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The primary aim of *World Journal of Clinical Cases (WJCC, World J Clin Cases)* is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

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Unexpected difficult airway due to severe upper tracheal distortion: A case report

Jian-Wei Zhou, Chuan-Guang Wang, Gang Chen, You-Fa Zhou, Jia-Feng Ding, Jia-Wei Zhang

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Abstract

BACKGROUND

Difficult airway is a significant cause of anesthesia-associated death and disability. Currently, physical examinations of thyromental distance, mouth opening, Mafampai classification, *etc.* combined with X-ray, computed tomography (CT), and other imaging technologies are mainly used to evaluate difficult airways. However, in many special cases, *i.e.*, emergency surgery, imaging examinations cannot be completed preoperatively. Such patients' airway can only be evaluated through general physical examination, which inevitably increases the likelihood of an unexpected difficult airway during anesthesia.

CASE SUMMARY

We report a rare case of difficult intubation because of severe upper trachea distortion after induction. Emergency holmium laser lithotripsy was performed under transurethral ureteroscopy because the patient had anuria for 4 d and a creatinine level of 890 $\mu\text{mol/L}$. Due to the urgency of the condition, chest radiography or chest CT was not examined before surgery and the anesthesiologist did not evaluate the airway adequately, resulting in an unexpected difficult airway.

CONCLUSION

The incidence of tracheal malformation and tracheal stenosis is extremely low, but the risk of hypoxia and even death due to difficult airways is extremely high for such patients. It is recommended to complete preoperative imaging examinations

of the airway. For life-threatening emergency patients, a pre-anesthesia reassessment should be performed and surgeons should be prepared to prevent and manage the difficult airway.

Key Words: Tracheal distortion; Difficult airway; Management; Imaging examination; Emergency

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Core Tip: In this paper, we report a case of severe upper tracheal distortion resulting in an unexpectedly difficult airway. The incidence of tracheal malformation and tracheal stenosis is extremely low, but the risk of hypoxia and even death due to difficult airways is extremely high for such patients. It is recommended to complete preoperative imaging examinations of the airway. For life-threatening emergency patients, a pre-anesthesia reassessment should be performed, attention should be paid to bedside physical examination, and surgeons should be prepared to prevent and manage the difficult airway.

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INTRODUCTION

Difficult airway is a significant cause of anesthesia-associated death and disability; a previous study suggests that 30% of anesthesia-associated death events are related to improper airway safety management[1,2]. Currently, physical examinations of thyromental distance, mouth opening, Mafampaii classification, *etc.* combined with X-ray, computed tomography (CT), and other imaging technologies are mainly used to evaluate difficult airways. However, in many special cases, *i.e.*, emergency surgery, imaging examinations cannot be completed preoperatively. Such patients' airway can only be evaluated through general physical examination, which inevitably increases the likelihood of an unexpected difficult airway during anesthesia[3,4]. Herein we report the anesthesia care of a patient who underwent emergency surgery with an unexpected difficult airway due to severe upper tracheal distortion.

CASE PRESENTATION

Chief complaints

A male patient presented with left lumbago with anuria for 4 d.

History of present illness

The patient developed left lumbago and anuria for 4 d without obvious inducement. He was diagnosed with left ureteral calculi accompanied by hydronephrosis and infection, renal failure, urinary tract infection, gallbladder calculi, traumatic osteoarthropathy of the right hip joint, and hypertension.

History of past illness

The patient had previous hypertension for many years (taking amlodipine tablets 5 mg, QD), his blood pressure control was reasonable, and he had no headache, dizziness, or discomfort. He had a history of right hip injury in childhood, hepatitis, and tuberculosis.

Personal and family history

This part does not cover related content.

Physical examination

The physical examinations revealed the following: Temperature: 36.5 °C; Pulse rate: 78 times/min; Respiration rate: 20 times/min; Blood pressure: 213/102 mmHg; Height 160 cm; Weight 55 kg; Scoliosis; Rales in the lower lungs; Deformity of the right lower limb; Percussive pain in the left kidney area (+).

Laboratory examinations

Positive laboratory results mainly included C-reactive protein 47.65 mg/L, white blood cell count $12.7 \times 10^9/L$, creatinine 890 $\mu\text{mol/L}$, and potassium 4.80 mmol/L.

Imaging examinations

Ultrasonography of the urinary system showed nephrocalcinosis with echogenic changes and hydronephrosis of the right kidney; compensatory renal enlargement with echogenic change and multiple renal calculi with hydronephrosis of the left kidney, as well as dilation of the left upper ureter. Abdominal CT showed left lower ureteral calculi with upper urinary tract hydroureter, ascites, nephrocalcinosis of the right kidney, and bilateral renal small calculi. Preoperative diagnoses included renal failure, hyperkalemia, and left ureteral calculi with hydroureter and infection. In order to find the real cause of the patient's unanticipated difficult airway, postoperative CT scan and 3D reconstruction of the trachea (see Figures 1 and 2) and fiberoptic bronchoscopy (see Figure 3) were performed after receiving the patient's informed consent.

