

Case Report

Multidisciplinary Assessment and Successful Conservative Management of Post-Intubation Tracheal Rupture

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Keywords

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Abstract

Background: Tracheal rupture is a fearsome complication that can occur after single-lumen, double-lumen intubation, percutaneous tracheostomy, or surgical tracheostomy. Mortality rate is high, and it is difficult to quantify the real number due to the unknown amount of procedures performed worldwide. Timing is critical. It is important to decide to follow a conservative or a surgical approach based on the type of rupture, clinical symptoms and radiological findings.

Case Description: We describe the case of a 52-year-old woman with tracheal rupture diagnosed after intubation for reduction mastectomy. The patient came to our attention with regular vital parameters and clinically without symptoms with a tracheal lesion on the chest CT scan. After a multidisciplinary evaluation including Interventional Pneumologist, Intensive Care Unit and Thoracic Surgery, in view of the clinical radiological picture, it was decided to follow-up the patient with radiological imaging and bronchoscopies. A surgical approach was not chosen, considering location, size of the lesion and clinical conditions. The patient after eleven days was discharged in good clinical conditions.

Conclusions: Treatment of tracheal tears is variable. This is a life-threatening condition, and a multidisciplinary evaluation is at the basis of the proper treatment. Although location and timely diagnosis are crucial, not all tracheal tears are to be treated surgically; conservative treatment is often crucial.

INTRODUCTION

Tracheobronchial injuries (TFi) are most commonly caused by iatrogenic trauma or penetrating traumas; tracheal rupture is a rare and fearsome complication of intubation maneuvers [1], which can be performed electively, before scheduled surgery, or urgently, to protect the airways and in cases of acute cardiorespiratory failure. Indeed, it may occur generally after intubation, tracheostomy or interventional pneumology [2,3]. However early recognition of this injury can be lifesaving; indeed, mortality rate is high. The exact incidence of this complication cannot be reasonably estimated because the large number of intubations and tracheotomies performed daily worldwide is not known.

Patient-related factors that increase the risk for tracheal injury and rupture include congenital tracheal abnormalities, weakness of the pars membranacea of the trachea, chronic obstructive pulmonary disease and other inflammatory lesions of the tracheobronchial tree, advanced age and female gender [4].

CASE DESCRIPTION

A 52-year-old woman (height 170 cm, weight 90 kg, body mass index 31.14), with hypothyroidism, obesity, chronic gastritis and diabetes mellitus on insulin therapy, presented to the emergency room with chest pain onset associated with appearance of subcutaneous emphysema in the neck region. The day before, the patient underwent reduction mammoplasty surgical treatment. Due to appearance of subcutaneous emphysema after surgical treatment, a chest CT scan was performed which showed a lesion of about 2 cm at the level of the middle-distal portion of the trachea. Therefore, the patient was transferred to our hospital for specific investigations.

Upon admission to hospital, the patient was awake and cooperative, in spontaneous breathing with nasal cannulas 2 L/min, respiratory frequency 15 breaths/minute, SpO₂ 98%, heart rate 92 bpm, blood pressure 161/81 mmHg.

Blood tests, blood gas analysis and electrocardiogram were

immediately requested, turning out to be normal. Evident swelling of the neck was present, which could be marked with a sensation of “fresh snow” on palpation. The hemodynamics was stable without need for pharmacological support. A new chest CT was required. At the chest CT, radiological findings were similar to the previous CT scan, showing bilateral interstitial emphysema, right pneumothorax and total compartmental pneumomediastinum. Indeed, the bilateral emphysema of subcutaneous soft tissues was also unchanged, appreciable in correspondence of the anterior chest wall, of the supraclavicular and laterocervical regions, with cranial extension up to the skull base and face.

These findings were confirmed by a continuous solution of about 5 mm appreciable in correspondence with the right posterolateral wall of the middle III of the trachea, at the level of D1-D2, extending longitudinally for a length of about 20 mm. Externally to the breach, a thin membrane appeared to delimit a small “pocket” containing air with a maximum axial dimension of 12 mm [Figure 1a, 1b].

