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Anesthetic Management of a Difficult Airway in a Patient with Renal Osteodystrophy and Secondary Hyperparathyroidism: A Case Report

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Abstract

Renal osteodystrophy (ROD) is a systemic bone metabolic disease caused by renal dysfunction and is a significant complication in patients with late-stage chronic kidney disease (CKD) or those undergoing hemodialysis. Patients with chronic kidney disease undergo long-term dialysis, which can lead to secondary hyperparathyroidism, hypocalcemia, hyperphosphatemia, and aluminium toxicity. This case presents a middle-aged woman who underwent long-term dialysis for uremia and developed hyperparathyroidism. She was scheduled to undergo parathyroidectomy under general anesthesia. During the pre-anesthesia assessment, deformities were found in the patient's maxillofacial region. It was suspected that there would be difficulty with face mask ventilation and tracheal intubation. In this case, fibreoptic bronchoscopy-guided endotracheal intubation was successfully performed under mild sedation. An individualized anesthesia plan was developed, and successful airway management was achieved. Ultimately, the patient's surgery went smoothly, with the tracheal tube being safely removed afterwards.

Keywords

Chronic Kidney Disease, CKD, Renal Osteodystrophy, Hyperphosphatemia, Difficult Airway, Awake Tracheal Intubation, Endotracheal Intubation

Introduction

Chronic kidney disease (CKD) is a very common condition and has become one of the leading non-communicable causes of death worldwide. It refers to the chronic structural and functional impairment of the kidneys caused by various factors (with a history of kidney damage of more than three months). Renal osteodystrophy (ROD) is a systemic bone metabolic disease caused by renal dysfunction and is a significant complication in patients with late-stage chronic kidney disease or who are undergoing hemodialysis. Patients with chronic kidney disease undergo long-term dialysis, which can lead to secondary hyperparathyroidism, hypocalcemia, hyperphosphatemia, and aluminium toxicity. These conditions are ultimately reflected in the bone structure as renal bone malnutrition. Individuals with severe ROD may experience reduced height due to the decalcification of the long bones in the limbs and spine, resulting in osteoporosis, osteomalacia, and skeletal deformities [1-3].

Case Presentation

A 42-year-old female patient with a history of uremia lasting more than five years. An external examination

revealed elevated blood calcium levels, indicating hyperparathyroidism. Parathyroidectomy is planned. Preoperative examinations revealed skeletal abnormalities in the maxillofacial region (**Fig-1**), including a collapsed nasal bridge, retracted mandible, hyperplastic hard palate and gums, and a small oral cavity. According to the Mallampati classification, the patient is graded as IV, with no visible soft palate, pharyngeal arch, or uvula. There were no obvious abnormalities in neck movement, and the patient reported having a regular liquid diet and experiencing no breathlessness after exercise. The patient snores during sleep but does not wake up.

Fig-1: Abnormal Human Face Appearances

Collapsed Nasal Bridge, Retracted Mandible, Hyperplastic Hard Palate and Gums

Preparing Anesthesia Personnel:

Performing intubation procedures under the supervision of experienced physicians and assistants.

Difficult Airway Preparation:

Non-invasive tools include various sizes and shapes of direct laryngoscopes, a visual laryngoscope, and a fibreoptic bronchoscope. Invasive tools include equipment for emergency airway management, such as cricothyroid puncture tubes, transbronchial jet ventilation (TTJV) tubes, cricothyroid puncture ventilation tubes, and cervical anterior surgical airway establishment devices.

Preparation of Induction Drugs:

Lidocaine hydrochloride, tetracaine, penehyclidine, propofol, midazolam, dexmedetomidine, sufentanil, rocuronium, and remifentanil.

Anesthesia Monitoring:

After the patient enters the operating room, an electrocardiogram, oxygen saturation, and non-invasive blood pressure are obtained, and oxygen (fresh air flow rate of approximately 6 L/min) is inhaled through a mask for more than three minutes.

Anesthetic Induction:

Explained to the patient the reasons and steps for performing awake tracheal intubation and obtained the patient's cooperation. 1 mg of penehyclidine was injected intravenously to reduce glandular secretion; 1 mg of midazolam was injected intravenously to provide sedation; and a continuous infusion of 0.4 μg/kg/min of dexmedetomidine was used to relieve the patient's anxiety. Lidocaine emulsion was administered orally, and 100 mg of lidocaine was used for surface anesthesia of the throat through a disposable spray. 25 mg of tetracaine was used for cricothyroid membrane puncture. Once the local anesthetic had taken effect, a 6.0 mm reinforced endotracheal tube was inserted under the guidance of a fibreoptic bronchoscope.