FINAL DIAGNOSIS

The final diagnoses were as follows: (1) Ureteral calculus with hydronephrosis and infection (left); (2) Kidney failure; (3) Urinary tract infection; (4) Bronchitis; (5) Hypertension; (6) Emphysema; and (7) Traumatic arthropathy of the hip (right).

TREATMENT

Emergency holmium laser lithotripsy was performed under transurethral ureteroscopy and general anesthesia.

OUTCOME AND FOLLOW-UP

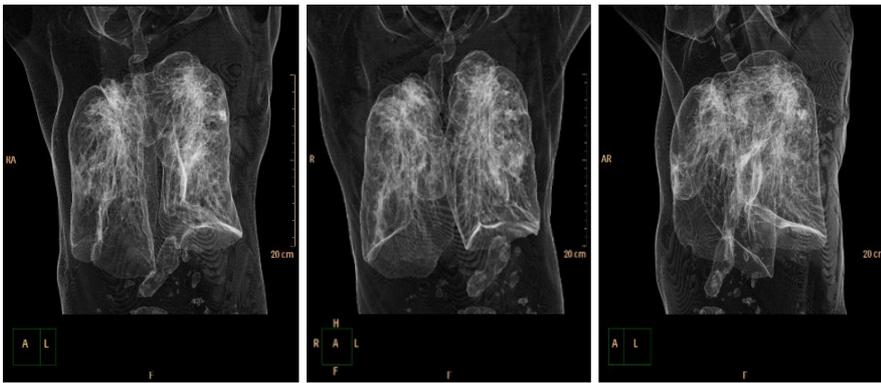
No adverse events occurred, and the patient benefited from timely treatment in accordance with the guidelines.

DISCUSSION

The incidence of tracheal malformation and tracheal stenosis is extremely low, and its pathogenesis is still unclear. It is believed that factors causing abnormal differentiation of tissues and organs could lead to tracheal dysplasia or malformed changes resulting in a difficult airway perioperatively[5]. Medical risks are also different due to various factors such as the patient's characteristics, medical history, surgical method, and current condition[6]. Since the airway cannot be opened, the chance of severe complications such as cerebral hypoxia or cardiac arrest in a short period of time increases[7]. To prevent such risks clinically, airway assessment has become a critical part of preoperative risk assessment to prevent the difficult airway from causing severe anesthesia complications or even death.

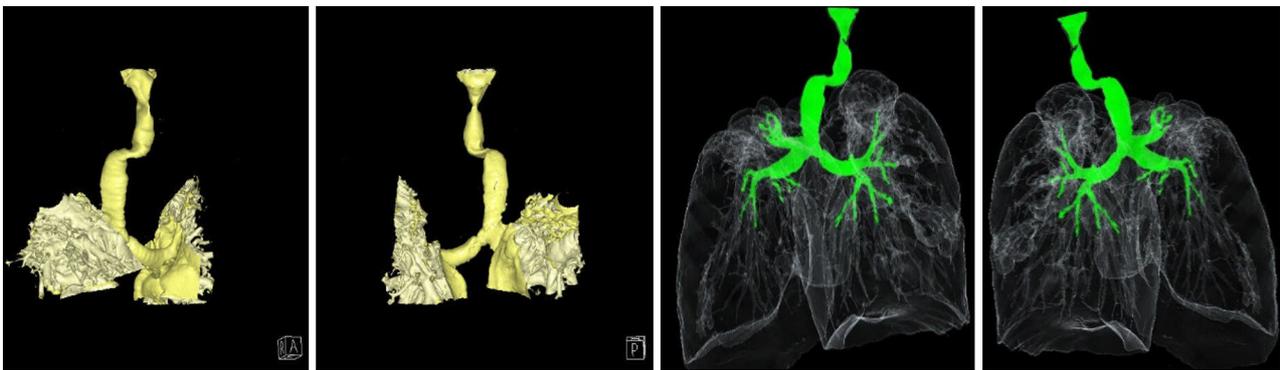
A previous study has suggested that three-dimensional reconstruction of the trachea and bronchus has high sensitivity and accuracy in diagnosing tracheobronchial stenosis[8]. The patient's postoperative airway reconstruction from CT images suggested a severe rightward twist at about 2.8 cm below the glottis of the main trachea, and the twist turned laterally at about 1.1 cm and then downward until the tracheal jugum. Meanwhile, tracheoscopy revealed severe twisting of the main trachea with mild stenosis. This result was consistent with the difficulty of inserting the tracheal catheter after it was 2 cm passing through the glottis and the condition of two consecutive turns found under fiberoptic bronchial guidance. It further confirmed that the patient's severe tracheal distortion caused the inability of the steel-wire reinforced tracheal tube to pass through the corner with stenosis. Due to surgical urgency, although the basic condition of the patient was assessed before anesthesia, because the patient's trachea was twisted high and close to his larynx, condition like malformation of the trachea was not detected in time during the assessment, resulting in the unexpected difficult airway. Fortunately, in this case, the anesthesiologist mastered good airway safety management skills and followed the difficult airway management guidelines to adopt standardized procedures to manage unexpected difficult airways in the critical situation, thus not leading to serious adverse consequences[9].

