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## Respiratory roller coaster ride following ambulatory surgery in a young woman: A case report

Yijun Liu, Xiaoyan Zhu\*, Yongqiu Xie, Jianqin Yan, Qulian Guo

Department of Anesthesiology, Xiangya Hospital of Central South University, Hunan, 410008, China

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## ABSTRACT

**INTRODUCTION:** Ambulatory surgery has the advantages of shortening the waiting time for hospitalization and reducing medical expenses. It has been more and more widely used in recent years in China. The patients admitted in Ambulatory Surgery Center are generally in good condition (ASA I-II), with clear diagnosis, short operation time, low operation risk and low incidence of postoperative complications. It is easy to paralyze the medical staff, neglecting the importance of preoperative preparation, and then causing physical and psychological damage to the patient.

**PRESENTATION OF CASE:** We describe the case of a 21-year-old woman, presented with erratic respiratory rate with a maximum of 40 breaths  $\text{min}^{-1}$  and a minimum of 7 breaths  $\text{min}^{-1}$  after undergoing arthroscopic meniscectomy. The arterial blood gas analysis revealed a disruption of the acid-base homeostasis with respiratory alkalosis and metabolic acidosis, while all other examinations were normal.

**DISCUSSION:** Drug-related adverse reactions, emergence agitation or psychiatric factors may have caused the observed symptoms.

**CONCLUSION:** Our observations demonstrate that more extensive clinical and psychological examinations prior to surgery involving general anesthesia may help in avoiding anesthesia-related complications, even in young individuals from the Ambulatory Surgery Center.

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## 1. Introduction

Anesthesiologists are often faced with postoperative respiratory complications, with a myriad of possible causes such as organic diseases, drug-related adverse reactions, or complications in the ventilation process. The incidence of postoperative respiratory complications following surgical procedures ranges from 2 to 5.6%, thus representing the second most common peri- and postoperative complication after wound infection [1]. This has severe implications for affected patients, who may suffer from respiratory failure, which in turn is associated with extended hospital stays, increasing financial burden, and increased mortality [1–3]. There-

fore, careful monitoring of anesthesia and respiratory function are essential in the prevention and limitation of such complications.

In the present study, we report for the first time a case of a severely erratic respiratory pattern with large fluctuations in the respiratory rate (RR) following arthroscopic meniscectomy. The patient provided written consent for the publication of this case report. This work has been reported in line with the SCARE 2018 criteria [4].

## 2. Presentation of case

A 21-year-old woman was admitted to our hospital with a 3-year history of pain in the right knee joint. Magnetic resonance imaging (MRI) examination showed a meniscus cyst in the right knee. Biochemical examinations, drug history, family history and psychosocial history were normal. The patient presented for right knee arthroscopic meniscectomy at the Ambulatory Surgery Center, Xiangya Hospital, China. The patient's perioperative examinations are listed in Table 1. Anesthesia was induced using dezocine 2 mg, midazolam 1 mg, sufentanil 0.01 mg, cis-atracurium 6 mg, and etomidate 20 mg. Endotracheal intubation with visual laryngoscope was smooth and without complications. Continuous infusion of propofol (10 mg/mL) and remifentanyl (0.02 mg/mL) was used to

**Abbreviations:** BP, blood pressure; CT, computed tomography; EA, emergence agitation; HR, heart rate; MRI, magnetic resonance imaging;  $\text{PaCO}_2$ , partial pressure of carbon dioxide;  $\text{PaO}_2$ , partial pressure of oxygen; RR, respiratory rate;  $\text{SpO}_2$ , pulse oxygen saturation.

\* Corresponding author at: Department of Anesthesiology, Xiangya Hospital of Central South University, 87 Xiangya Road, Changsha, Hunan, 410008, China.

E-mail addresses: [18373165010@163.com](mailto:18373165010@163.com) (Y. Liu), [xiaoyanzhu@csu.edu.cn](mailto:xiaoyanzhu@csu.edu.cn) (X. Zhu), [yongqiuxie@163.com](mailto:yongqiuxie@163.com) (Y. Xie), [1489122054@qq.com](mailto:1489122054@qq.com) (J. Yan), [qulianguo@hotmail.com](mailto:qulianguo@hotmail.com) (Q. Guo).

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**Table 1**  
Timeline and examinations of the case.

