CASE REPORTS

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Case report

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„SABER-SHEATH” TRAHEJA KAO IZAZOV ZA BEZBEDNU HIRURGIJU – PRIKAZ SLUČAJA

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Summary

Introduction. Saber-sheath trachea is a rare malformation of the trachea marked with coronal narrowing with concomitant widening of sagittal diameter, with a sagittal-to-coronal diameter ratio exceeding 2:1. As tracheal rings are stiff and do not collapse around the tube, the intubation is difficult. Case Report. A 53-year-old female was referred to our hospital due to failed intubation at the local hospital during a planned surgery of skin melanoma. The patient was scheduled for surgery in our hospital, her case was presented to a panel of anesthesiologists and she was prepared for surgery. The intubation failed again, even though a video-assisted laryngoscope and endotracheal tube with 5 mm internal diameter was used. The anesthesiologist noticed that the endotracheal tube entered the trachea only 2 cm due to strong resistance, so further intubation was not an option in order to avoid damaging the trachea. The surgery was performed in local anesthesia with analgosedation. Later on, computed tomography was done, because of suspected pathological process compressing trachea, but the radiologist described the anomaly as saber-sheath trachea. One year later, the patient presented with axillary lymph node metastases and needed another surgery. This time the anesthesiologist knew about the trachea malformation, anticipated difficult intubation and used i-gel™ for airway management. Conclusion. Despite the fact that numerous methods have been developed for the purpose of identifying patients at risk of difficult intubation, there are many unexpected airway pathologies that can lead to failed intubation. Adequate preoperative assessment, knowledge of Guidelines for Difficult Intubation Management, availability of supraglottic airway devices, and cooperation between the surgeon and anesthesiologist, are crucial to successful patient management.

Keywords: Trachea; Cartilage; Intubation, Intratracheal; Anesthesia, General; Airway Obstruction; Tracheal Stenosis; Perioperative Care; Airway Management; Laryngeal Masks

Sažetak

Uvod. Saber-sheat traheja je retka malformacija traheje za koju je karakteristično suženje koronalnog, a proširenje sagitalnog dijame- tra u odnosu 2 : 1. Trahealni prstenovi su zadebljeni, a intubacija je otežana. Prikaz slučaja. U našu bolnicu je upućena 53-godišnja žena zbog neuspešne intubacije u regionalnoj bolnici, gde je pripremana za operaciju melanoma kože. U našoj ustanovi ovaj slučaj je prezentovan konzilijumu anesteziologa i pacijentkinja je pripremljena za operaciju. Ni ovaj put anesteziolog nije uspeo da intubira pacijentkinju, iako je koristio video-laringoskop i endoktrahealni tubus unutrašnjeg dijama eter od 5 mm. Uočeno je da tubus ulazi svega 2 cm u traheju, nakon čega se nailazi na veliki otpor, a zbog čega se odustalo od dalje intubacije kako bi se izbegla povreda traheje. Operacija je urađena u lokalnoj anestezijskoj u analgosedaciji. U postoperativnom periodu urađena je kompjuterizovana tomografija vrata i grudnog koša zbog sumnje da neki patološki proces u gradu koša pritiska traheju, ali je radiolog opisao anomaliju označenu kao saber-sheat traheja. Go- dinu dana kasnije, kod bolesnice su se razvile metastaze u pazuhnim limfnim čvorovima i ponovo je bila neophodna operacija. Ovaj put anesteziolog još je bio upoznat sa malformacijom traheje, očekivano je otežanu intubaciju i uspešno obezbedio disajni put korisnjenjem i-gel™ supraglotičnog sredstva. Zaključak. I pored raznih metoda koje su razvijene sa ciljem identificiranja prediktora teške intuba- cije, postoje brojni neočekivani patološki procesi traheje koji mogu da onemoguću intubaciju. Adevratna preoperativna procena, po- znavaanje preporuka za problematičan disajni put, dostupnost supraglotičnih sredstava i saradnja hirurga i anesteziologa značajni su koraci ka uspešnom tretmanu pacijenta.

