



Post-intubation tracheal rupture treated surgically using a muscle graft from the Latissimus Dorsi: a rare disorder and review of literature

Sultaneh Haddad, MD^{a,b,*}, Farah Haneyah, MD^d, Mu'taz Nader Ibrahim Jwainat, MD^e, Ghassan Bayat, MD^h, Amjad Zakka, MD^a, Emad Albekaa, MDⁱ, Omar Abd Elfattah Ali Al-Rashdan, MD^f, Basil Daradkeh, MD^g, Yamama Abo Dakka, MD^c, Mohamad Shbat, MD^c, Hussain Chaban, PhD^c

Introduction: Post-intubation tracheal rupture (PiTR) is an extremely uncommon disorder. Pneumothorax, pneumomediastinum, hemorrhage, cutaneous emphysema, and sepsis are common clinical presentations that eventually result in organ failure and mediastinitis. Endoscopy and computed tomography (CT) are considered the gold standards for assessment and diagnosis.

Case presentation: Here, the authors present a 96-year-old woman with asthma and ischemic heart disease presented to the Emergency Department with dyspnea following viral pneumonia. Despite initial treatment, her condition worsened, requiring tracheal intubation. Subsequent complications led to a diagnosis of tracheal rupture, requiring surgical repair. The procedure involved using a muscle graft from the Latissimus Dorsi muscle: which is a novel Surgical Technique as the authors have conducted a literature review.

Discussion: Upon scrutinizing analogous cases delineated within the medical literature, it becomes evident that our patient manifests four distinct risk factors. These factors include gender, advanced age, asthma, and prolonged steroid use. While the clinical manifestation and diagnostic methods for tracheal rupture are frequently consistent throughout cases, there is a significant variation in the surgical treatments used to treat the condition.

Conclusion: More research should be conducted to investigate the use of muscle grafts as a treatment technique for tracheal rupture in the future.

Keywords: asthma, case report, tracheal rupture

Introduction

Orotracheal intubation is the most prevalent cause of iatrogenic tracheal rupture^[1]. According to reports, the incidence is as high as 1% during percutaneous dilation tracheotomies, 0.05–0.19% during double-lumen intubations, and roughly 0.005% with single-lumen intubations^[2]. Pneumothorax, pneumomediastinum, hemorrhage, cutaneous emphysema, and sepsis are common

HIGHLIGHTS

- It is a must to educate anesthesiologists about the importance of exercising caution when performing intubation procedures, especially when dealing with patients who have a number of risk factors of tracheal rupture.
- More researches about investigating the use of muscle grafts as a treatment technique for tracheal rupture.
- There is a need for thorough studies to identify the best course of treatment, in order to improve patient outcomes for the management of tracheal ruptures.

^aAleppo University, Faculty of Medicine, Aleppo, ^bStemosis for Scientific Research, ^cAssad University Hospital, Damascus, Syrian Arab Republic, ^dAl-Balqa Applied University, Salt, ^eJordanian Royal Medical Services, ^fDepartment of Oral and Maxillofacial Surgery, Jordanian Royal Medical Services, Amman, ^gJordan University of Science and Technology, Irbid, Hashemite Kingdom of Jordan, ^hPlymouth University Hospitals NHS Trust, Plymouth, UK and ⁱBeirut Arab University, Beirut, Lebanon

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*Corresponding author. Address: Aleppo University, Aleppo street, Damascus, Syria. Tel.: +96 393 059 3703 E-mail: sultanhhaddad@gmail.com (S. Haddad).

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clinical presentations that eventually result in organ failure and mediastinitis^[3]. Endoscopy and computed tomography (CT) are considered the gold standards for assessment and diagnosis, while prompt administration of broad-spectrum antibiotics and surgical healing of wounds larger than two centimeters are thought to be essential for successful outcomes^[3]. The work has been reported in line with the SCARE 2023 criteria^[4].

Case presentation

A 96-year-old woman with a medical history notable for asthma with prolonged corticosteroid history and ischemic heart disease presented to the Emergency Department (ED) with altered mental status, facial swelling and dyspnea. The patient had recently experienced a viral pneumonia characterized by hyperthermia and cough.