The patient tolerated this well and showed no obvious signs of coughing. Then connected to a ventilator, the tidal volume was approximately 300 ml, with an end-tidal carbon dioxide level of 40 mmHg. Confirm that the tracheal tube was in place, then administered propofol, rocuronium, and sufentanil intravenously in sequence. Sevoflurane was used to maintain anesthesia, and remifentanil was administered continuously for analgesia. After the surgery, the patient regained consciousness, fully recovered spontaneous breathing, and was able to open his eyes on command. The tracheal tube was then removed. The patient underwent surgery successfully and was discharged from the hospital three days later.

Discussion

Every anesthesiologist will inevitably encounter difficult airways at some point in their career. To ensure the safety and quality of anesthesia, it is necessary for anesthesiologists to be proficient in the management of difficult airways. Difficult airways can present as difficulty with mask ventilation, difficulty with tracheal intubation, or both [4]. For anticipated difficult airways, a careful preoperative assessment of the airway is especially important. This includes evaluating the patient's medical history, Mallampati grading, mouth opening, nail-chin distance, chest-chin distance, and neck movement [5,6].

Awake tracheal intubation is currently the safest method of intubation for difficult airways. Establishing an artificial airway while preserving the patient's ability to breathe spontaneously can maximize oxygenation and prevent adverse events such as hypoxic respiratory arrest caused by an inability to ventilate [7,8]. Fibreoptic bronchoscopy is the gold standard for successful tracheal intubation in cases of a difficult airway, and it is the most commonly used technique in clinical practice [9]. The patient in this case had facial deformities, a collapsed nasal cavity, and was expected to have difficulty with facemask ventilation and tracheal intubation. The small oral volume and the overgrowth of the upper jaw and gums made it difficult to insert a laryngoscope, and endotracheal intubation was impossible. Therefore, our patient underwent transnasal tracheal intubation guided by fibreoptic bronchoscopy.

Due to the protrusion of the patient's jaw and face, mask ventilation was suspected to be difficult. If a conventional anesthesia induction protocol had been used, intubation might have failed, the mask might not have been able to ventilate, and oxygen saturation might not have been maintained. Therefore, in this case, the patient needed to choose an appropriate face mask for ventilation and underwent awake tracheal intubation. Awake tracheal intubation can cause severe reactions in the pharynx and airways, leading to anxiety, coughing, and severe hemodynamic fluctuations. Therefore, effective anesthesia of the airway is key to successful tracheal intubation.

Current analgesic techniques include surface anesthesia and nerve block. Surface anesthesia involves the use of lidocaine spray, lidocaine mucus, and atomised lidocaine. Circumcision may also be used to anesthetize the airways [10]. Neural blocks include the superior laryngeal nerve block, the recurrent laryngeal nerve block, and the glossopharyngeal nerve block [4,11,12]. However, a single oral and nasal surface anesthetic cannot fully prevent stress responses such as coughing, glottal closure, and vomiting; various drugs or methods were used to suppress stress reactions, reduce airway reflexes, improve patient comfort and cooperation, and enhance hemodynamic stability. This ensured the safe and effective establishment of an artificial airway [13,14].

In this case, once the patient was in the operation room, we administered a low dose of sufentanil for analgesia, alongside midazolam and dexmedetomidine for sedation. We then performed a cricothyroid puncture and applied lidocaine for surface anesthesia, closely monitoring vital signs throughout to minimize the stress response caused by tracheal intubation. The patient tolerated the process of fibreoptic bronchoscopy-guided endotracheal intubation well and did not experience any significant cardiovascular complications.

Managing difficult airways is undoubtedly a major challenge for anesthesiologists. Incorrect management can result in irreversible damage or even death for the patient. Therefore, anesthesiologists must be proficient in difficult airway intubation techniques, improve the success rate of the first attempt at tracheal intubation, and minimise or avoid adverse events. They should also enhance their theoretical understanding of difficult airways and refine their practical skills. Regular simulation training on difficult airway skills would help them to recognize difficult airways more quickly, standardize assessment procedures, and reduce intubation injuries. Conducting repeated simulation training enables us to prevent disasters such as asphyxiation and hypoxia while ensuring patient airway safety.

Conflict of Interest

The author has read and approved the final version of the manuscript. The author has no conflicts of interest to declare.

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