

Management of membranous tracheal rupture due to the endotracheal tube cuff during thyroid surgery

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ABSTRACT

Tracheobronchial ruptures can be extremely dramatic and life threatening and are encountered in approximately 5 out of 100,000 cases after orotracheal intubation. They can occur as a result of intubation, tracheostomy, and bronchoscopy. In this case report, we presented a 56-year-old female patient with a history of thyroid surgery 27 years prior who presented to our clinic with recurrent multinodular goiter. The patient underwent a complementary complication-free thyroidectomy assisted by intermittent intraoperative nerve monitoring. After hemostasis, final controls involving digital palpation of the possible remnants of the thyroid gland and a search for pathological lymph nodes in the central compartments, a mass structure with a rubbery consistency suspicious for residue thyroid tissue was palpated in both posterolateral aspects of the trachea, but more prominently in the left. The anesthesia team was asked to decrease the cuff pressure, assuming that the palpated mass could be the cuff of the endotracheal tube, and the mass was noted to shrink. The membranous tracheal rupture due to the endotracheal tube cuff was closed with sutures running superiorly, and a superiorly based strap muscle flap was placed over during thyroid surgery. The patient was discharged on day 7. A simple routine digital examination by the attending surgeon dealing with the thyroid surgery would contribute favorably to prognosis, as such a precaution would allow early repair in cases where such injuries occur.

Keywords: Endotracheal tube cuff; thyroidectomy; tracheal rupture.

INTRODUCTION

Traumatic injuries to the main bronchi and tracheal segment between the cricoid cartilage and the point at which the main bronchi stem to the lobar bronchi are referred to as tracheobronchial ruptures and can be extremely dramatic and life threatening.^[1,2] Acute injuries to the tracheobronchial system can occur as a result of intubation, tracheostomy, and bronchoscopy. Tracheobronchial ruptures in those undergoing orotracheal intubation occur in approximately 5 out of 100,000 cases.^[3]

In anesthesia, the Mallampati score or Mallampati classification, named after the Indian anesthesiologist Seshagiri Mallampati, is used to predict the ease of endotracheal intubation. The test comprises a visual assessment of the distance from the tongue base to the roof of the mouth and therefore the amount of space in which there is to work.^[4] The modified Mallampati

score used routinely today is as follows: Class 0: Any part of the epiglottis is visible, Class I: soft palate, uvula, and pillars are visible, Class II: soft palate and uvula are visible, Class III: only the soft palate and base of the uvula are visible, and Class IV: only the hard palate is visible. A high Mallampati score (Class III or IV) is associated with more difficult intubation.^[5]

CASE REPORT

A 56-year-old female patient with a body mass index of 29 kg/m² and a history of thyroid surgery 27 years prior presented to our clinic with recurrent multinodular goiter. Thyroid ultrasound revealed a predominantly isoechoic and partially cystic nodule and measuring 48×29×61 mm. A fine needle aspiration biopsy of the nodule revealed follicular neoplasia, and a decision was made to perform a complementary thyroidectomy. The signed written consent was obtained from

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the patient.

The patient, who had a Mallampati score of 2, was intubated with a 7.5-mm single-lumen endotracheal tube as direct laryngoscopy performed by the anesthesia care team reported a normal glottis. The patient underwent a complementary complication-free thyroidectomy assisted by intermittent intraoperative nerve monitoring. After hemostasis, final controls involving digital palpation of the possible remnants of the thyroid gland and a search for pathological lymph nodes in the central compartments, a mass structure with a rubbery consistency suspicious for residue thyroid tissue was palpated in both posterolateral aspects of the trachea, but more prominently in the left. The anesthesia team was asked to decrease the cuff pressure, assuming that the palpated mass could be the cuff of the endotracheal tube, and the mass was noted to shrink. While exploring the deeper tissues, an expansive area of perforation extending from the superior level of the cricoid cartilage to the fourth tracheal ring in the inferior was discovered in an area conforming to the tracheoesophageal groove, posterior to the cartilage rings of the trachea, and medial to the recurrent laryngeal nerve (Fig. 1). It was planned to repair the tracheoesophageal groove with superiorly based flaps using the strap muscles. To this end, the left recurrent laryngeal nerve was suspended and a superiorly based flap was prepared by dissecting the strap muscles from the inferior (Fig. 2). To secure the recurrent laryngeal nerve, the groove for the nerve to pass was prepared, and the inferior tracheal area was sutured around the nerve with the 4-0 polyglactin 910 (Vicryl, Ethicon). The posterolateral tracheal perforation site was subsequently closed with sutures running superiorly, and a superiorly based strap muscle flap was placed over (Fig. 3). The 4-0 polyglactin 910 (Vicryl, Ethicon) was used as suture

material in all reconstruction and repair procedures. Air leakage was checked with a pressurized ventilation and air-water test, and a tracheotomy was opened between the third and fourth tracheal rings as a precaution. This was followed by the closure of the platysma, subcutaneous tissue, and the skin up to the tracheostomy cannula. No subcutaneous emphysema was observed in the post-operative period. Respiratory function was normal. The vocal cords were observed to be bilaterally mobile in an examination in the intensive care unit using a fiberoptic flexible laryngoscope. The tracheostomy cannula was removed on post-operative day 5, the wound was left to secondary healing, and the patient was discharged on day 7. The patient's definitive post-operative histopathological examination result was reported as "benign" after discharge.