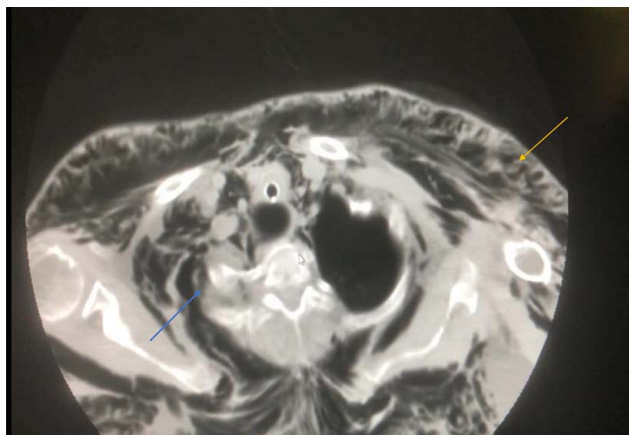


Figure 1. Thoracic computed tomography reveals subcutaneous emphysema and pneumomediastinum.

Upon arrival, vital signs including normothermia, blood pressure of 128/72 mmHg, respiratory rate of 22, and oxygen saturation of 97% on room air. Physical examination revealed pallor and crackles upon chest auscultation, while other organ systems appeared unremarkable. Laboratory results were within normal limits, and a chest X-ray demonstrated evidence of community-acquired pneumonia.

The following day, the patient's dyspnea escalated, necessitating tracheal intubation performed by an experienced anesthesiologist which was reported as 'easy'. A stylet was used with, single-lumen tube, and as soon as the tube tip passed the vocal cords, it was removed.

Subsequently, subcutaneous emphysema developed, prompting incisions for drainage. Pulmonary consultation indicated severe mediastinal emphysema and dilation around the endotracheal tube. We continued investigations using a thoracic CT, which found subcutaneous emphysema and pneumomediastinum (Fig. 1), as well as dilation of the trachea (Fig. 2).

We decided to do a bronchoscopy as there was a strong suspicion of a tracheal rupture. The results verified our clinical suspicions and showed a 7 cm rupture of the trachea's posterior wall ~2–3 cm from carina. Following the confirmation of the

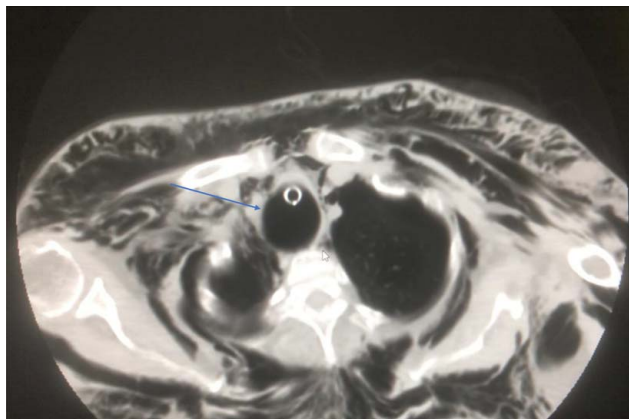


Figure 2. Thoracic computed tomography reveals dilation of the trachea.

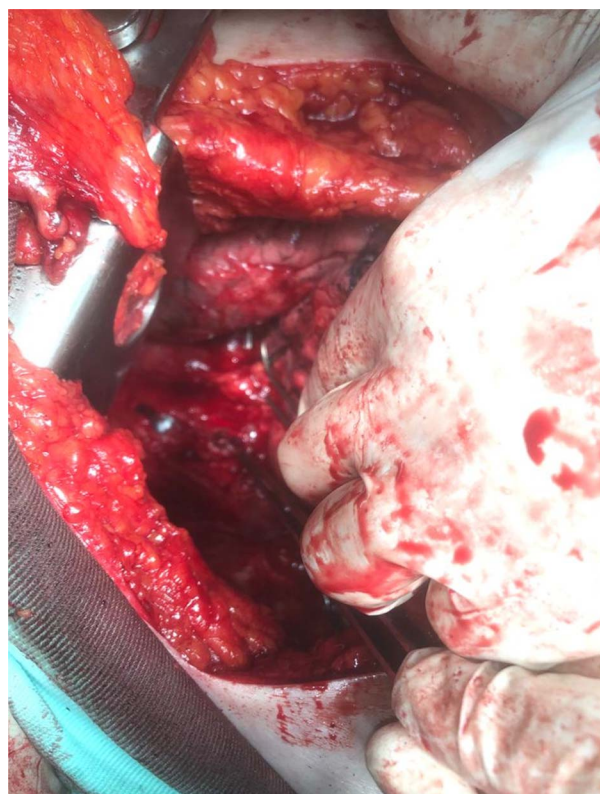


Figure 3. Wide tear with ragged edges extending up to 7 cm above the carina.