Ključne reči: traheja; hrskavica; intratrahealna intubacija; opšta anestezija; opstrukcija disajnih puteva; stenoza traheje; perioperativna nega; zbrinjavanje disajnih puteva; laringealna maska

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Introduction

Establishment of safe airway and good ventilation during operation is essential for every surgery. Numerous guidelines and morphometric tests have been developed in order to preoperatively identify patients who are at risk of difficult intubation, but half of difficult intubations are still unexpected [1–3]. Any kind of tracheal malformation, congenital or acquired, that is unrecognized before surgery may cause intubation failure and postpone the surgical procedure. On the other hand, forced intubation through a narrowed trachea can lead to tracheal rupture, uncommon, but a very serious complication [4, 5]. The shape of trachea is variable and can have different configurations at multiple levels [6].

One of the abnormal morphological shapes is saber-sheath trachea [7]. The saber-sheath trachea is defined as intrathoracic coronal narrowing with concomitant widening of the sagittal diameter, with a sagittal-to-coronal diameter ratio exceeding 2:1. At the same time, the extrathoracic trachea is normal. A deformed trachea is unlikely to collapse and it makes endotracheal intubation difficult. This malformation is more common in males and is usually associated with chronic obstructive pulmonary disease (COPD) [8].

We report a female patient undergoing surgery for melanoma that was twice preoperatively evaluated by anesthesiologists and was not identified as potentially difficult intubation, but later on, after two unsuccessful intubation attempts, she was diagnosed with saber-sheath trachea.

Case Report

A 53-year-old female was referred to the Clinical Center of Vojvodina due to unsuccessful attempt of intubation in a local hospital. She needed a surgery for a rapidly growing skin tumor that was diagnosed as melanoma. The patient underwent a standard preparation for this type of surgery. The preoperative chest X-ray was unremarkable. The patient was a non-smoker, with controlled hypertension, body mass index 34.34 kg/m² (body weight – 89 kg, height - 161 cm, obese class I), American Society of Anesthesiologists (ASA) III, Mallampati class II, Patil > 6 cm, neck circumference 39 cm, no evidence of obstructive sleep apnea or snoring. Preoperative assessment of this patient did not indicate potential intubation problems. The patient was scheduled for radical surgery in general anesthesia, but the surgery was canceled due to unsuccessful intubation. No further diagnostic procedures were done, and the patient was referred to a tertiary health center. Two weeks later, the patient was scheduled for surgery and was admitted to the Clinic of Plastic and Reconstructive Surgery. Her case was presented to a panel of anesthesiologists, and besides standard preparation, an opinion of an ear-nose-throat specialist was requested. Indirect laryngoscopy was unremarkable. The intubation failed again, even though a video-assisted laryngoscope and endotracheal tube (ETT) with 7 mm internal diameter (ID) was used, then 6 mm ID, and finally 5 mm ID. According to Cormack-Lehane classification, the patient was grade I. The anesthesiologist noticed that ETT was entering trachea only 2 cm and then there was a strong resistance so she did not want to force further intubation in order to avoid tracheal injury. The patient was operated under local anesthesia with analgesia. The anesthesiologist indicated that further diagnostic procedures should be done in order to evaluate the tracheal lumen and a potential pathologic process in the thorax. A computed tomography (CT) was done and the radiologist described the anomaly called saber-sheath trachea (Figure 1). There was a coronal narrowing of the intrathoracic portion of trachea with widening of the sagittal diameter at some levels.

Figure 1. Saber-sheath deformity of the trachea; computed tomography scans: A) axial view, B) coronal view

Abbreviations
ETT – endotracheal tube
COPD – chronic obstructive pulmonary disease
ID – internal diameter
CT – computed tomography

Slika 1. „Sabersheath” deformitet traheje – kompjuterizovana tomografija: A) aksijalni presek, B) koronalni presek
reaching 3:1 (18 x 6 mm). The findings also showed ossification of tracheal rings with thickening of the tracheal wall (maximum 6 mm) and irregular inside and outside tracheal contours with a few diverticula (Figure 2).

One year later, the patient presented with axillary lymph node metastases and had to undergo surgery again. This time the surgeon and anesthesiologist knew about the tracheal malformation, anticipated difficult intubation and planned a different approach to anesthesia.