DISCUSSION

Tracheobronchial rupture is perhaps the greatest cause for concern among other complications related to endotracheal intubation. Etiological causes can include endotracheal tube cuff overinflation, the use of an inappropriate stylet, pre-existing frailty in the tracheal structures, chronic disease, previous head-and-neck surgeries, trauma, and prolonged use of steroids.^[3]

The main function of an endotracheal tube cuff, completely sealing the tracheal lumen, is to prevent air leakage during positive-pressure ventilation and aspiration of the pharyngeal content. Insufficient cuff pressure can result in the microaspiration of oropharyngeal content, while overinflation compromises the supply of blood to the trachea, leading to tracheal injury, tracheal fistula, or stenosis. The ideal endotracheal tube cuff pressure should be in the range of 26–30 cmH₂O^[6] and was within the normal range in our patient.

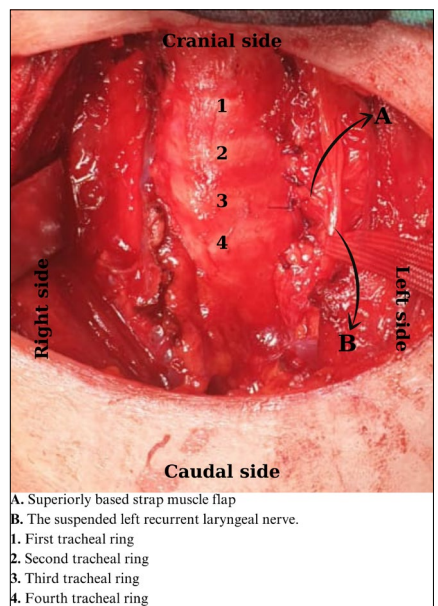
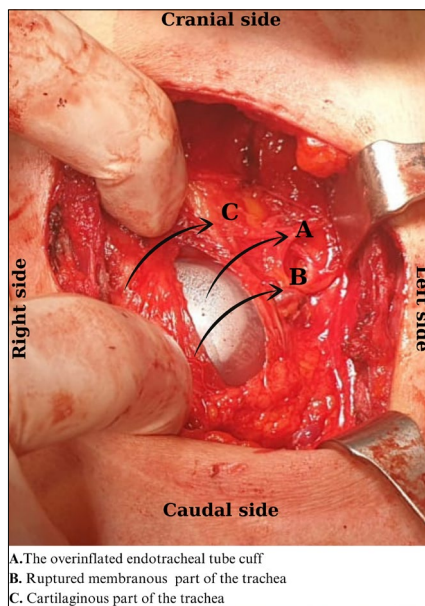
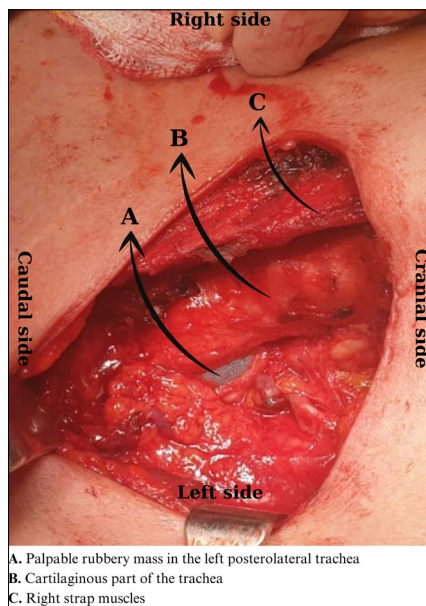


Figure 1. The view of the operation field when the membranous tracheal rupture was first noticed.

Figure 2. Revealing the severity and the boundaries of the injury by the exploration of the tracheal rupture.

Figure 3. Final view of the injury repaired with a superior-based strap muscle flap

Tracheal ruptures following intubation often occur at the junction of cartilaginous and membranous tracheal segments.^[3] In our case, the ruptured part was also in this localization and was approximately 5–6 cm in diameter.

Respiratory distress, mediastinal and subcutaneous emphysema, and hemorrhage are the most commonly observed symptoms in cases of iatrogenic tracheobronchial rupture. Diagnosis is generally made after surgery through thoracic imaging studies and fiberoptic bronchoscopy in suspected cases.^[3] In our case, we were fortunate that the ruptured area was recognized during surgery, as it allowed us to carry out a reconstruction before developing post-operative complications.