Figure 4. The dissected Latissimus Dorsi muscle was sutured in place of the tear.

Table 1

Literature review with all case reports of post-intubation tracheal rupture.

Age/sex	Risk factors	Intubation conditions	The time between intubation and rupture	Size and location of the tear	Symptoms	Treatment/surgical technique	Follow-up	References
9 women and 1 man, and their ages ranged from 23 to 72 years (mean 50 years).	NA	A stylet was used with double-lumen tubes were used, and removed as the tube tip passed the vocal cords.	NA	In the posterior membranous part of the trachea, ranging in size from 1 cm (3 cases) to 5 cm (4 cases).	In six patients subcutaneous emphysema/ One patient had tension pneumothorax/ Another had minimal hemoptysis	3 patients were treated conservatively/Six patients underwent surgical repair. A woman underwent a tracheostomy	All of the patients have been symptom-free after treatment	Borasio <i>et al.</i> 1997 9262088 ^[8]
77/F	Chronic obstructive pulmonary lung disease, using corticoids for several years.	NA	NA	9.5 cm linear rupture of the posterior wall of the trachea into the right main bronchus	A massive subcutaneous pectoral and collar emphysema gradually spread to the thighs.	Interrupted absorbable monofilament sutures and pleuro-mediastinal tissue was used to cover the suture line.	Uncomplicated	Evagelopoulos <i>et al.</i> 1999 10670801 ^[9]
12 female, 1 male, mean age 68 years, range 45–86	NA	Single-lumen intubation ($n=8$), double-lumen intubation ($n=4$), and tracheostomy ($n=1$)	Intraoperatively 15 h 13 h 4 h 5 h 3 days 2 h 7 h 9 h 1 days 3 h Intraoperatively	3 cm carina 5 cm 5 cm 4 cm 6 cm 8 cm 4 cm 4 cm 3 cm 5 cm 6 cm 3 cm	Mediastinal and subcutaneous emphysema (8/13). Hemoptysis (5/13).	Surgical treatment via right-sided thoracotomy.	5 patients survived. The remainder died.	Meyer <i>et al.</i> 2001 11339448 ^[10]
80/F	Female sex, age greater than 50.	Intubation was easy and no stylet was used, and the tube was a single-lumen type with a low-pressure balloon	NA	linear laceration running the length of the tracheal from the first tracheal ring to the carina.	NA	Suture of the adjacent esophageal wall	Uncomplicated	Satyadas <i>et al.</i> 2003 12579068 ^[11]
69/F	Using a stiffened endotracheal tube /short stature /morbid obesity	7.5-mm endotracheal tube. with a stylet.	NA	NA	Massive subcutaneous emphysema of the head, neck, and thorax.	Bilateral needle thoracostomies and chest tube insertion.	The patient died.	Sternfeld <i>et al.</i> 2003 12827127 ^[12]
71/F	NA	Woodbridge (7.0 mm)	48 h	1.5 cm, membranous part, midline	❖ Subcutaneous emphysema, respiratory distress	❖ Interrupted sutures, 3/0 PDS	❖ Uncomplicated, postoperative extubation	Sippel <i>et al.</i> 2006
65/F		-SLT, HL (8.0 mm)	3 h			❖ Continuous suture, 2/0 PDS, pleural patch		
57/F		-DLT (7.0 mm)	11 h	5.0 cm, membranous cartilaginous		❖ Interrupted sutures, 4/0 PDS, pleural patch, fibrin	❖ Death on POD 10, liver cirrhosis	16485190 ^[13]
61/F		-SLT, HL (7.0 mm)	6 h		❖ Subcutaneous emphysema, respiratory distress, tension pneumothorax	❖ Continuous suture, 4/0 PDS, pleural patch, fibrin glue	❖ Uncomplicated, extubation on POD 4	
41/F		-SLT, HL (7.5 mm)	120 h	junction, right side		❖ Interrupted sutures, 4/0 PDS, pleural patch	❖ Uncomplicated, extubation on POD 6	
76/M		-TS (10.0 mm)	24 h	2.0 cm, membranous cartilaginous		❖ Continuous suture, 3/0 PDS, pleural patch, fibrin	❖ Death on POD 12, liver cirrhosis	
59/F		-SLT, HL (6.5 mm)	3 h	junction, right side		❖ Continuous suture, 4/0 PDS	❖ Uncomplicated, long-term ventilation	
30/F		-SLT, HL (8.0 mm) -SLT, HL (7.0 mm)	84 h	1.5 cm, membranous part, midline	❖ Subcutaneous emphysema, hemoptysis	❖ Nonoperative (tube-bridging)	❖ Death on POD 8, liver cirrhosis	
75/F		-SLT, HL (7.5 mm)	48 h			❖ Continuous suture, 3/0 PDS	❖ Uncomplicated, extubation on POD 6	
60/F		-SLT, HL (7.0 mm)	3 h		❖ Subcutaneous emphysema	❖ Nonoperative (tube-bridging)	❖ Uncomplicated, extubation on POD 1	
21/F		-SLT, HL (8.0 mm)	24 h	4.5 cm, membranous part, right-side		❖ Continuous suture, 2/0 PDS, pleural patch, fibrin	❖ Uncomplicated	
83/F		-TS (9.0 mm)	24 h		❖ Subcutaneous emphysema, respiratory distress, tension pneumothorax	❖ Continuous suture, 3/0 PDS, intercostal muscle flap, fibrin	❖ Uncomplicated, extubation on POD 10	
		-SLT, HL (7.5 mm)		4.5 cm, membranous cartilaginous junction, right side		❖ Continuous suture, 4/0 PDS	❖ Uncomplicated, tracheostomy closure on POD 22	
				12.0 cm, membranous part, right side, right main bronchus	❖ Subcutaneous emphysema, ventilatory failure (PaO2/Fi O2↓, air leak)		❖ Uncomplicated, extubation on POD 2, bilateral recurrent nerve dysfunction with spontaneous recovery	
				1.5 cm, membrane	❖ Subcutaneous emphysema			
					❖ Subcutaneous			