Time	Examination	Incident/examination results
Pre-operation	Vital signs Preoperative examinations <sup>a</sup>	BP 130/70 mm Hg; HR 85 beats min <sup>-1</sup> ; RR 18 breaths min <sup>-1</sup> ; SpO <sub>2</sub> 100% Normal
10:10AM-11:15AM	Operation	
11:50AM	Extubation	
12:30PM	<b>Erratic respiratory pattern</b>	
12:35PM	Blood gas analysis	Respiratory alkalosis in combination with metabolic acidosis
15:00PM	CT	No new organic disease
16:50PM	Blood glucose Coagulation function Blood electrolytes <sup>b</sup> D-dimer	7.38 mmol L <sup>-1</sup> Normal
17:00PM	<b>Symptoms relieved</b>	

BP, blood pressure; HR, heart rate; RR, respiratory rate; SpO<sub>2</sub>, pulse oxygen saturation; CT, computed tomography.

<sup>a</sup> Preoperative examinations include complete blood count, renal and liver function, blood electrolytes, coagulation function, chest radiography and electrocardiogram.

<sup>b</sup> Blood electrolytes include the concentration of sodium, potassium, calcium and chloride ions.

maintain anesthesia. The procedure was performed by an orthopedic surgeon with more than 10 years of clinical experience. Ondansetron (8 mg) and parecoxib (40 mg) were given 30 min prior to the end of surgery, which lasted 65 min without any complications.

The extubation at the postanesthesia care unit was smooth and the immediate pain score was 3. Shortly thereafter, the patient had shivering and dyspnea, but the vital signs were stable. She was given tramadol 100 mg i.v., which alleviated the patient's shivering, whereas dyspnea had not significantly improved. About 15 min later, the patient's dyspnea worsened with tachypnea, blood pressure (BP) was 140/80 mm Hg, heart rate (HR) was 80 beats/min, RR was 32 breaths/min, and pulse oxygen saturation (SpO<sub>2</sub>) was 80 %. The arterial blood gas analysis showed that pH was 7.65, arterial partial pressure of carbon dioxide (PaCO<sub>2</sub>) and oxygen (PaO<sub>2</sub>) were 15 mm Hg and 196 mm Hg, respectively, Na<sup>+</sup> was 134 mmol/L, K<sup>+</sup> was 4 mmol/L, HCO<sub>3</sub><sup>-</sup> was 16.5 mmol/L, and lactic acid was 4.2 mmol/L, which together indicated that the patient had respiratory alkalosis in combination with metabolic acidosis. The patient was given oxygen by mask immediately and both dexamethasone (10 mg) and methylprednisolone (40 mg) were given by i.v. injection. Subsequently, her SpO<sub>2</sub> increased to 98 %, but her RR was abnormal, characterized by large fluctuations: the quickest RR was 40 breaths/min and the slowest was 7 breaths/min, which was accompanied by headache and elevated BP. Another arterial blood gas analysis was performed when the patient's RR rose again, showing that all measures remained relatively unchanged (pH was 7.57, PaCO<sub>2</sub> was 24 mm Hg, PaO<sub>2</sub> was 148 mm Hg, Na<sup>+</sup> was 132 mmol/L, K<sup>+</sup> was 4.4 mmol/L, and HCO<sub>3</sub><sup>-</sup> was 22 mmol/L). Consequently, a computed tomography (CT) scan was conducted for brain, lung and mediastinum. CT results showed symmetrical calcification of bilateral globus pallidus and nodules of the right upper lung. The symptoms gradually relieved without further intervention thereafter. No abnormality was found in blood glucose levels, blood coagulation function and D-dimer levels, and the pain score decreased to 1. The patient was discharged 3 days after surgery and we followed her up by phone three months later. She recovered well, and there was no recurrence of the above abnormal symptoms, nor did she have any complications or adverse events [4].

### 3. Discussion and conclusions

In the present study, a young female patient had respiratory complications characterized by dyspnea and tachypnea, with a highly erratic RR following arthroscopic meniscectomy. Based on the laboratory examinations we can exclude organic diseases, which may cause postoperative respiratory symptoms such as

acute pulmonary edema, pulmonary embolism, or stroke. There are several possible explanations for the present case including drug-related adverse reactions, emergence agitation (EA), and psychiatric factors.

The patient has never received anesthesia before. Consequently, the observed symptoms may have been caused by drug-related adverse events, which would explain the transient nature of the symptoms in relation to the pharmacokinetics of the administered drugs.

Tramadol has analgesic activity mainly via stimulating the  $\mu$ -opioid receptor and enhancing inhibitory effects on pain transmission in the spinal cord [5]. In the present case, tramadol alleviated postoperative shivering, but the RR remained abnormal and the dyspnea exacerbated. Remarkably, the duration of symptoms coincided with the half-life of tramadol (6h), strongly supporting the hypothesis that this drug may have been responsible for causing the observed respiratory complications.