Based on clinical and radiological findings, it was indicated to transfer patient to the Intensive Care department, agreeing to perform a bronchoscopy for better evaluation, before performing any surgical procedure. Upon entry to the Intensive Care Unit, a chest x-ray was performed which showed “a thin layer of pneumothorax in the right apical site; mediastinum in axis. Amount of bilateral supraclavicular/laterocervical soft tissue emphysema and a large amount of pneumomediastinum. Areas of nuanced parenchymal hypodiaphania, of hypoventilative significance, in the basal site on the left. Pleural cavities apparently free from effusion. Regular left breast implant” [Figure 2].

On I day of hospitalization, in multidisciplinary agreement and after the acquisition of informed consent, she underwent a first bronchoscopy under deep sedation which revealed in trachea, at about 7.5 cm from the chordal plane, a laceration of the pars membranacea extended for 5 cm [Figure 3], and within a rupture extending longitudinally for about 3 cm.

The following two days after bronchoscopy, the patient remained clinically and radiologically stable; a reduction in the amount of subcutaneous emphysema and pneumomediastinum was noticed. Therefore, in accordance with the Intensive Care Unit and due to stable conditions, on VI day of hospitalization, she was transferred to our Thoracic Surgery department, where a new reevaluation with bronchoscopy was performed. The well-known tracheal laceration of the “pars membranacea” was completely covered by a layer of fibrin [Figure 4].

Therefore, on VII day of hospitalization, a new chest CT was performed, in which the continuous solution previously reported at the level of the right posterolateral wall of the proximal trachea was no longer appreciable; only a residual wall thickening of about 3 mm, probably due to reparative phenomena, with a minimal amount of adjacent secretions. The patient was definitively evaluated by the multidisciplinary team, including Thoracic Surgery, Intensive Care Unit and Interventional Pneumology, which considered her stable and dischargeable, with no further surgical indication.

The patient was discharged after IX days of hospitalization, with indication of 20 days of home rest and new control with bronchoscopy three days after discharge and antibiotic coverage with Augmentin 875/125 mg.

The patient underwent two follow-up bronchoscopies, one 3 days after discharge and the other after one month. The first one showed that the lesion appeared to be in almost complete repair, in the absence of continuous solution [Figure 5]. After one month, the recent middle third tracheal lesion appeared completely repaired and re-epithelialized with minimal hyperemia, in the absence of continuous solution [Figure 5].

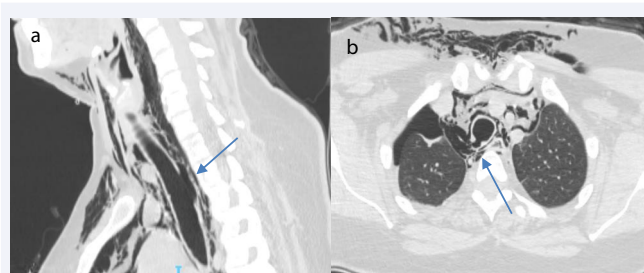


Figure 1 a) Tracheal rupture at CT scan. b) CT scan showing tracheal breach.



Figure 2 Chest X Ray showing bilateral soft tissue emphysema.



Figure 3 Longitudinal pars membranacea rupture of the trachea.



Figure 4 Tracheal laceration covered by fibrin.

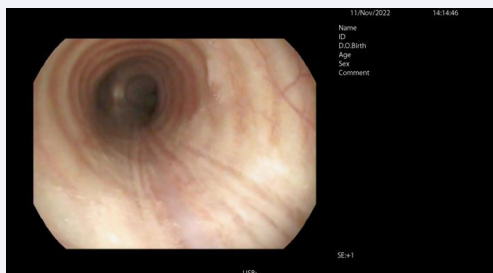


Figure 5 Complete tracheal lesion repair at one month bronchoscopy control.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this Case Report and any accompanying images.

DISCUSSION

TBi's are not common, but often life-threatening [5]. The most frequent cause of tracheal-bronchial injury is after intubation or tracheotomy procedures [6]. Despite the number of cases worldwide, the real amount is underestimated due to high mortality. Orotracheal intubation causing tracheal rupture has a reported incidence of approximately 0.05%-0.37%, despite it is underreported in literature [7]. Trauma appears to be essentially the main reason, but a few risk factors have been reported such as female gender and short stature [8]. When discovered and evaluated by a multidisciplinary team, good outcomes are possible. Bronchoscopy has a key role and is still considered to be the gold standard approach, together with CT scan, to clearly identify dimension, type and position of a TBi [9].

