Epiretinal Membrane Surgery for a Patient with Dyskinesia Related to Parkinson’s Disease Using Intravenous Dexmedetomidine Administration

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Abstract
General anesthesia is usually selected when patients cannot remain still during surgery with local anesthesia. However, damage to the lungs from positive pressure ventilation under general anesthesia is a major concern in patients with Parkinson’s disease. We report a case in which dyskinesia related to Parkinson’s disease was attenuated by intravenous dexmedetomidine (DEX) administration, following which epiretinal membrane (ERM) and inner limited membrane peeling could be smoothly performed. A 68-year-old woman with systemic dyskinesia related to Parkinson’s disease underwent cataract surgery for her right eye with local anesthesia (topical anesthesia with 4% lidocaine and sub-Tenon’s anesthesia with 2% lidocaine and 30% nitrous oxide inhalation). During the surgery, continuous involuntary facial movement related to Parkinson’s disease remained uncontrollable. One week later, she underwent cataract surgery and pars plana vitrectomy for the ERM of her left eye. In addition to local anesthesia (topical anesthesia with 4% lidocaine and retrobulbar anesthesia with 2% lidocaine and 30% nitrous oxide inhalation), the patient received intravenous DEX, which halted movement from the beginning of surgery until the end. Therefore, ERM surgery was performed without the influence of dyskinesia. This case highlights that intravenous DEX administration can inhibit dyskinesia related to Parkinson’s disease during ERM surgery, which is among the most delicate microscopic procedures performed in ophthalmological...
settings. Additional studies are required to examine the actual effectiveness of DEX administration in patients with Parkinson’s disease-related dyskinesia undergoing ophthalmological procedures.

Introduction

Dexmedetomidine (DEX) is a highly selective α2-adrenoceptor agonist with sedative, analgesic, and opioid-sparing properties. While DEX is mainly utilized in intensive care units due to its demonstrated suitability for achieving both short- and longer term sedation [1, 2], it has more recently been applied in conjunction with local anesthesia in various surgical fields due to its minimal effects on respiratory depression. Several studies have noted that incorporating DEX into the regimen can induce light intraoperative sedation, which can help alleviate the fear of surgery in patients undergoing ophthalmological procedures [3–5].

However, few reports have demonstrated the safety of DEX administration among patients who cannot undergo surgery under local anesthesia due to dyskinesia related to Parkinson’s disease (PD) [6]. To the best of our knowledge, no reports have discussed DEX administration during ophthalmologic surgery for patients who cannot remain still due to PD-related dyskinesia. In this report, we present a case in which intravenous DEX administration temporarily inhibited dyskinesia related to PD, allowing for epiretinal membrane (ERM) surgery without the influence of dyskinesia.

Case Report/Case Presentation

The patient was a 68-year-old woman with PD and hypertension (weight: 58.0 kg, height: 153.3 cm) taking 600 mg of levodopa per day for PD and an angiotensin II receptor blocker for hypertension. She had no diseases other than hypertension and PD, especially respiratory disease. She had cataracts in both eyes and ERM in her left eye. She was first scheduled for cataract surgery for her right eye, followed by cataract surgery and pars plana vitrectomy (PPV) for the ERM in her left eye 1 week later.

At the initial presentation in 2022, the best-corrected visual acuity in the right and left eyes was 1.2 and 0.4, respectively (decimal visual acuity). The intraocular pressure values for the right and left eyes were 17 mm Hg and 13 mm Hg, respectively. No other specific diseases were known to cause decreases in visual acuity in either eye. Slit-lamp examinations consistently revealed uncontrollable systemic movements extending to the face (online suppl. Movie 1; for all online suppl. material, see www.karger.com/doi/10.1159/000527157).

Cataract surgery for the right eye was performed with topical anesthesia using 4% lidocaine, sub-Tenon’s anesthesia using 1 mL of 2% lidocaine, and 30% nitrous oxide inhalation. Her vital signs before surgery were as follows: heart rate (HR) of 67 beats per minute (bpm), blood pressure (BP) of 165/67 mm Hg, and percutaneous oxygen saturation (SpO2) of 96% in room air. Those at the end of surgery were as follows: HR of 69 bpm, BP of 170/100 mm Hg, and SpO2 of 98% in room air.

At the beginning of surgery, she exhibited uncontrollable facial dyskinesia, which remained uncontrollable during surgery despite the anesthesia regimen mentioned above. Although we were able to complete the surgery with extreme caution, the procedure was not considered repeatable or safe. Upon a review of the literature to identify a suitable strategy
for inhibiting dyskinesia, we found one report suggesting that intravenous DEX administration can decrease dyskinesia related to PD during local anesthesia in patients undergoing tension-free vaginal mesh surgery for pelvic organ prolapse [6]. Therefore, we decided to use DEX when performing PPV with ERM and ILM peeling for the other eye.

Cataract and ERM surgery for the left eye was performed with topical anesthesia using 4% lidocaine, retrobulbar anesthesia with 6 mL of 2% lidocaine, 30% nitrous oxide inhalation, and intravenous DEX. The loading dose of DEX was 5.5 μg/kg/h for the initial 10 min after the patient was placed in the surgical chair, while the maintenance dose thereafter was 0.4 μg/kg/h. Her vital signs before surgery were as follows: HR of 67 bpm, BP of 165/67 mm Hg, and SpO2 of 96% in room air. These vital signs were measured every 10 min and remained stable during surgery.

Eight minutes after the start of DEX administration and prior to the administration of retrobulbar anesthesia, which exerts suppressive effects on eye movement, systemic/facial dyskinesia had stopped. This allowed us to perform cataract and ERM surgery without the influence of dyskinesia. Five minutes before the end of the surgery, DEX administration was stopped. Vital signs at the end of surgery were as follows: HR of 69 bpm, BP of 170/100 mm Hg, and SpO2 of 98% in room air. No systemic adverse effects, including respiratory or circulatory depression related to DEX, were observed during or after surgery.