In the operating room, after preoxygenation of the patient in supine position, she was given premedication, 1 mg of midazolam and 50 µg of fentanyl. Anesthesia was induced with 200 mg of propofol. The next step was introducing a supraglottic airway device i-gel™ No 4, that was done easily and fixed to the mouth by using adhesive tapes. A muscle relaxant was not used, as difficult airway management was expected. The maintenance of anesthesia was done using sevoflurane MAC 2, 100 µg of fentanyl and oxygen-air mixture 50:50. Anesthesia apparatus settings were tidal volume 8 ml/kg and 12 breaths per minute. The patient was ventilated mechanically without noticeable air leakage during the surgery. After finishing the surgery, i-gel™ was removed and the patient regained consciousness without any respiratory problems Afterwards.

**Discussion**

Safe airway management is a predisposition for every surgery requiring endotracheal intubation. Any kind of malformation of the trachea can be challenging for an anesthesiologist, especially if unrecognized before entering the operating room [9]. Standard preoperative imaging, if not required differently, generally includes only a chest X-ray, but tracheal malformations may not always be apparent, as in this case.

Difficult intubation with apparent airway obstruction, as in our patient, raises suspicion of some benign or malignant intrathoracic process or some disease that can affect the trachea, especially bearing in mind that this patient was already diagnosed with a malignant tumor - melanoma [10]. Even though the patient presented with a malignant disease, she had no significant respiratory problems, so there was no reason for performing a CT instead of chest X-ray routinely, as part of preoperative preparation. Later on, the CT showed a saber-sheath trachea. As can be seen from the literature, CT is the imaging modality of choice for trachea [11–14]. It shows the tracheal anatomy, but also enables good evaluation of adjacent mediastinal structures and intrathoracic masses that may compress the trachea or invade its walls. It also provides important morphological information concerning vascular elements and calcification of structures that can be important in recognition of some particular pathology.

This malformation is commonly associated with COPD, emphysema, chronic bronchitis and bronchiolitis obliterans syndrome after lung transplantation [15, 16]. It is believed that in COPD patients recurrent coughing and elevated intrathoracic pressure cause tracheal injuries repeatedly. Degeneration and calcification of the cartilaginous rings during the healing process lead to remodeling and bending of rings that are seen in this specific deformity. The trachea becomes rigid and inflexible.

Our patient was a non-smoker and did not have COPD or any other kind of respiratory disease in her medical history. Her chest X-ray was described as regular, so there was no reason for additional imaging procedures during a standard preparation for melanoma surgery. The problem with intubation occurred twice, in two different hospitals, with two different doctors trying to perform intubation and both made the same remark on tracheal obstruction. We assumed that there was some intrathoracic process, some constricting mediastinal mass, possible secondary deposits of melanoma or something else that had to be further diagnosed.

Tracheal stenosis influences the clinical decision making process with regard to the mode of intubation, whether to use some supraglottic airway device or ETT, which size of ETT to use, and if there is a need for video- or fibre-optically guided intubation. From the anesthesiologists’ point of view, there are many problems connected with this deformity of the trachea. The most important issue is placement of ETT through a narrow and stiff trachea. If this problem is successfully solved, there is a possibility of air leaking as circular shaped balloon on endotracheal tube cannot obliterate perfectly the tracheal cavity because of the sagittal elongation of trachea. In order to avoid forcing the ETT through the obstructed trachea, a supraglottic airway device should be used whenever possible [17, 18]. The decision making process in difficult airway management can be challenging and depends on multiple factors, such
as urgency of the operation, comorbidities, doctor’s skills, availability of supraglottic airway devices, team coordination. The failure of ETT placement is not a personal deficiency. It is just a decision to “stop and think” and take the next step. Limiting the number of airway intervention attempts is important, because every attempt may potentially cause a trauma. We cannot overemphasize the importance of guidelines that clearly lead us from step to step in order to avoid our stress induced cognitive overload to result in a bad decision [3].

Conclusion

It is important to recognize saber-sheath trachea and explain to the patient the potential problems in the future. Also, all the problems that occur during surgery and general anesthesia need to be clearly marked in medical records, whereas the patient must be instructed about them in order to make proper diagnosis in the future. In this way, any potential problem in subsequent operations may be anticipated and the anesthesiologist can decide on the best option for secure airway management during general anesthesia without unnecessary stress and unpleasant surprises in the operating room. Failed intubation can lead to great morbidity during anesthesia and it is potentially life-threatening. Adequate preoperative assessment, knowledge of guidelines for difficult intubation, availability of second generation devices, such as video laryngoscope, supraglottic airway devices, calm head and cooperation between the surgeon and anesthesiologist, are important steps to safe patient management.

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