We want to affirm the pivotal role of multidisciplinary assessment in these life-threatening cases. As reported in literature, multidisciplinary approach is demanding and highly necessary to better establish the most appropriate treatment [10]. According to many authors in literature, TFis can be managed conservatively with good resolution [11,12]. Indeed, these patients must meet specific criteria to be evaluated as potentially conservatively approached. Membranous injuries are often treated with a conservative approach with good outcomes and lower rate mortality [13]; however, in specific cases, surgical treatment results to be necessary. There are no guidelines regarding surgical treatment. Surgical approach depends on a series of factors including location whether in the proximal one-third to two-third or distal one-third of the trachea extending to main bronchos. Based on Cardillo et al. [4,14], for tracheobronchial injuries after intubation, according to multidisciplinary team algorithm, conservative bronchoscopic treatment is effective in patients with partial thickness PITL (level I) or full thickness PITL (level II) with no oesophageal or mediastinal soft-tissue hernia. The presence of oesophageal/mediastinal soft tissue hernia identifies a high-risk category (IIIA) which can be treated

conservatively if an adequate respiratory status is achieved and only in highly experienced Centres because of the strong possibility of mediastinitis. A patient with oesophageal injury, mediastinitis (level IIIB) or with extensive loss of substance/fracture of tracheal rings (level IV) requires prompt surgical treatment [Table 1].

Cardillo's revised morphologic classification of the tracheal injury. Despite early surgical treatment is recommended in specific and selected cases after intubation, conservative approach is still a viable alternative in patient unfit for surgery, with reasonable ruptures and in absence of gross air leak [15].

In our case, the patient had no signs of mediastinitis or esophageal laceration, (Level II). No surgical treatment was required and no ventilation was required; in fact the patient was discharged home after IX days without further complications.

Keyrolewasdictatedbypatientmultidisciplinarymanagement. In this type of life-threatening cases, multidisciplinary evaluation is essential to better assess correct approach to the patient and time plays an important role. From the time patient arrived at the emergency room, subsequent investigations such as radiological investigations with bronchoscopists aid, made diagnosis accurate as possible. When transferred to Intensive Care Unit, patient's management was precise, and according to multidisciplinary decision, it was decided to keep monitoring based on subsequent radiological images and clinical picture, found to be stable during all hospitalization. Ultimately, Thoracic Surgery opinion did not depose for surgical treatment, but only observational follow-up. Patient's clinical parameters were found to be improving day by day.

Another important issue again, stemming from multidisciplinary approach was discharge time. Patient was discharged in the absence of any complications on IX hospitalization day. There is no exact average of discharge days described in patient treated conservatively without ventilation need, considering available elements and wide cases reported.

In literature, cases of patients treated conservatively in absence of neither surgical treatment nor ventilation, average days of observation were higher, attesting a discharge time between 11 and 20 days [16-18]. However, the average of hospitalization and discharge days in patients treated conservatively, with brief ventilation support, as reported in

Table 1: Modified from: Cardillo G, et al. Eur J Cardio-thoracic Surg 2010; 37:581-587.

Classification	Morphologic description
Level I	Mucosal/Submucosal tracheal involvement without subcutaneous -mediastinal emphysema (partial thickness PITL)
Level II	Full-thickness tracheal lesion with subcutaneous or mediastinal emphysema without oesophageal injury or mediastinitis
Level IIIA	Full-thickness laceration of the tracheal wall with oesophageal or mediastinal soft-tissue hernia without oesophageal injury or mediastinitis
Level IIIB	Full-thickness laceration of the tracheal wall with oesophageal injury or mediastinitis
Level IV	Extensive Loss of substance/fracture of tracheal rings

the literature is almost between 6 and 30 days [19]. Therefore, our timing through shared action among colleagues was perfect. Satisfactory result was rapidity of choices, turning into reduction of hospitalization time.

CONCLUSIONS

Despite the presence of a large tracheal tear, conservative approach should always be implemented if the patient is stable. Treatment of intubation-related tracheal laceration is based on the patient's condition. The need for multidisciplinary collaboration beyond treatment is critical. With the ability of combined work between complex units, better outcome, as it was in our case, is the main goal. As a life-threatening disease, time is critical. As multidisciplinary team works together, time of discharge and observation are reduced.