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						<ul style="list-style-type: none"> emphysema ❖ Subcutaneous emphysema, hemoptysis, superior vena cava syndrome ❖ Subcutaneous emphysema, respiratory distress, bilateral pneumothorax, pneumoperitoneum ❖ Subcutaneous emphysema, ventilatory failure (PaO2/Fi O2 ↓, air leak) ❖ Subcutaneous emphysema 				
					Our part, right-side cervical					
					6.0 cm, membranous part, midline					
					3.0 cm, membranous part, midline, cervical					
					6.5 cm membranous cartilaginous junction, right side					
					5.0 cm, membranous part, right side					
					4.0 cm, membranous part, midline					
75/F	Chronic obstructive pulmonary disease, difficult intubation.	The intubation was difficult because of aberrant cervical anatomy in the setting of the patient's spinal disease	2 h.	A 4.0 cm tear of the posterior membranous trachea.	Minimal subcutaneous emphysema	A 6 cm *14 mm self-expanding, covered metallic stent (Microinvasive, Natick, MA) was deployed over the tracheal injury.	NA		Yopp <i>et al.</i> 2007	17462432 ^[14]
67/F	Female sex, age greater than 50 years. cuff overinflation	6.5 cuffed preformed orotracheal tube without a stylet. The cuff was overinflated with 20 ml of air.	Four hours after extubation	Posterior tracheal transmural rupture 4 cm long	Subcutaneous emphysema of the facial, bilateral laterocervical, and upper anterior chest.	Conservative treatment with antibiotic cover	Uncomplicated		Delgado Pecellin <i>et al.</i> 2008	18945364 ^[6]
C1: 72/F C2: 63/M	C1, C2: female sex, age greater than 50 years.	C1: A 7.5-mm endotracheal tube using a rapid-sequence intubation protocol after two attempts C2: NA	C1: Postoperatively C2: day 3.	C1: 4-cm posterior tracheal disruption, 5 cm from the carina C2: 5-cm tear in the distal trachea, extending into the right main stem bronchus	Chest pain C1: crepitus C2: subcutaneous emphysema	C1: A percutaneous gastrostomy tube. The patient was given of empiric antibiotics and a scopolamine patch to minimize secretions. C2: A percutaneous gastrostomy was performed and the patient was maintained on airway pressure-release ventilation.	C1: uncomplicated C2: uncomplicated		Fong <i>et al.</i> 2009	20338349 ^[15]
C1: 12/M C2: 9/F	C1 C2: NA	C1 C2: NA	C1 C2: NA	C1: 2 × 4-mm in the upper third of the posterior tracheal wall C2: 4–5 mm in the posterolateral region.	C1: desaturation and bradycardia, chest hyperinflation, and subcutaneous emphysema C2: subcutaneous emphysema	C1/C2: conservative approach	C1/C2: uncomplicated		Pecellin <i>et al.</i> 2009	19376632 ^[16]

