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Successful Deep Brain Stimulation Surgery Using Remifentanil Sedation in a Noncompliant Patient With Holmes Tremor

Vincenzo Fodale[a, d], Raffaella Mallamace[a], Sebastiano Lucerna[b], Alfredo Conti[b], Francesca Morgante[c]

Abstract

Holmes tremor is characterized by irregular resting, postural and intention tremors. Deep brain stimulation (DBS) is an effective treatment. A 34-year-old man with Holmes tremor, secondary to head trauma, became agitated during DBS performed under local anesthesia. Remifentanil 0.03 µg/kg/min provided effective sedation and DBS was safety and successful performed.

Keywords: Agitation; Deep brain stimulation; Holmes tremor; Neurosurgery; Remifentanil; Sedation

Introduction

Holmes tremor is a dysfunction of cerebellothalamic and nigrostriatal pathways as a result of stroke, vascular malformation, tumor, multiple sclerosis, trauma, or infection. Tremor is characterized by a combination of irregular resting, postural, and intention movement of large amplitude and slow frequency of less than 4.5 Hz [1].

Medical treatment for Holmes tremor include drugs, botulinum toxin injections, stereotactic surgery and, recently, thalamic deep brain stimulation (DBS) [2]. Implantation of DBS for Holmes tremor is addressed to cases which are refractory to medical treatment. However, DBS surgery is a prolonged, invasive procedure, and patient collaboration is sometime difficult to obtain.

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[a]Department of Human Pathology, Section of Anesthesiology, University of Messina, Italy
[b]Department of Biomedical and Dental Sciences and Morphofunctional Imaging, University of Messina, Messina, Italy
[c]Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy
[d]Corresponding Author: Vincenzo Fodale, Department of Human Pathology, Section of Anesthesiology, University of Messina, Policlinico Universitario Pad. E, Piano 1, Via C. Valeria, 98125 Messina, Italy.
Email: vfodale@unime.it

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Here we present a case report of DBS surgery in a patient with Holmes tremor who, because of the occurrence of agitation and noncompliant behavior, required a sedation protocol.

Case Report

A 34-year-old man (168 cm, 58 kg, BMI 20) was admitted to the neurology department for evaluation and possible treatment because of a 12-year history of debilitating Holmes tremor, which developed after a car crash resulting in closed head trauma involving the frontal-parietal lobe. On examination, postural and action tremor with prevailing interest of pectoralis major, upper trapezius and levator scapulae muscles was observed on the left side. No associated palatal tremor, nystagmus, signs of brain stem dysfunction, chorea, dystonia, bradykinesia or rigidity were evidenced. EEG was unremarkable.

His behavioral disorders were well compensated by the administration of atypical antipsychotic, sodium valproate, and selective serotonin reuptake inhibitors (SSRIs). However, previous medical treatments for tremor (anticholinergics and botulinum toxin injections) had obtained short-term effects (about 20 days).

The patient was therefore scheduled for a DBS implantation. Both he and his relatives were informed on the nature of the procedure and the need for cooperation during the awake surgery procedure. Written informed consent was taken. Patient was then transferred to the neurosurgery clinic.

On the morning of surgery, a stereotactic Leskill head frame was applied to the patient's head after infiltration with lidocaine 2% into scalp and periosteum. Mapping was performed using a StealthStation S7 (Medtronic). Patient was then positioned in a semi-sitting position. Standard monitoring was applied and a forced air-warming device was used for patient comfort and temperature control. Supplemental oxygen (3 L/min) was delivered as standard procedure. During the preparation procedures, the patient was calm and compliant.

However, during surgical drapes positioning, the patient exhibited agitation and was noncompliant. He requested that surgical procedure be stopped. Considering the various options available, the anesthesiologist decided to administer a remifentanil infusion to decrease anxiety level.

Continuous infusion of remifentanil was started at an initial dosage of 0.02 µg/kg/min and thereafter adjusted to 0.03

Figure 1. Deep brain stimulation surgery performed on a patient with Holmes tremor using local anesthesia and remifentanil awake analgo-sedation. The patient is positioned in a semi-sitting position with a Leskill stereotactic frame applied on the head.

μg/kg/min based on patient compliance, to obtain a score of 4 - 5 of the modified observer's assessment of alertness/sedation scale (MOAA/S). Before starting surgery, peri-incisional local anesthesia was administrated using ropivacaina 7.5% and mepivacaine 2%. Approximately 10 min before intraoperative microelectrode recording (MER), remifentanil infusion was stopped. This allows the surgeon to map the target area precisely. During MER, the patient was asked to move arms, hands, feet and/or legs, to target precise electrode insertion. DBS procedure was successfully performed (Fig. 1).The patient did not evidence pain, and vital signs remained stable; no airway obstruction or complications occurred. Patient's postoperative course was uncomplicated, and he was discharged home on postoperative day 4.

Discussion

Numerous anesthetic options have been described for DBS: local anesthesia, regional anesthetic techniques (as well as scalp nerve blockade), intravenous sedation, or general anesthesia. Since MER and macro-stimulation have become important means of localization of brain target, the awake technique has obvious advantages, and most neurosurgical centers avoid general anesthesia, at least during the mapping phase, in order to best detect cellular activity and movement-related responses to neurostimulation. Awake sedation is considered an acceptable alternative.

Sedation with the hypnotic propofol, or benzodiazepines like midazolam, has been used, but administration of these GABAergic sedative agents, despite improved tremor or rigidity, could interfere with brain mapping and DBS electrode implantation. Moreover, these medications easily impair level of consciousness, may cause inability to cooperate during intraoperative testing, as well as respiratory depression, which can lead to disastrous complications in relation to limited airway access due to stereotactic frame presence.

Remifentanil is an opioid analgesic, commonly administered in neuroanesthesia and neurointensive care with an excellent pharmacokinetic profile, short elimination half-life, and a time-independent context-sensitive half-time [3]. Respiratory depression, muscular rigidity and hemodynamic instability are rarely seen at the dosage used for conscious sedation [3]. In relation to these characteristics, remifentanil can be considered a proper analgo-sedative agent for DBS surgery.

In this patient, analgo-sedation with very low doses of the opioid remifentanil provided sedation, obtaining an MOAA/S score of 4 - 5. He was sedated but easily arousable and cooperative with verbal stimulation. Surgical DBS procedure was successfully completed.

Finally, to evaluate the state of sedation, the MOAA/S has been used. Choice of sedation scoring system is a matter of personal preference. However, the MOAA/S scale is directed at determining the degree of suppression of consciousness and is widely used in anesthesia research literature for quantifying the hypnotic effects of drugs.

Conflict of Interest

No authors involved in this case report have any potential conflict of interest.

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Author Contributions

VF conceived and designed the study, RM conducted the literature review and drafted the manuscript, SL and AC conducted data collection and interpretation to the writing of the paper, and FM revised it critically for important intellectual content. All authors were equally involved in reading and final appraisal for publication.

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