In addition to nausea (6.1 %), dizziness (4.6 %), drowsiness (2.4 %), and fatigue (2.3 %), epilepsy and serotonin syndrome can be caused by tramadol [6]. Some indications suggest that the complications observed in the present case could be explained by serotonin syndrome. The clinical features of this syndrome involve mental state change, hyperactive autonomic system and neuromuscular abnormalities [7]. These features may in turn manifest as symptoms such as headache, hypertension, or shortness of breath [8]. It is conceivable that the latter symptom may have added to the respiratory complications of our patient. However, the lack of laboratory evidence does not allow a diagnosis of serotonin syndrome. Furthermore, while tramadol alone may cause this syndrome [9], it is usually caused by a combination of tramadol with other drugs, in particular antidepressants.

Dezocine has agonist-antagonist effects on opioid receptors, which can alleviate pain by specifically stimulating the  $\kappa$  receptor [10]. It is commonly used to reduce choking cough caused by sufentanil and to prevent etomidate-induced injection pain, and it may cause adverse reactions related to respiration (<1 %), such as respiratory depression, respiratory symptoms, and atelectasis. Although there are no reports about such adverse events in the literature, we cannot exclude the possibility that this drug may have played a role in the present case.

EA refers to a temporary state of excitement of mental and motor functions during the recovery period of anesthesia, and may be triggered by preoperative cognitive impairment, pain, or the use of an endotracheal catheter [11]. Clinical manifestations are disturbance of consciousness and aggressive behavior, which are usually accompanied by abnormal vital signs such as shortness of breath,

elevated BP, and/or increased HR. The incidence of EA ranges from 4.7%–19% [12].

In addition to sex, age, and use of general anesthesia, abnormal RR with elevated BP, headache, and anxiety (Riker Sedation-Agitation Scale score was 5 and Richmond Agitation-Sedation Scale score was 1) are observations supporting EA in the present case. Nevertheless, the patient's cognitive function and memory were not impaired. Therefore, the respiratory complications observed in the present study may be only partially explained by EA.

Another possible cause for the observed symptoms in the present case may be of psychiatric nature, including dissociative disorder. Its clinical features can be divided into several types, including invasive disorder of consciousness and behavior, and partial or complete loss of neuropsychiatric function [13].

Postoperative dissociative disorder is a rare complication and there is a lack of relevant retrospective analysis and research. Tanaka and colleagues published a case of a 30-year-old woman who had dyspnea after general anesthesia, and who was diagnosed with dissociative disorder by Case Management Inventory and Minnesota Multiphasic Personality Inventory psychological tests [14]. While we have no information on the psychiatric history or postoperative psychological state of the patient in the present study, there are some similarities with the previously-mentioned case such as sex, age, application of general anesthesia, as well as respiratory complications. Other potential factors of psychological nature may be based on postoperative traumatic stress, such as intraoperative awareness, delirium, pain, or panic. Such stress occurs in about 20 % of patients after surgery under general anesthesia [15].

While a lack of clinical measures does not allow to draw a final conclusion, it is possible that a combination of factors may have caused the respiratory complications in the present case. Insufficient clinical evidence, besides the lack of a psychological evaluation, is the main limitation of our study. The development of efficient and feasible methods for the monitoring of potential drug-related adverse effects, beyond the measurement of vital signs, would be helpful for future studies. Thus, while it is likely that the patient had adverse reactions to anesthesia-inducing drugs, we cannot exclude that EA or psychiatric factors may have also played a role. A previous report has pointed out that the level of preoperative anxiety can be used to predict the occurrence of emergence delirium and postoperative behavioral changes [16] but there is a lack of research about the effect of preoperative psychological evaluation on EA and postoperative mental disorders.

In conclusion, apart from careful consideration of potential known adverse reactions to certain drugs and the close monitoring of patients following general anesthesia, preoperative psychological evaluation may be helpful in the prevention of postoperative mental complications.

#### Declaration of Competing Interest

None.

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#### Ethical approval

This case report is exempt from ethical approval in our institution.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Author contribution

Yijun Liu and Xiaoyan Zhu: study design, data analysis and writing the manuscript.

Yongqiu Xie, Jianqin Yan and Qulian Guo: data analysis.

#### Registration of research studies

- 1 Name of the registry: This is not a research study, thus it is not registered.
- 2 Unique identifying number or registration ID: There is no number.
- 3 Hyperlink to your specific registration (must be publicly accessible and will be checked): There is no link.

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