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Perioperative Anesthesia Management of a Patient with Mild Cognitive Impairment Before Operation

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Case data

Basic information

A 53-year-old male patient, 172cm in height and 72kg in weight, was admitted to hospital due to "recurrent low back pain for 5+ years, recurrent aggravation with left calf numbness for 2+ months".

History of present disease

The patient developed waist pain and discomfort after fatigue 5+ years ago, which was not paid attention to. After repeated back pain and discomfort, the patient went to a hospital diagnosed as "lumbar disc herniation", and improved after physiotherapy such as "acupuncture and traction". After repeated attacks, each time after physiotherapy improved. In May 2020, the low back pain recurred, and after poor physiotherapy, lumbar MRI was performed in the outpatient department of our hospital, which showed that the L4/5 intervertebral disc was central herniation. The L5/S1 disc has slipped backward and below, narrowing the L5/S1 intervertebral space. Topical plasters, oral drugs and other treatment after the symptom relief is not obvious, the lumbago still repeated attacks; It often appears after fatigue, sitting for a long time and bending for a long time. 2^{+} months ago, the patient had a recurrence of low back pain, which was worse than before, accompanied by numbness and pain in the anterolateral part of the left calf and painful claudication. The patient was admitted to our hospital for further diagnosis and treatment.

Past History

The patient was admitted to the Otolaryngology outpatient Department of our hospital 1^{+} years ago due to "deafness". He went to the outpatient department of Neurology of our hospital for "neurosis and sleep disorder", the specific diagnosis was unknown, and he was treated with alprazolam and other drugs orally, but the effect of private complaint was not good. 1^{+} month ago, he was admitted to a hospital for "poor sleep, memory loss and slow reaction for 1^{+} year" and was diagnosed as "1. The cause of mild cognitive dysfunction to be investigated: Susac syndrome? 2, lacunar cerebral infarction 3, cerebral atrophy ". After treatment with trazodone hydrochloride tablets, oxazepam tablets, acetylglutamine, the effect was poor. The rest of the patient's history was not unusual.

Laboratory examination

Preoperative CT and spinal MRI showed that the L4/5 intervertebral disc was central herniated, and the L5/S1 intervertebral disc was prolapsed backward and below, with secondary spinal stenosis at the corresponding level. Head and face MRI showed that the left lateral ventricle was slightly larger than the contralateral ventricle. A few spot-like shadows in bilateral frontal lobes were considered ischemic foci. No obvious abnormality was found in other examinations of the patient.

Diagnosis

1. L4/5 disc herniation; 2. L5/S1 disc prolapse; 3. Mild cognitive impairment; 4. Sensorineural deafness in both ears; 5. Sleep disorders.

Proposed operation

Lumbar 4/5 and lumbar 5/ sacral 1 intervertebral disc removal , spinal canal decompression, bone grafting, fusion and internal fixation were performed by posterior approach.

Preparation for Anesthesia (or Anesthesia Plan)

Evaluation of anesthesia

2 days before surgery: MMSE scale score 22 points, MoCA scale score 22 points, RCSQ scale score 20mm; 1 day before surgery: MMSE scale score 22 points, MoCA scale score 23 points, RCSQ scale score 23mm. The patient had mild cognitive dysfunction, binaural sensorineural deafness and sleep disorder before surgery. The rest of the patient is OK, NYHA heart function was normal, ASA grade II.

Preparation for anesthesia

After admission, a neurologist was invited for consultation. Consultation opinion: taking Zopiclone tablets and alprazolam to improve sleep, but the effect is not good. The anesthesiology department was invited to consult and evaluate the patient's condition 3 days before surgery. Consultation advice: intranasal administration of fast-acting insulin (20U/ time, twice/day, at 09:00 AM and 19:00 PM) was given from 2 days before surgery until the last time 10 minutes before anesthesia on the day of surgery, to prevent the occurrence of serious perioperative neurocognitive disorders.

Method of anesthesia to be administered

Endotracheal intubation was performed under total intravenous anesthesia and erector spinal block under ultrasound guidance.

Procedure of Anesthesia

Preparation for anesthesia

After entry, invasive arterial pressure was monitored by radial artery puncture and catheterization under local anesthesia and blood gas analysis was performed. ECG, SpO2, PetCO2, BIS and rSO2 were routinely monitored. Peripheral veins were opened and right internal jugular vein catheterization was performed under ultrasound guidance. 20U of fast-acting insulin was administered intranasally 10 minutes before anesthesia.

