

# Clinical report of delayed recovery after general anaesthesia in elderly patients with cervical spine surgery: A case report

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## Abstract

This report describes a case of a 70-year-old male that underwent decompression laminectomy and internal fixation under general anaesthesia. After extubation, the patient gradually developed no response to instructions and the disturbance of consciousness persisted with unequal pupils in size, but clinical neurological findings and a brain computed tomography scan showed no organic abnormalities. A careful medical history undertaken by anaesthesiologists revealed that the patient had a history of trauma to his left eye, resulting in blindness in this eye, but the surgeons, anaesthesiologists and nurses did not find these problems before the operation. The diagnosis in this case was prolonged unconsciousness due to delayed recovery from anaesthesia. Careful titration of the dose based on individual response in order to reduce adverse effects of general anaesthetics is especially important in elderly patients. Multiple checks of the patient information, surgical safety checklist and medical history by anaesthesiologists, surgeons and nurses can minimize the chance of an adverse outcome.

## Keywords

Case report, posterior cervical decompression and fusion, cerebrovascular accident, delayed recovery, anaesthesia, Swiss Cheese Model

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## Introduction

An abnormally slow rate in regaining consciousness after general anaesthesia is characterized by persistent somnolence. It is



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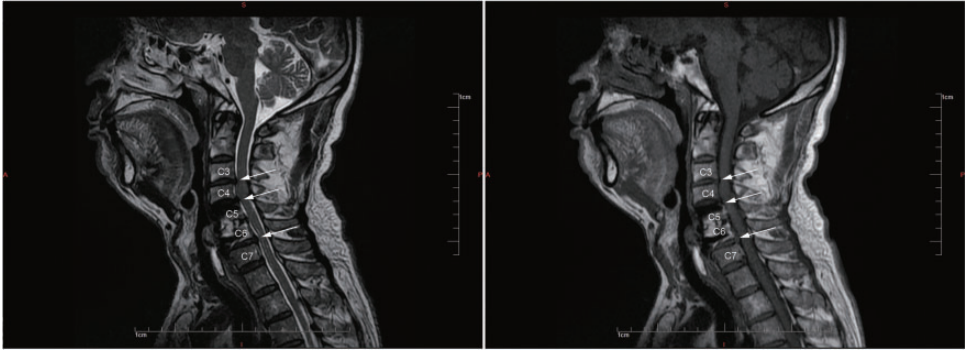
medically defined as a state of unresponsiveness from which the patient cannot be aroused.<sup>1</sup> Delayed recovery from anaesthesia is often multifactorial and the main cause can be due to physiological causes (hypoglycaemia, hyperglycaemia, dyselectrolytaemia, hypothermia, cerebral hypoxia, intracerebral event) or pharmacological causes (opioid/benzodiazepine over dosage, central nervous system depressants, residual neuromuscular blockade).<sup>2</sup> In addition, the occurrence of delayed recovery usually relates to an underlying undiagnosed condition or medical error.<sup>3</sup> Recognizing organic conditions is important as they require prompt surgical intervention to reverse serious sequelae, especially in head or neck surgery, as this type of surgery may be associated with serious postoperative complications such as stroke. Of course, accurately collecting information on patient interview and checklists to ensure that all information exists can also reduce the risk and harm to patients. This current case report describes an elderly male patient with delayed awakening from general anaesthesia after undergoing cervical spine surgery.

## **Case report**

In June 2020, a 70-year-old male (weight 62 kg, height 172 cm) attended the Department of Anaesthesia, Huzhou Central Hospital, Affiliated Central Hospital Huzhou University, Huzhou, Zhejiang Province, China with a history of pain in his left shoulder of 2 months duration. He had undergone an anterior cervical surgery because of an infected of cervical intervertebral space 6 months previously. He had a history of hypertension for 10 years and no other major medical history was noted. There was no history of medication other than oral calcium channel blockers to control blood pressure within the normal range. During the physical

examination, an old surgical scar could be seen on the neck. There was pain in the left shoulder and anterolateral of the left upper limb. Neurological examination revealed that the left traction test of the brachial plexus (Eaton test) was positive, patellar and achilles tendon reflexes were normal, Hoffman's sign was negative and the muscle strength was grade 5 for the upper limbs on both sides. Preoperative blood investigations and electrocardiogram were within normal limits. Magnetic resonance imaging revealed changes after C5/C6 vertebral body fixation and prolapsed intervertebral discs at the C3/4, C4/5 and C6/7 levels (Figure 1). The patient was diagnosed with adjacent segment degeneration after anterior cervical fusion and left rotator cuff injury. A decompression laminectomy with internal fixation of C3–C6 was planned by the posterior cervical approach under general anaesthesia.

