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CLINICAL INFORMATION

Maintenance of balance between airway pressure and intracranial pressure in a patient with tracheal stenosis undergoing craniotomy: a case report



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KEYWORDS

Craniotomy;
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Abstract

Background and objectives: Tracheal stenosis is a rare but a life-threatening condition and anesthesia of a patient with tracheal stenosis is challenging for anesthesiologists. Maintaining stable hemodynamics and ventilation parameters are important issues in neuroanesthesia. Any increase in airway peak pressure and $ETCO_2$ will result in increase in intracranial pressure which must be avoided during craniotomies. Tracheal stenosis could be a reason for increased airway pressure.

Case report: We described a patient undergoing craniotomy with tracheal stenosis.

Conclusion: Detailed preparation for intubation, to stabilize airway dynamics and to make the right decision for the surgery were important points. To maintain of a good balance between cerebral dynamics and airway dynamics were the pearls of this case.

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PALAVRAS-CHAVE

Craniotomia;
Estenose traqueal;
Pressão intracraniana

Manutenção do equilíbrio entre a pressão das vias aéreas e a pressão intracraniana em paciente com estenose traqueal submetido à craniotomia: relato de caso

Resumo

Justificativa e objetivos: Estenose traqueal é uma doença rara, mas de risco, e a anestesia em paciente com estenose traqueal é um desafio para os anesthesiologistas. Manter os parâmetros hemodinâmicos estáveis e a ventilação são questões importantes em neuroanestesia. Qualquer aumento da pressão de pico das vias aéreas e da $ETCO_2$ resultará em aumento da pressão intracraniana, o que deve ser evitado durante craniotomias. A estenose traqueal pode ser uma razão para o aumento da pressão das vias aéreas.

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Relato de caso: Descrevemos o caso de um paciente submetido à craniotomia com estenose traqueal.

Conclusão: A preparação detalhada para a intubação, estabilizar a dinâmica das vias aéreas e tomar a decisão certa para a cirurgia foram pontos importantes. Manter um bom equilíbrio entre a dinâmica cerebral e a dinâmica das vias aéreas foi a pérola deste caso.

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Introduction

Tracheal stenosis is a rare but life-threatening condition. It may be caused by congenital problems, postintubation injury, trauma, intratracheal tumors, or compression by extratracheal tumors.¹ Anesthesia in patients with tracheal stenosis is challenging for anesthesiologists. In addition, anesthetic management of patients undergoing craniotomy requires special attention to maintain stable cerebral hemodynamics. After taking consent from patient for publication we herein describe a patient with tracheal stenosis who underwent craniotomy for treatment of a supratentorial mass.

Case description

A 58-year-old woman was admitted to our hospital for vision problems caused by an intracranial mass. She had tracheal stenosis due to prolonged intubation in 1999 and underwent tracheal stenting in 2000. She subsequently developed respiratory distress, and the stent was removed in 2005 at her request. Since that time, she has experienced dyspnea, orthopnea, and limited effort capacity. After taking the patient's consent the preoperative evaluation performed, her physical evaluation revealed rough breath sounds, and arterial blood gas analysis indicated mildly impaired oxygenation (pO_2 , 58; SpO_2 , 91%; pCO_2 , 41.9; FiO_2 , 0.21). Spirometry in the sitting position gave unreliable results because the patient was uncooperative. Thoracic computed tomography revealed tracheal stenosis that began 2 cm distal to the vocal cords and continued 2 cm into the trachea. Upon arrival in the operating room, routine monitoring was begun. We were prepared for difficult intubation (different size of laryngoscopes, laryngeal mask airways, bronchoscopy, tracheostomy set). Anesthesia was induced with Pentothal, safe mask ventilation was established, and rocuronium was administered. Laryngoscopy allowed for visualization of the stenosis just under the vocal cords, and the Cormack–Lehane score was I. In the first intubation attempt, a no. 7 tube was unable to pass the stenosis. Hence, we tried no. 6 and 5.5 tubes. We avoided using a smaller tube because the increased airway pressure would compromise the cerebral pressure. We decided to evaluate the ventilation parameters with the use of a no. 5.5 tube. Although the tube could not be advanced past the stenosis, the patient's ventilation could be adequately managed. The

tidal volume was 400 mL, frequency was 14/min, peak pressure was 27 mmHg, and $ETCO_2$ was 35 mmHg. We followed the peak pressure and $ETCO_2$ values. Because peak pressure of the airway and $ETCO_2$ remained stable, we decided to let the surgeons to perform the surgery. All parameters remained stable during surgery. After the surgery, the patient was safely extubated with sugammadex and followed up in the intensive care unit. Her arterial blood gas levels were in the normal ranges. She stayed in the intensive care unit for 2 days before transfer.