One week after surgery, best-corrected visual acuity values for the right and left eyes were 1.2 and 0.8 (decimal), respectively. Intraocular pressure values for the right and left eyes were 16 mm Hg and 11 mm Hg, respectively. Optical coherence tomography showed an absence of the ERM in the macula of the left eye, and no complications were observed in either eye (Fig. 1).

**Discussion/Conclusion**

The key takeaway of this case is that dyskinesia related to PD can be suppressed via intravenous DEX administration without the need for general anesthesia, allowing for ophthalmologic surgery, including ERM and ILM peeling, which are among the most delicate surgical procedures in the ophthalmologic field. To our knowledge, no other reports have described the use of DEX to suppress PD-related dyskinesia in an ophthalmological surgery setting. However, one group reported successful suppression of PD-related dyskinesia in a patient undergoing tension-free vaginal mesh surgery for pelvic organ prolapse using local anesthesia and DEX [6]. In both cases, the patients were treated with levodopa for PD symptoms. Thus, we believe that DEX inhibited dyskinesia via the same mechanism in both cases [6]. Although the suppressive effects of DEX may be related to the stimulation of α2 receptors...
rather than the GABA_A receptors that induce levodopa-induced dyskinesia, the precise mechanism underlying this phenomenon remains unclear.

We used DEX when performing PPV with ERM and ILM peeling in this patient. Meanwhile, inhalational anesthetics have complex effects on brain dopamine concentrations during general anesthesia. Opioids inhibit dopamine release in the central nervous system and increase the likelihood of muscle rigidity. Therefore, anesthesiologists consider whether patients with PD are vulnerable to anesthetics and opioid side effects [7]. In addition, airway problems due to swallowing disorders in patients with PD and damage to the lungs from positive pressure ventilation under general anesthesia can be concerns. Such cases are thought to be managed by local anesthesia with light sedation under spontaneous respiration [6]. Considering the above, we consulted with the patient and performed the surgery using DEX instead of general anesthesia.

DEX can cause hemodynamic effects such as hypertension, hypotension, and bradycardia [8, 9]. However, DEX is associated with less pronounced respiratory depression [10], making it suitable for ophthalmologists who are not used to general management in cases of failed respiratory or circulatory function.

We believe that DEX can suppress dyskinesia to the extent that delicate microscopic procedures such as ERM and ILM can be performed safely. Therefore, in the future, we aim to examine the actual effectiveness of DEX administration in patients with PD-related dyskinesia undergoing ophthalmological procedures.

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Statement of Ethics

This study protocol was reviewed, and the need for approval was waived by the Ethics Committee of Shinseikai Toyama Hospital. This report adhered to the tenets of the Declaration of Helsinki 1964. Written informed consent was obtained from the patient to publish this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Takafumi Suzuki was involved in the study design, data collection, analysis of the results, and manuscript drafting. Hirofumi Sasajima and Yoshiki Ueta were involved in the analysis of results, manuscript review, and editing. Hidetoshi Ishida, Yoshihiro Hashimoto, and Naoko
Tachi participated in manuscript review and editing. Takafumi Suzuki, Hirofumi Sasajima, Yoshiki Ueta, Hidetoshi Ishida, Yoshihiro Hashimoto, and Naoko Tachi have read and approved the final manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in this article and its online supplementary files. Further inquiries can be directed to the corresponding author.

References

1. Keating GM. Dexmedetomidine: a review of its use for sedation in the intensive care setting. Drugs. 2015 Jul;75(10):1119–30.
2. Afonso J, Reis F. Dexmedetomidine: current role in anesthesia and intensive care. Rev Bras Anestesiol. 2012 Jan-Feb;62(1):118–33.
3. Kumar CM, Chua AWY, Imani F, Sehat-Kashani S. Practical considerations for dexmedetomidine sedation in adult cataract surgery under local/regional anesthesia: a narrative review. Anesth Pain Med. 2021 Sep 18;11(4):e118271.
4. Yuan YJ, Zhou P, Xia F, Zhang XB, He SS, Guo DY, et al. Intranasal dexmedetomidine combined with local anesthesia for conscious sedation during breast lumpectomy: a prospective randomized trial. Oncol Lett. 2020 Oct;20(4):77.
5. Xu T, Chen X, Li X, Wang M, Wang M. Analysis of anesthesia effect of dexmedetomidine in clinical operation of replantation of severed finger. Comput Math Methods Med. 2021 Dec 13;2021:3822450.
6. Nakajima T, Suzuki Y, Miyaue N. Successful management of Parkinson’s disease dyskinesia during local anesthesia with dexmedetomidine. Cureus. 2021 Mar 6;13(3):e13739.
7. Kim JI, Lee DH, Kim H. Bilateral vocal cord paralysis during emergence from general anesthesia in a patient with Parkinson's disease. Saudi J Anaesth. 2020 Jan-Mar;14(1):112–4. Epub 2020 Jan 6.
8. Miller RD. Miller's anesthesia. Philadelphia, PA; Edinburgh: Elsevier Saunders; 2009.
9. Coursin DB, Coursin DB, Maccioli GA. Dexmedetomidine. Curr Opin Crit Care. 2001 Aug;7(4):221–6.
10. Koroglu A, Teksan H, Sagr O, Yucel A, Toprak H, Ersoy O. A comparison of the sedative, hemodynamic, and respiratory effects of dexmedetomidine and propofol in children undergoing magnetic resonance imaging. Anesth Analg. 2006 Jul;103(1):63–7.