Further inquiry of the medical history after the operation revealed that the patient had secondary tuberculosis for more than 40 years and developed thoracic scoliosis 5 years ago, but the patient denied any history of poliomyelitis and other diseases. Considering the patient's imaging findings, his long-



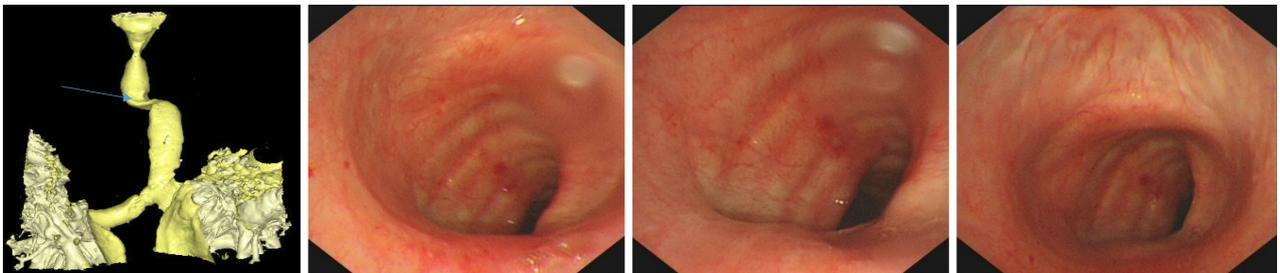
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Figure 1 3D computed tomography scan image of trachea and lung.



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Figure 2 3D computed tomography reconstruction of the trachea.



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Figure 3 Image under bronchoscopy. The blue arrow shows the site of distortion of the upper airway, the fiberoptic bronchoscopy figures are more intuitive.

term chronic secondary tuberculosis may have led to significant lateral traction of the lung tissue, which caused a twisted trachea. In addition, given the patient's conditions of thoracic scoliosis, thoracic malformation, *etc.*, severe tracheal distortion and stenosis caused by the above reasons cannot be ruled out. To this end, we searched the studies in multiple databases, and no report of severe trachea distortion caused by diseases, *i.e.*, tuberculosis, was reported, while the studies and reports about etiologies of airway distortion have suggested that the history of diphtheria in childhood, airway fatty deposition, and mucopolysaccharidosis can lead to severe airway stenosis and trachea tortuosity[10-12]. However, when the patient's medical history was further inquired about after surgery to understand his specific condition, it was found that the patient had only a junior education level, paid minimal attention to his diseases, and had no relevant medical information records. As a result, the abovementioned influencing factors could not be confirmed by the patient's past illness history.

According to the above discussions, anesthesiologists should clinically pay close attention to unexpected difficult airways, especially in emergency surgery patients. Sorbello *et al*[13] confirmed that the commonly used clinical methods to measure airway difficulty include Mafampaii classification, thyromental distance, mouth opening, head-neck range of motion, chest-chin distance, *etc.* However,

these methods cannot accurately predict the probability of intubation difficulty when performing laryngoscopy directly. It is believed that no perfect airway assessment tool can comprehensively address the risk assessment needs of patients with a difficult airway. In contrast, the combined analysis of multiple assessment tools can better predict complex and difficult airways[14]. The study also suggested that preoperative airway ultrasound can be used to evaluate the intubation conditions of patients. However, it is unclear which specific ultrasonic scan parameters can be used as reliable indicators for evaluating difficult airways[15,16].

Hence, when a patient does not have distinctive features of difficult airway, such as glossohypertrophy, oral soft tissue abscesses, and lack of radiological imaging results due to emergency resuscitation or other reasons, more attention should be paid to bedside assessment. Especially, preoperative airway imaging including ultrasonography of airway, pulmonary auscultation, *etc.* are particularly important[17-19]. The patient was in critical condition upon admission; therefore, emergency ureteroscopy holmium laser lithotripsy was performed without a preoperative chest radiology examination, resulting in inadequate preparation before anesthesia, the inability to assess the risk of anesthesia before surgery fully, as well as an unexpected difficult airway. Fortunately, no adverse event occurred due to proper management.

CONCLUSION

In summary, severe upper tracheal malformation in adult patients is very rare, but the risk of hypoxia and even death due to difficult airways is extremely high for such patients. Especially for patients with a preoperative history of neck trauma surgery, pulmonary tuberculosis, diphtheria, airway fatty deposition, mucopolysaccharidosis, *etc.*, enough attention should be paid to perioperative anesthesia and safety management. It is recommended to complete preoperative imaging examinations of the airway as much as possible. For life-threatening emergency patients, a pre-anesthesia reassessment should be performed, attention should be paid to bedside physical examination, and surgeons always be prepared to prevent and manage the difficult airway.

FOOTNOTES

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