On the day of surgery, the patient received his morning dose of anti-hypertensives and no other premedication. In the operating room, the patient was monitored with three-lead electrocardiography, pulse oximetry and noninvasive blood pressure measurement. His initial blood pressure was 149/103 mmHg, heart rate was 59 beats/min (bpm) and peripheral oxygen saturation was 97%. Anaesthesia was induced with 70 mg propofol (single intravenous injection at a rate of 20 mg/10 s) and 30 µg sufentanil (single intravenous injection (lasting approximately 10 s)). Rocuronium 50 mg was administered to facilitate endotracheal intubation (single intravenous injection) and intermittent positive pressure ventilation was commenced. Balanced anaesthesia was maintained with an intravenous infusion of propofol 2–4 mg/kg per h, remifentanyl 2–4 µg/kg per h and sevoflurane in 60% oxygen with air. Intraoperatively, end-tidal carbon dioxide concentration, volatile anaesthetic concentration, minimal alveolar concentration,



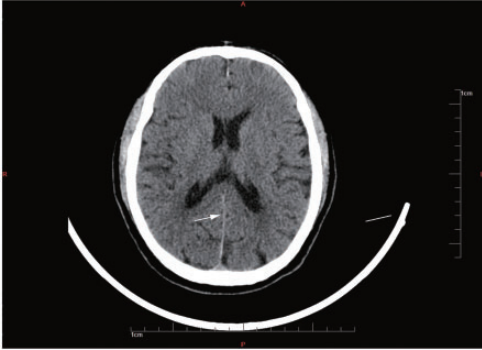
**Figure 1.** Magnetic resonance imaging of a 70-year-old male that presented with a history of pain in his left shoulder of 2 months duration revealed changes after C5/C6 vertebral body fixation and prolapsed intervertebral discs at the C3/C4, C4/C5 and C6/C7 levels (arrows). The patient was diagnosed with adjacent segment degeneration after anterior cervical fusion and left rotator cuff injury. A decompression laminectomy with internal fixation of C3–C6 was planned by the posterior cervical approach under general anaesthesia.

fraction of inspired and expired oxygen concentration, and degree of neuromuscular blockade were monitored. Surgeons used screws to fix the plate to the lateral mass on both sides of C3, C4 and C6; and performed decompression laminectomy of C3–C6. The analgesics and antiemetics administered were 100 mg tramadol, 16 mg lornoxicam and 3 mg granisetron (single intravenous injection), 15 min before the end of surgery; and the patient also received incision ropivacaine local infiltrating anaesthesia. The intraoperative procedure was uneventful. During surgery, systolic blood pressure ranged between 100 and 135 mmHg, heart rate between 55 and 81 bpm, and peripheral oxygen saturation between 99–100%. The surgery lasted 3.5 h and he received 1.5 l of crystalloids. Estimated blood loss was 50 ml and urine output was 600 ml.

At 10 min after surgery, the patient was drowsy but was following verbal commands and he was then extubated. Oxygen was given by mask and changes in vital signs were observed. During the next 30 min, he was unable to obey verbal commands, but spontaneous breathing was maintained with

stable haemodynamics. He only slightly opened his eyes up to 1 h and 30 min after extubation and did not respond to instructions. The anaesthesiologist found that his pupils were unequal in size, the pupil on the left was dilated and did not react to the light or accommodation. The anaesthesiologists and surgeons informed the patient's family of his status and obtained consent from his family members for further examinations and diagnosis.

The decision was made to obtain a head computed tomography (CT) scan in order to rule out an intracranial haematoma or other cerebrovascular accidents, but clinical neurological findings and the brain CT scan showed no organic abnormalities (Figure 2). In addition, an arterial blood gas sample was analysed and revealed the following: pH 7.353, PaCO<sub>2</sub> 44.4 mmHg, PaO<sub>2</sub> 224.4 mmHg, Na<sup>+</sup> 139 mmol/l, K<sup>+</sup> 3.65 mmol/l, glucose 7.8 mmol/l and Ca<sup>++</sup> 1.153 mmol/l. Due to the patient's unexpected status, a multi-disciplinary consultation was organized, including the Department of Neurology and Department of Neurosurgery, although the neurological physical examination was negative. The anaesthesiologists made a detailed



**Figure 2.** Plain computed tomography scan of the brain of a 70-year-old male to rule out an intracranial haematoma or other cerebrovascular accidents when he failed to awaken correctly after general anaesthesia showed that the density of the interhemispheric fissure (arrow) was slightly higher than normal but there were no organic abnormalities.

inquiry about the patient's medical history from his family members, which revealed that the patient had a history of trauma to his left eye and the pupil in this eye was dilated. The patient was able to move his extremities and obey commands at 200 min after extubation. He recovered and was discharged 12 days after the operation.