Table 1

(Continued)

Age/sex	Risk factors	Intubation conditions	The time between intubation and rupture	Size and location of the tear	Symptoms	Treatment/surgical technique	Follow-up	References
62/F	Female sex, age greater than 50 y.	NA	NA	9 cm in length	Subcutaneous emphysema and dyspnea	Conservatively treated with antibiotics	Favorable healing process	Conti <i>et al.</i> 2010 20461501 ^[17]
C1:68/F C2: 52/F	C1 female sex, age greater than 50 years- 145 cm C2: female sex, age greater than 50 158 cm tall.	NA	C1: One hour after extubation C2: The next day,	C1: 7 cm of a membranous posterior tracheal linear laceration C2: 4-cm posterior membranous tracheal laceration	C1: dyspnea and subcutaneous emphysema hemoptysis and dyspnea. C2: subcutaneous emphysema dyspnea	C1/ C2: The laceration was repaired with 4-0 Monosyn interrupted stitches	C1/ C2: uncomplicated	Kim <i>et al.</i> 2011 22263165 ^[18]
48/F	Short stature, female sex	Double-lumen endobronchial tube (37 French) was placed with some difficulty with the use of a stylet	NA	A 7-cm long rupture in the posterior (membranous) aspect of the trachea	subcutaneous emphysema	An 8 cm × 2 cm patch was harvested from the pleura	Uncomplicated, extubation on POD14	Bostancı <i>et al.</i> 2012 22290057 ^[19]
43/F	Short stature. Asthmatic vigorous intubation	Stylet loaded 7.5 cuffed flexometallic tube	After 30 min	(2.5 cm) in the posterior membranous part of the trachea	Subcutaneous emphysema	Conservatively	Uncomplicated	Bangaari <i>et al.</i> 2012 22529431 ^[20]
67/F	Female sex, age greater than 50 years, Obesity, operator inexperience, and cuff overinflation	The cuff displaced towards the right and grossly overinflated.	NA	6 cm posterior tracheal rupture	Significant air leak in addition to hemoptysis.	The resultant defect was reconstructed with a bovine pericardial patch.	Uncomplicated	Carter <i>et al.</i> 2012 22228286 ^[21]
14/M	NA	NA	3 h	NA	Subcutaneous emphysema and pneumothorax at the right hemithorax	Conservatively	Uncomplicated	Paksu <i>et al.</i> 2013 23925255 ^[22]
C1:76/F C2: 69/F	female sex, age greater than 50 years	C1: N/A C2: ETT with stylet.	C1: NA C2: NA	C1: 4 cm posterior tracheal tear C2: 7 cm posterior tracheal tear	NA	C1/ C2: The ETT was secured proximal to the defect's upper extent, with low-volume ventilation, so reducing strain on the tear.	C1: uncomplicated C2: uncomplicated	Singh <i>et al.</i> 2013 23983415 ^[23]
73/F	Obesity female sex, age greater than 50 years	Difficult intubation was attempted twice and for the second attempt, a Boussignac bougie was used as a tube exchanger	7 h	Rupture of the posterior tracheal wall. 0.5 cm from the carina	Subcutaneous emphysema. Dyspnea	Conservative management	Symptoms resolved.	Tacquard <i>et al.</i> 2014 24469985 ^[24]
78/F	Chronic obstructive pulmonary disease	NA	1 h	NA	NA	Conservatively treated with antibiotics	Died on the fourth postoperative day due to multiple organ failure.	Üzümcügil <i>et al.</i> 2015 25066906 ^[25]
64/F	Female sex, age greater than 50	A normal 8 mm endotracheal tube	Six hours after	5 cm.	Chest pain and dyspnea	Stent placement was performed	Uncomplicated	Geltner <i>et al.</i> 2016 28018811 ^[26]
68/M	The protrusion of a factory-preloaded stylet beyond the distal orifice of the endotracheal tube	Single-lumen, 8.0-mm internal diameter oral endotracheal tube (TaperGuard Tracheal Tube with Stylet, Covidien)	6 h	1.9-cm anterior tracheal wall involving the second, third, and fourth tracheal rings	progressive subcutaneous emphysema in the neck and upper sternum and a large air leak around his endotracheal tube	Tracheostomy	Uncomplicated	Warner <i>et al.</i> 2016 26513675 ^[27]
86/F	Female sex, age greater than 50 years and the short stature. The emergency intubation and the cuff inflated by a syringe	Orotracheal intubation was simple and performed without a stylet. The endotracheal tube cuff was inflated with a syringe	Soon after intubation.	2 cm Posterior tracheal gap	Extensive subcutaneous emphysema.	Surgical intervention was not considered	The patient passed away a few hours later	Bouattour <i>et al.</i> 2017 25450732 ^[28]
91/M	NA	A n.8 cuffed tube	An hour and a half	Tracheal tear at the distal third of the	Subcutaneous emphysema	Two covered self-expandable metal stents were then coaxially released under fluoroscopic control to cover the defect.	uncomplicated	Bozzo <i>et al.</i> 2018 30595784 ^[29]