Induction of anesthesia

Sufentanil 0.4 μg/kg, etomidate 0.3 mg/kg and cisatracurium 0.2 mg/kg were injected intravenously. Endotracheal intubation was performed under visual laryngoscope after the muscle relaxant took effect.

Procedure of anesthesia

Basic vital signs: AIBP 152/89 mm Hg, HR 92 bpm, SpO2 98%, RR 15 bpm, BIS 91, rSO2 left 61.3%, right 61.1%. After anesthesia induction with sufentanil 30 μg, etomidate 20mg and cis-attriumium 14mg in sequence, the glottis was completely exposed with the assistance of visual laryngoscope, and a 7.0 ordinary tracheal intubation was successfully placed with a depth of 22 cm.Vital signs after intubation were: AIBP 113/72mm Hg, HR 78 bpm, SpO2 100%, RR 13bpm, BIS 63, rSO2 62.9% on the left side and 63.0% on the right side. After endotracheal intubation, ventilator was connected to control ventilation, and heating blanket was reasonably applied to keep warm under temperature monitoring. Respiratory parameters: FiO2 70%, VT 6~8 ml/kg, RR 12~15 times/min, I:E 1:2, PEEP 3cmH2O, PetCO2 controlled at 35~45 mmHg. Intraoperative anesthesia was performed by total intravenous anesthesia: The intravenous pump was injected with retroifentanil 0.05-0.2 μg/kg/min and propofol 4-10 mg/kg/h. Dexmedetomidine was pre-injected with a loading dose of 0.8μg/kg within 10 minutes before induction of general anesthesia, and then the infusion was maintained at a constant rate of 0.5μg/ (kg·h), and cisatracurium was intermittently added. Dexmedetomidine infusion was completed 30 minutes before the end of surgery, and remifentanil and propofol infusion 5 minutes before the end of surgery. Intraoperative systolic blood pressure fluctuated from 85 to 143 mmHg, diastolic blood pressure fluctuated from 52 to 90 mmHg, HR fluctuated from 61 to 79bpm, SpO2 maintained at 100%, BIS value fluctuated from 40 to 50, and rSO2 fluctuated from 60.2% to 64.5%.Vasoactive drugs were not used during the operation. 5 minutes after the operation, the patient recovered from spontaneous breathing. 7 minutes after the operation, the patient was conscious, and the conjunctival reflex and swallowing reflex were active. After 5 minutes of deoxygenation observation, SPO2 remained above 90%. At this time, the patient's shoulder was gently patted, the patient's name was loudly called, and the trachea catheter was removed after sputum suction. Three days after operation, patients were treated with intravenous self-control electronic analgesia pump.

Summary of Anesthesia

Intranasal administration of fast-acting insulin (20U/ time, twice/day, at 09:00 AM and 19:00 PM) continued 1-3 days after surgery. Postoperative follow-up was as follows: 1 day after surgery: MMSE scale score 22 points, MoCA scale score 24 points, RCSQ scale score 25mm, RASS score -1 points, CAM-ICU score negative, NRS score 2 points; 2 days after surgery: MMSE scale score 22 points, MoCA scale score 23 points, RCSQ scale score 24mm, RASS score: +1 points, CAM-ICU score: negative, NRS score: 2 points; 3 days after surgery: MMSE scale score 23 points, MoCA scale score 24 points, RCSQ scale score 24mm, RASS score: 0 points, CAM-ICU score: negative, NRS score: 1 point. Compared with the preoperative results, the cognitive function of the patient was not decreased 1-3 days after the operation, and the sleep quality was improved to some extent. The patient was discharged from the hospital 5 days after the operation.