Surgery is the main treatment approach in tracheobronchial ruptures. The ruptured area is primarily repaired, and the repair area is further strengthened using various flaps, depending on the localization. Some studies have also reported success with the conservative management of tracheal lacerations related to endotracheal intubation in stable patients with uncomplicated ruptures measuring <2 cm. Conservative management involves the administration of appropriate antibiotics and intubation with the tip of the endotracheal tube being left below the rupture. Intratracheal stent placement has also been reported among the conservative treatment options in recent years.^[3,6,7] In our patient, the membranous trachea was repaired using absorbable sutures and the repair site was strengthened using superiorly based strap muscle flap.

CONCLUSION

Despite their low incidence, it should be remembered that endotracheal injuries can occur in patients undergoing surgery under general anesthesia. The sooner the injury is recognized and repaired, the better for the patient. It must be noted that the increases in airway pressures may also in-

crease the pressure of the endotracheal tube cuff, even if the tracheal cuff has been inflated to pressures within the normal range after intubation. A simple routine digital examination by the attending surgeon dealing with the thyroid surgery would contribute favorably to prognosis, as such a precaution would allow early repair in cases where such injuries occur.

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REFERENCES

1. Roxburgh JC. Rupture of the tracheobronchial tree. *Thorax* 1987;42:681–8. [CrossRef]
2. Grillo HC. *Surgery of the Trachea and Bronchi*. USA: PMPH USA; 2004.
3. Grewal HS, Dangayach NS, Ahmad U, Ghosh S, Gildea T, Mehta AC. Treatment of tracheobronchial injuries: A contemporary review. *Chest* 2019;155:595–604. [CrossRef]
4. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiburger D, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. *Can Anaesth Soc J* 1985;32:429–34. [CrossRef]
5. Samsoun GL, Young JR. Difficult tracheal intubation: A retrospective study. *Anaesthesia* 1987;42:487–90. [CrossRef]
6. Colak A, Arar C, Sahin SH, Söker A, Günday I, Turan N. Is anesthesiologist's experience important while inflating the endotracheal tube cuff with the right pressure. *J Clin Exp Invest* 2010;1:195–8. [CrossRef]
7. Schneider T, Storz K, Dienemann H, Hoffmann H. Management of iatrogenic tracheobronchial injuries: A retrospective analysis of 29 cases. *Ann Thorac Surg* 2007;83:1960–4. [CrossRef]

OLGU SUNUMU - ÖZ

Tiroid cerrahisi esnasında endotrakeal tüp kafına bağlı gelişen membranöz trakeal rüptürün yönetimi

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Trakeobronşiyal rüptür son derece dramatik ve yaşamı tehdit edici olabilir ve orotrakeal entübasyon sonrası yaklaşık 100.000 vakanın 5'inde görülür. Entübasyon, trakeostomi ve bronkoskopi sonucunda meydana gelebilir. Bu olgu sunumunda 27 yıl önce bir tiroid cerrahisi geçirmiş olan ve kliniğimize nöks multinodüler guatr sebebiyle başvuran 56 yaşında bir kadın hastayı sunduk. Aralıklı intraoperatif sinir monitorizasyonu eşliğinde tamamlayıcı tiroidektomi operasyonu komplikasyonsuz olarak uygulanan hastada hemostaz sonrasında, olası rezidü tiroid dokusu ve santral kompartmanlarda olası patolojik lenf nodlarının parmak palpasyonu ile aranmasını içeren son kontroller sırasında solda daha belirgin olmak üzere trakeanın her iki posterolateralinde rezidü tiroid dokusu olduğundan şüphe edilen lastik kıvamında kitle yapısı palpe edildi. Palpe edilen kitlenin endotrakeal tüpün kafı olabileceği düşünülerek anestezi ekibinden endotrakeal tüp manşon basıncının düşürülmesi istendi ve manşon basıncının düşürülmesiyle birlikte palpe edilen kitlenin küçüldüğü gözlemlendi. Endotrakeal tüp manşonunun neden olduğu membranöz trakeal rüptür sütürlerle kapatıldı ve üzerine superior bazlı strap kas fleb ile rekonstrüksiyon uygulandı. Hasta 7. gün sağlıklı taburcu edildi. Tiroid cerrahisi ile uğraşan cerrahlar tarafından ameliyat sonunda yapılacak basit bir rutin dijital muayene bu tür yaralanmaların meydana geldiği durumlarda erken onarıma izin vereceği için prognoza olumlu katkıda bulunacaktır.

Anahtar sözcükler: Endotrakeal kaf; trakeal rüptür; tiroidektomi.

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