7/M	NA	No use of style was reported.	In the meanwhile.	posterior tracheal wall 4 cm 4 cm along the posterior wall of the distal trachea, till the proximal tract of the right mainstem bronchus	Neck and chest subcutaneous emphysema and abdominal tension	Endoscopic treatment as first-line therapy Before stent positioning, the injured airway was protected with a double-lumen tube.	Uncomplicated	Vedovati <i>et al.</i> 2018 29575278 ^[30]
52/F	Female sex, age greater than 50 y, the use of Bougie	Bougie Boussignac. This device is suitable for a 6- to 11-mm tracheal tube. A double duct for oxygenation during intubation.	NA	7 cm	Subcutaneous emphysema in the thorax, neck, and face	The wound was treated by suture of the posterior wall then an intercostal muscle pedicled flap was sutured around the wound to consolidate it. Two straight thoracic drains were placed.	She died of cardiac arrest after 19 days	Schaeffer <i>et al.</i> 2018 29685475 ^[31]
65/F	Female sex, age greater than 50 years, overinflated tube cuff. chest compressions were performed when an ETT with an overinflated cuff.	An aluminum stylet wrapped in polyvinyl chloride was used. a 7 mm size endotracheal tube (ETT) was used, and the insertion depth of the ETT was 21 cm.	2 days later	A 4 cm size longitudinal rupture was observed at the posterior lower tracheal wall	Subcutaneous emphysema	Emergency surgery for tracheal wall repair was performed.	Uncomplicated.	Jung <i>et al.</i> 2019 31057286 ^[32]
45/M	Long-term steroid therapy.	NA	NA	NA	Subcutaneous emphysema was noted on the patient's neck and chest,	Conservatively	Uncomplicated,	Akeely <i>et al.</i> 2020 33308913 ^[33]
67/F	Female sex, age greater than 50	NA	NA	NA	Dyspnea and subcutaneous emphysema	Conservative treatment,	Uncomplicated,	Kuridze <i>et al.</i> 2021 34306717 ^[34]
19/F	NA	3.5 size 30 cm Storz bronchoscope – ID: 5 mm, OD: 5.7 mm	NA	0.5 cm along the right corner of the membranous trachea	NA	Conservative treatment,	Uncomplicated, extubation on POD8	Acer-Demir <i>et al.</i> 2021 33642406 ^[35]
53/F	Female sex, age greater than 50 years.	NA	A few hours after the procedure	3 cm from the carina and 3 cm in length in the posterior tracheal wall	Non-bloody non-bilious vomiting at home. facial swelling mild shortness of breath	Upon re-evaluation with bronchoscopy, it was found that the tracheal injury seemed to be in the cervical region which can be best approached via the cervical region by ENT. Hence, the patient was transferred to a tertiary care center for definitive care.	NA	Jesani <i>et al.</i> 2021 34377703 ^[36]
C1:65/M C2: C2:32/M C3:56/F C4:57/F C5:52/F	Mild-to-severe obesity (BMI range: 26–39 kg/m ²) and 2 of them were females aged > 50 y with short stature.	NA	C1:5 C2:6 C3:96 C4:0 C5:24	C1: 5 cm Lower 1/3 C2: 6 cm Lower 1/3 + carina C3: 5 cm Lower 1/3 C4:3cm Middle1/3 C5: 3.5 cm Lower 1/3	C1: PSM-Emph C2: PSM-Emph, BiPN C3: PSM-Emph, UnPn C4: IOVis C5: PerAir	Video-assisted thoracic surgery repair (VATS-R)	The postoperative course was uneventful in all the patients, who were discharged on average after 16 days.	Karpitski <i>et al.</i> 2022 35251412 ^[7]
54/F	Repositioning of the patient after intubation in ventral decubitus to position for the hernia surgery. female sex, age greater than 50 years.	Standard using a 7.0 flexometallic endotracheal tube by an experienced anesthesiologist.	Within the first 24 h postoperative	Right on the edge of the membranosa, 5 cm long.	Subcutaneous emphysema of the supraclavicular fossa.	The rupture was sutured with a 4-0 monofilament surjet suture under both robotic and bronchoscopic control.	The patient was discharged a week postoperative with a full recovery, bronchoscopy, and radiology evaluation 6 months later showing no signs of recurrence.	Melinte, <i>et al.</i> 2022 36584062 ^[37]