REFERENCES

- Kaloud H, Smolle-Juettner FM, Prause G, List WF. Iatrogenic ruptures of the tracheobronchial tree. *Chest*. 1997; 112: 774-778.
- Massard G, Rougé C, Dabbagh A, Kessler R, Hentz JG, Roeslin N, et al. Tracheobronchial lacerations after intubation and tracheostomy. *Ann Thorac Surg*. 1996; 61: 1483-1487.
- Seijo LM, Sterman DH. Interventional pulmonology. *N Engl J Med*. 2001; 344: 740-749.
- Cardillo G, Ricciardi S, Forcione A R, Carbone L, Carleo F, Di Martino M, et al. Post-intubation tracheal lacerations: Risk-stratification and treatment protocol according to morphological classification. *Front Surg*. 2022; 9: 1049126.
- Balci AE, Eren N, Eren S, Ulkü R. Surgical treatment of post-traumatic tracheobronchial injuries: 14-year experience. *Eur J Cardiothorac Surg*. 2002; 22: 984-989.
- Kyobu Geka. *Tracheobronchial Injury*. 2022; 75: 841-845.
- Symbas PN, Justicz AG, Ricketts RR. Rupture of the airways from blunt trauma: treatment of complex injuries. *Ann Thorac Surg*. 1992; 54: 177-183.
- Boutros J, Marquette CH, Ichai C, Leroy S, Benzaquen J. Multidisciplinary management of tracheobronchial injury. *Eur Respir Rev*. 2022; 31: 210126.
- Marquette CH, Bocquillon N, Roumilhac D, Nevière R, Mathieu D, Ramon P. Conservative treatment of tracheal rupture. *J Thorac Cardiovasc Surg*. 1999; 117: 399-401.
- Gómez-Caro A, Ausín P, Moradiellos FJ, Díaz-Hellín V, Larrú E, Pérez JA, et al. Role of conservative medical management of tracheobronchial injuries. *J Trauma*. 2006; 61: 1426-1434.
- Jougou J, Ballester M, Choukroun E, Dubrez J, Reboul G, Velly JF. Conservative treatment for postintubation tracheobronchial rupture. *Ann Thorac Surg*. 2000; 69: 216-220.
- Cardillo G, Carbone L, Carleo F, Batzella S, Jacono RD, Lucantoni G, et al. Tracheal lacerations after endotracheal intubation: a proposed morphological classification to guide non-surgical treatment. *Eur J Cardiothorac Surg*. 2010; 37: 581-587.
- Borasio P, Ardissonne F, Chiampo G. Post-intubation tracheal rupture. A report on ten cases. *Eur J Cardiothorac Surg*. 1997; 12: 98-100.
- Jorge N, Costa L, Teixeira S, Silva-Pinto A, Paiva J. Tracheal Rupture after Trauma: A Successful Conservative Management. *Cureus*. 2022; 14: e32681.
- Prunet B, Lacroix G, Asencio Y, Cathelinaud O, Avaro JP, Goutorbe P. Iatrogenic post-intubation tracheal rupture treated conservatively without intubation: a case report. *Cases J*. 2008; 1: 259.
- Hyeon Oh J, Jun Hong S, Soo Kang S, Mi Hwang S. Successful Conservative Management of Tracheal Injury After Forceful Coughing During Extubation: A Case Report. *Anesth Pain Med*. 2016; 6: e39262.
- Conti M, Pougeoise M, Wurtz A, Porte H, Fourrier F, Ramon P, et al. Management of postintubation tracheobronchial ruptures. *Chest*. 2006; 130: 412-418.
- Hyeon Oh J, Jun Hong S, Soo Kang S, Mi Hwang S. Successful Conservative Management of Tracheal Injury After Forceful Coughing During Extubation: A Case Report. *Anesth Pain Med*. 2016; 6: e39262.
- Conti M, Pougeoise M, Wurtz A, Porte H, Fourrier F, Ramon P, et al. Management of postintubation tracheobronchial ruptures. *Chest*. 2006; 130: 412-418.