The study was approved by the Ethics Committee of Huzhou Central Hospital, Affiliated Central Hospital Huzhou University, Huzhou, Zhejiang Province, China (no. 2022-0801). The patient was informed of the anaesthesia method that would be used before the operation and provided written informed consent for anaesthesia. Written informed consent was also obtained from the patient for the publication of this report and any accompanying images. The report conformed with the CARE guidelines.<sup>4</sup>

## Discussion

At present, with the widespread use of short-acting anaesthetic agents, patients

usually awaken quickly after general anaesthesia. If disturbance of consciousness persists, anaesthesiologists must pay more attention to the accurate diagnosis of the underlying cause, especially in head or neck surgery, as this type of surgery can carry a potential risk of stroke. Posterior cervical discectomy with fusion is an established intervention for cervical degenerative disease. Although stroke during cervical spine surgery in a patient without previous neurological deficit is a rare event, a previous report described a case of a cerebrovascular accident resulting from occlusion of the basilar artery during cervical spine surgery in a previously asymptomatic patient.<sup>5</sup> Currently, only a few case reports have described patients suffering from strokes following cervical spine surgery.<sup>6-9</sup> Unfortunately, the current patient gradually developed no response to instructions and persistent disturbance of consciousness following extubation. The detailed medical history inquiry by the anaesthesiologists revealed that the patient had a history of trauma to the left eye and the pupil in this eye was dilated. In addition, the clinical neurological findings and findings of the brain CT scan excluded a cerebrovascular accident. The clinical team had cause for concern after the work-up was negative and additional questions remained.

Delayed recovery from anaesthesia is feared by all anaesthesiologists. It is generally believed that the main cause of delayed awakening following anaesthesia is an overdose of anaesthetic agents administered in the perioperative period. With increased age, the patient's physical function shows degenerative changes including within the central nervous system and this may explain the perceived decrease in anaesthetic agent requirements in elderly patients. The changes in pharmacokinetics and pharmacodynamics of elderly patients result in a diminished rate of elimination, and the drug dose administered should be reduced,

especially opioids and benzodiazepines. Studies have shown that the demand for opioids is reduced by almost 50% in geriatric patients.<sup>3</sup> A prospective study found that older patients required 20% less tramadol than younger patients.<sup>10</sup> Therefore, careful titration of the dose based on the individual response to reduce adverse effects of general anaesthetics, opioids and benzodiazepines is especially important in elderly patients. In the current case, anaesthesia was induced with 30 µg sufentanil, and 100 mg tramadol and 16 mg lornoxicam were administered 15 min before the end of the operation. In addition, incision ropivacaine local infiltrating anaesthesia was administered. For a 70-year-old patient, that could have led to anaesthetic agent overdose. Drowsiness due to tramadol and drug–drug interactions may prolong the awake time of patients. Some underlying physiological or metabolic disorders such as hypoglycaemia, hyperglycaemia, dyselectrolytaemia, hypothermia, cerebral hypoxia and intracerebral events may also be responsible for delayed recovery following anaesthesia. In the current case, blood gas analysis, electrolyte examination and brain CT imaging during the operation ruled out the above conditions. A previous case report described a patient with hysterical paralysis after spinal cord stimulator implantation caused by psychiatric disorders.<sup>9</sup> The patient did not respond to painful stimuli, and different from the current case, they used a standard dose of anaesthetics and all organic factors were excluded with appropriate tests and consultations.<sup>9</sup>

In the current case, the patient had a history of trauma to his left eye. The anaesthesiologists, surgeons and nurses did not know about this although he had undergone surgery 6 months previously. The lack of information regarding the patient's medical history and careless examination can be categorized as medical errors that

cannot be assigned to only one person or a forgotten physical examination. Arguably, this was the result of the accumulation of negligence and loopholes in multiple links. These error accumulations were modelled in a Swiss Cheese Model.<sup>11</sup> In this model, a security system with close links is similar to the slices of Swiss cheese, each piece of cheese represents a defence line, and the holes in the slices represent potential system weaknesses. The existence of holes in any block usually does not result in failure, but if the holes on each slice connect into a line, the probability of accidents will be higher. In the current case, the following occurred: (i) the patient's clinical history was not adequately inquired at the previous operation; (ii) the orthopaedic surgeon referred to the medical record of the previous operation and did not perform a detailed physical examination; (iii) similarly, the medical history inquiry by nurses often referred to that by the doctors; (iv) the preoperative anaesthesiology evaluation was careless; (v) the handover between the ward nurses and operating room nurses on the day of the operation made the same mistakes; (vi) in addition, an overdose of anaesthetic agents may have been administered. Any single error in a procedure could be mitigated by other procedures, but all the above errors eventually led to the final adverse event.

In clinical anaesthesia, anaesthesiologists often face the problems of high workload and a highly effective flow process that affect the safety of anaesthesia, as well as problems of staff shortage, unskilled staff, equipment failure, careless shift handover and poor communication. Each of these may lead to the occurrence of adverse events in the perioperative period.<sup>12</sup> The current case highlights the importance of the careful titration of the anaesthetic dose in elderly patients based on an individual's response. Although stroke during cervical spine surgery in a previously



asymptomatic patient is a rare event, ruling out an intracranial haematoma or other cerebrovascular accidents is necessary. In addition, multiple checks of the patient information, surgical safety checklist and medical history by anaesthesiologists, surgeons and nurses can minimize the chance of an adverse outcome.

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### Author contributions

Y.L. designed the report and wrote the manuscript. Y.L. and H.L.H. reviewed the literature, collected the data and reviewed the manuscript.

### Declaration of conflicting interests

The authors declare that there are no conflicts of interest.

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