BiPN, bilateral pneumothorax; C, case; F, female; IOVis, intraoperative visualization; M, male; NA, not applicable; PerAir, persistent postoperative air leakage via pleural drainage; PiTR, post-intubation tracheal rupture; POD, post operation day; PSM-Emp, progressive subcutaneous and mediastinal emphysema; UnPn, unilateral pneumothorax.

diagnosis, we determined that surgical repair was the best choice because the rupture was too large to be repaired conservatively.

Surgery was performed by an expert surgeon under general anesthesia. The chest wall was opened, revealing severe adhesions in the lung. All adhesions were dissected. The trachea was isolated, revealing a wide tear with ragged edges extending up to 7 cm above the carina (Fig. 3). Initial suturing was deemed unfeasible due to the extensive edge laceration. The dissected Latissimus Dorsi muscle from the fourth rib was introduced along the anterior axillary line, and the muscle was sutured in place of the tear (Fig. 4). During surgery Leakage testing at the mediastinum yielded negative results. Through postsurgical physical examination, the subcutaneous emphysema had regressed. Pulmonary consultation indicated regressed mediastinal emphysema, so there was no need to redo the CT scan because all the investigations were heading to the success of the surgery. The patient was put on Rocephin 1 g/12 h and Levofloxacin 500g/12 h after doing the surgery was a challenging choice due to the patient's advanced age and her poor health condition. The surgeons had not encountered such a case before, and at a time when the tear was long, they utilized a new technique, which in itself posed a challenge for them.

The patient died 5 days later as a result of multiple organ failure. The surgeons assured us that the cause of death was purely internal and that the surgery was successful.

Discussion

Orotracheal intubation is a routine procedure with potential complications. They range from throat pain to laryngeal or tracheal stenosis and tracheal rupture.

Since PiTR is an extremely uncommon disorder, there aren't enough studies to determine its incidence. The estimation of incidence throughout the past 10 years varied between 0.05 and 0.37%^[4].

PiTR is caused by a number of risk factors, which can be categorized as mechanical or anatomical. Multiple forced attempts at intubation, the health professional inexperience, endotracheal tube introducers, an overinflation of the cuff, incorrect tube tip positioning, incorrect tube size, and head and neck movements during the intubation process are examples of mechanical factors.