Discuss

Normal aging in the human body is associated with the decline of many cores' cognitive functions. When cognitive deterioration exceeds the normal age-related changes, the ability to perform daily activities to perform daily functions remains largely unchanged, this condition is described as mild cognitive impairment (MCI)[1]. MCI is considered as the pre-clinical stage of dementia, a transitional state between normal aging of the

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brain and dementia, with a high risk of conversion to dementia [2], mainly manifested as memory impairment and/or mild cognitive impairment in language, attention, and visuospatial ability, but normal social, professional or daily life functions [3]. Studies have shown [4] that MCI is being transformed into Alzheimer's disease (AD) at a high rate of 10% ~ 15% every year, and the cognitive impairment and independent function of patients are gradually lost, causing serious social and economic burden to public health care [5]. Therefore, it is urgent to identify patients with MCI before surgery, take active brain protective interventions, and not increase or even reverse the MCI process.

In this case, the patient did not have significant cognitive fluctuations in the whole perioperative period because of the anesthesiologist's close evaluation and treatment from preoperative to intraoperative to postoperative. It was found in the study that MMSE and MoCA were single MCI assessment tools with ideal effect at the present stage [6]. Therefore, MMSE scale and MoCA scale were used to evaluate the cognitive function of patients before surgery, and active intervention was carried out after MCI was found in patients before surgery.In addition, patients have serious sleep disorders before surgery, which often lead to the disturbance of sleep-wake cycle (wake time accounts for a significant increase in the percentage of total sleep time), abnormal hyperactivity of the hypothalamic-pituitary-adrenal axis (which plays an important role in maintaining alertness and regulating sleep), and excessive cortisol secretion affecting cognitive function [7]. After intranasal administration, insulin can cross the blood-brain barrier to reach the central nervous system, inhibit the secretion of the hypothalamic-pituitary-adrenal axis by acting on the hypothalamic nucleus and limbic structures (such as the hippocampus) that can express a large number of insulin receptors, and improve the disorder of sleep cycle [8]. At the same time, previous studies of our research group have shown that repeated intranasal administration of insulin before surgery can prevent POD occurrence in elderly patients after laparoscopic radical resection of gastrointestinal tumors, and reduce plasma levels of TNF-α, IL-1β and IL-6 at the same time [9]. For this patient, intranasal insulin can be given from 2 days before surgery to 3 days after surgery to prevent the aggravation of postoperative cognitive dysfunction. Research shows that SctO2max%>13.74% during lumbar surgery in elderly patients with mild cognitive impairment can be used as an indicator to predict the occurrence of perioperative neurocognitive disorders (PND) [10]. Maintaining BIS value of 40-50 during surgery can reduce the occurrence of PND in elderly patients with mild cognitive impairment [11]. Therefore, in addition to routine monitoring, local cerebral oxygen saturation and BIS can be used to enhance the monitoring of brain function. Studies have shown that sevoflurane aggravates cognitive impairment in MCI patients [12], and preoperative sleep deprivation can further aggravate inflammatory nerve damage caused by inhalation of sevoflurane [13]. Considering this inducing factor, intraoperative induction and maintenance of total intravenous anesthesia can be performed to avoid the use of related drugs that can increase the risk of cognitive dysfunction. A large number of literatures suggest that dexmedetomidine can maintain hemodynamic stability in elderly patients after general anesthesia and alleviate postoperative cognitive dysfunction [14,15]. Therefore, continuous intraoperative injection of dexmedetomidine can play a protective role in the brain. G Zhang found that ultrasound-guided erector ridge muscle plane block could effectively improve postoperative analgesia in patients undergoing decompression and internal fixation, which was conducive to early postoperative recovery [16]. Therefore, preoperative ultrasound-guided erector ridge muscle plane block combined with postoperative PCIA could improve analgesia and reduce the risk of PND caused by pain [13]. Follow-up of patients after surgery is conducive to the detection and timely treatment of PND, which is conducive to the recovery of patients.

In conclusion, for the anesthesia management of preoperative patients with MCI, anesthesiologists should be involved in the active treatment of preoperative, intraoperative and postoperative stages. Preoperative: 1. Preliminary assessment of the patient's condition with some cognitive function assessment scales, so as to know well; 2. 2. Intranasal insulin was administered after confirming the patient with MCI. Intraoperative: 1. Enhanced monitoring of brain function: monitoring BIS and local cerebral oxygen saturation; 2. Use total intravenous anesthesia; 3. Continuous injection of dexmedetomidine during the operation; 4. Avoid the use of high-risk drugs that induce PND. Postoperative: 1. Enhanced analgesia, such as nerve block combined with PCIA; 2. Timely postoperative follow-up.

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