off' state due to pre-op medication stoppage, GABA versus non GABA-minergic mechanism of drugs, amount of dependence on PD drugs, severity of disease and finally requirement of the testing team. No drug can be singled out to be better and must be chosen based on individual merits of the patient and disease.

Conflict of interest

The authors declare that there is no conflict of interest.

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