Congenital tracheal abnormalities, chronic obstructive pulmonary disease, other inflammatory lesions of the tracheobronchial tree, diseases that change the position of the trachea, long-term steroid use, advanced age, and female sex are among the anatomical factors^[4].

Asymptomatic patients are uncommon. The most prevalent clinical manifestation (is cervical-thoracic subcutaneous emphysema. Dyspnea, cyanosis, hemoptysis, and pneumothorax are also usual manifestations. Less common symptoms include hypotension and chest pain.

Up to 72 h may pass between the injury and the onset of clinical symptoms. The literature mentions a diagnosis that was made 240 h later^[5].

According to standard cervical-thoracic radiography, early signs of deep cervical and mediastinal emphysema. The only investigation that can confirm the diagnosis is bronchoscopy, which directly showing the lesion and the exact location^[5].

For certain patients, conservative treatment may be a good option: small rents, short lacerations in the upper third of the trachea, and patients breathing on their own, or patients with no obvious respiratory embarrassment or gross air leak. Conservative treatment can be achieved with chest drain, continuous airway humidification, broad-spectrum antibiotics, chest physiotherapy, and mechanical ventilation^[6].

Patients who have any of the following conditions require surgical treatment: intraoperatively, para-carinal lacerations after intubation, progressive pneumomediastinum, subcutaneous emphysema, and mediastinitis, major air leak, and large defect size ($> 3\text{--}4\text{ cm}$)^[7]. In our case, the tear was 7 cm and it was the first time for our doctors to face tracheal rupture, so the decision to proceed with surgery was made due to the length of the tear and concerns about facing a situation for the first time.

We conducted a literature search of the PubMed database using filters for English language case reports. The search used the keywords "Postintubation", "iatrogenic", and "tracheal rupture".

We excluded irrelevant articles and those that were inaccessible and ultimately reviewed 31 articles (Table 1).

Upon scrutinizing analogous cases delineated within the medical literature, it becomes evident that our patient manifests four distinct risk factors. These factors include gender, advanced age, asthma, and prolonged steroid use.

While the clinical manifestation and diagnostic methods for tracheal rupture are frequently consistent throughout cases, there is a significant variation in the surgical treatments used to treat the condition.

A significant subject that needs to be addressed in this study is the technique for treatment, which involves the use of a dorsal muscle graft and hasn't been explained in the collection of research findings before (Table 1).

Interestingly, the article presents a surgical method that might represent an example of more successful outcomes than standard techniques. The work has been reported in line with the SCARE 2023 criteria^[38].

Conclusion

The primary aim of this research to educate anesthesiologists about the importance of exercising caution when performing intubation procedures, especially when dealing with patients who have a number of risk factors of tracheal rupture as in our case. There is also a key message for the research community, which is to investigate the use of muscle grafts (here we used Latissimus Dorsi graft and it was mentioned for the first time) as a treatment technique for tracheal rupture. This call to action emphasizes the need for thorough studies to identify the best course of treatment in order to improve patient outcomes for the management of tracheal ruptures. At a time when the surgeons confirmed that the surgery was successful despite its difficulty, we directed researchers to investigate further the effectiveness of using muscle grafts in treating tracheal ruptures, as it prove to be an effective method in the future. It could potentially achieve even greater efficacy than other methods.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

Consent

Written informed consent was obtained from the patient's parents/legal guardian for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

S.L., F.H., and M.J.: contributed to drafting, reviewing, editing, and approving the final manuscript. G.B.: contributed to drafting, editing, and approving the final manuscript. A.Z.: contributed to drafting, reviewing, editing, corresponding, and approving the final manuscript. E.A.: contributed to reviewing, supervising, and approving the final manuscript. O.A. and B.D.: contributed to drafting, editing, and approving the final manuscript. Y.A., M.S., and H.C.: supervising. All authors read and approved the final manuscript.

Conflicts of interest disclosure

The author declares no conflicts of interest.

Guarantor

All authors have read and approved the manuscript, on behalf of all the contributors I will act and guarantor and will correspond with the journal from this point onward.

Data availability statement

Data sharing is not applicable to this article.

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