Discussion

This case is about a stenosis that was located 2 cm distal to the vocal cords and could be easily seen with laryngoscopy. After preparing the appropriate equipment for difficult intubation and attempting to establish the airway with various tube sizes, a suitable tube with which to maintain an acceptable airway pressure was found. After attempting to pass a no. 5.5 tube, we did not try a smaller one because of concerns about increasing the peak pressure of the airway. We decided instead to monitor the pressures as displayed on the ventilator. The peak pressure was maintained at 27 mmHg, and the $ETCO_2$ was 35–38. After monitoring these values for some time, we allowed the surgeons to perform the surgery. No problems were encountered during surgery.

We planned to create a tracheostomy under the stenosis if any problems with the airway pressures occurred. Because this procedure is more invasive and complicated, it was not our first choice.

Maintaining cerebral hemodynamics during craniotomy is important in the field of neuroanesthesia. Appropriate management of hemodynamic variables is a cornerstone of anesthesia for patients undergoing craniotomy and includes manipulation of the arterial blood pressure, airway pressure, and cerebral blood flow. In addition, intracranial dynamics are related to respiratory dynamics. When the $ETCO_2$ rises in association with any changes in respiratory function, cerebral vasodilation occurs and the intracranial pressure rises, compromising the cerebral metabolism. Achieving stable respiratory dynamics is important in the performance of craniotomy.²

Postintubation tracheal stenosis was first recognized as a phenomenon in 1880, after Mac Ewen instituted prolonged endotracheal intubation in four patients with upper airway obstruction.³ Prolonged intubation may result in tracheal

stenosis at various levels within the trachea.⁴ Other factors promote stenosis include; a history of previous intubation or tracheostomy, excessive corticosteroid use, advanced age, the estrogen effect in female patients, severe respiratory failure, severe reflux disease, autoimmune disease, obstructive sleep apnea, and radiation therapy for oropharyngeal and laryngeal cancer.¹

Stenosis can occur anywhere from the level of the endotracheal tube, but the most common sites are the area of contact between the endotracheal tube cuff and tracheal wall. The American Society of Anesthesiologists practice guidelines for management of the difficult airway primarily focus on problems in the extrathoracic airway and may not be helpful for the management of patients with intrathoracic tracheal stenosis.⁵

For patients with tracheal stenosis, the anesthesiologist must be prepared for a difficult airway and difficult intubation, and have specialized equipment available. The anesthesiologist must always be prepared with other plans in case of failure. Different sizes of endotracheal tubes, various supraglottic airway devices, and bronchoscopy and tracheostomy equipment must be ready for airway management.

The maintenance of stable hemodynamics and ventilation parameters is important in the field of neuroanesthesia. Any increase in the peak pressure of the airway or ETCO_2 will result in an increase in the intracranial pressure, which

must be avoided during craniotomy. Tracheal stenosis may increase the airway pressure. Patients with tracheal stenosis undergoing craniotomy require special attention in this respect. Careful preparation for a possible difficult airway and intubation, stabilization of airway dynamics, and careful attention to the timing of surgery are important.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Koshkareva Y, Gaughan JP, Soliman AM. Risk factors for adult laryngotracheal stenosis: a review of 74 cases. *Ann Otol Rhinol Laryngol.* 2007;116:206–10.
2. Wijayatilake DS, Shepherd SJ, Sherren PB. Updates in the management of intracranial pressure in traumatic brain injury. *Curr Opin Anesthesiol.* 2012;25:540–7.
3. MacEwen W. Clinical observations on the introduction of tracheal tubes by the mouth instead of performing tracheotomy or laryngotomy. *Br Med J.* 1880;2:122–4.
4. Poetker DM, Ettema SL, Blumin JH, et al. Association of airway abnormalities and risk factors in 37 subglottic stenosis patients. *Otolaryngol Head Neck Surg.* 2006;135:434–7.
5. Isono S, Kitamura Y, Asai T, et al. Case scenario: perioperative airway management of a patient with tracheal stenosis. *Anesthesiology.* 2010;112:970–8.