

CASE SERIES

Delay between onset of indication and definitive surgery for tracheal trauma

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Abstract

Tracheal stenosis is rare but a recognized complication after traumatic injury or prolonged intubation. We assessed the time lag between onset of indication for tracheal reconstruction surgery following trauma and actual surgical intervention. We reviewed our operative records for all patients undergoing tracheal reconstruction over the past 10 years. Files were reviewed retrospectively to collect all the relevant data. Surgically all patients were operated via cervical approach. Series 12 cases were identified with an equal split between external trauma and iatrogenic tracheal trauma from prolonged intubation. On, an average patients presented 185 days after initial indication of surgery however there was a wide range of time lag which leads to the importance of early diagnosis of such injuries to reduce delay of definitive management.

Keywords: Trachea Reconstruction Trauma Delay.

Introduction

Tracheal injury is a potentially catastrophic trauma. While iatrogenic trauma associated with intubation leading to tracheal stenosis is the more common indication for intervention, external injury is also a significant contributor. With an average length of 11 cm, the trachea begins at the base of the larynx and ends at the carina bifurcating into the lungs as two primary bronchi. Given the small size, external injury is rare however the relatively unprotected portion in the neck means it is prone to both penetrating and blunt trauma and the mechanism of injury has an impact on final repair strategy. Similarly prolonged intubation traumatizes the trachea with long standing ischaemia secondary to high cuff pressure which exceeds mucosal perfusion pressure leading to ulceration and fibrotic scarring causing stenosis. As such the incidence of tracheal reconstruction surgery depends on local risk factors. One key factor is delay in presentation from onset of pathology. This not only complicates

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management it increases the cost both in terms of management and human suffering with loss of productive days. It also serves as a proxy to assess the general degree of preparedness of trauma and ICU facilities to address tracheal injury. Given the dearth of thoracic surgeons that can perform tracheal reconstructions in the city, a time lag between indication and actual surgery would further negatively impact the situation. As such the focus of our paper is on the lag between onset of indication of surgery and actual date of the definitive procedure for tracheal reconstruction. This is especially pertinent as up to 95% of patients receiving appropriate intervention make a full recovery.¹

Methods

The electronic surgical database at the Aga Khan University Karachi was queried from July 2008 to July 2019 for Tracheal reconstruction procedures. Operative times were obtained from operative room records while patient files were retrospectively reviewed for injury, time between injury and date of operation and demographics like age and gender. Given all procedures were performed by a single surgeon protocols, procedure and surgical technique were uniform for all patients. Investigations included CT imaging as part of their preoperative workup and mandatory flexible bronchoscopy after intubation in the operation theater for all patients. Informed consent was employed for all patients.

Cervical approach was utilized universally and transverse incision was preferred in most cases except where external trauma warranted an altered cervical incision. Systematic dissection with subsequent resection and debridement of the pathological segment followed by reconstruction using PDS sutures was the standard approach.

Results

Over a course of 10 years 12 patients underwent tracheal reconstruction. There were no mortalities. Eight (66.6 %) patients were male with a mean age of 34± 16.5 years. Six patients had iatrogenic tracheal injury due to prolonged intubation, 3 had penetrating trauma while the remaining 3 had blunt trauma to the trachea. Two patients had

Table-1: Delay in presentation of tracheal trauma patients.

Age Years	Gender	Nature of Injury	Presentation Delay	Case time	T-tube Used
40	Male	Blunt trauma	1 week	70 min	No
28	Male	Blunt trauma	15 days	158 min	No
52	Female	Postintubation	Same day	100 min	No
22	Male	Penetrating injury	Same day	65 min	Yes
50	Male	Postintubation	18 months	135 min	Yes
53	Male	Blunt Trauma	2 years	175 min	No
20	Male	Postintubation	1 Month	105 min	No
22	Female	Postintubation	2 Months	125 min	Yes
72	Female	Penetrating Trauma	1 week	150 min	No
40	Male	Postintubation	2 week	144 min	No
52	Female	Penetrating Trauma	2 year	250 min	No
25	Male	Postintubation	3months	155 min	No

developed a tracheoesophageal fistula secondary to the trauma. Time lag between onset of pathology and presentation was highly variable with a mean post injury presentation delay of 185 ± 282 days. Average operative time including bronchoscopy was 136 ± 47.8 minutes. T Tube was utilized in 4 patients. Results are summarized in Table-1.

Discussion

Tracheal injuries can be classified into Traumatic (penetrating or blunt), iatrogenic injury, chemicals and inhalation of toxic fumes. According to a National Safety Council report, thoracic trauma accounted for 25% of all deaths due to blunt trauma² Penetrating or blunt injuries to the neck and chest may damage the trachea. The lack of an early diagnosis may lead to life-threatening problems such as stenosis. The trachea might also be damaged during road traffic accident causing crush injury or high speed impact from the steering wheel leading to tracheoesophageal fistula (TEF) as the trachea and oesophagus compress between the anterior and posterior chest wall. Additionally, serious damage can occur to the trachea in case of an accident that leads to chest and neck trauma.

Early diagnosis of tracheal injury is main priority in trauma setting. Tracheal injuries are not easily diagnosed and for most patients, they are not diagnosed immediately in 25% to 68% of the patients³ presenting symptoms in most of the patients are dyspnoea and respiratory distress along with hoarseness or dysphonia, tracheal injury leading to tracheal stenosis presents with stridor and dyspnoea. Subcutaneous emphysema of neck is a pathognomonic sign of tracheal laceration and is observed in approximately 60% of patients with penetrating injury of cervical trachea.^{3,4} For successful diagnosis, a thorough knowledge about how the injuries

occur is required because the symptoms presented may be highly non-specific. Moreover, the symptoms depend on where the injury occurred and how severe it is. In a trauma setting routine X-ray chest and cervical spine are important for diagnosis. Most patients with tracheal injury present with pneumomediastinum or subcutaneous emphysema. Suspected tracheal injury is further delineated with CT scan neck and chest with IV contrast and direct bronchoscopy.⁵⁻⁷

The primary goal of emergency treatment of tracheal injuries is to stabilize the airway and determine the extent of the injury. Focus is placed on airway, breathing, and circulation. Management of the injury depends on the cause of injury and its extent. For mild injuries, conservative management is adequate. Surgical intervention is required for reconstruction in order to restore the airway.⁵ Bronchoscopy may be used to expand the trachea for improved airflow. In addition, the constricted portion of the trachea may be resected with the remaining ends are anastomosed primarily.

Our cohort represents the unique challenges of our patients in the setting of an urban metropolitan environment. It is unclear how many patients make it to the hospital following critical tracheal injuries from penetrating or blunt trauma. As such the numbers in our cohort may not necessarily represent the real pattern of tracheal injury in the community. This is further supported by the wide variation in time lag between onset of pathology justifying surgery and actual definitive operation. This may explain why a greater proportion of patients had iatrogenic tracheal trauma from prolonged intubation than trauma. Cases where the injury arose from penetrating trauma presented early, usually within 24 hours of the injury while those with intubation related stenosis classically presented later with 2 patients presenting nearly 2 years after the onset of disease. Both

patients with a late presentation had developed tracheoesophageal fistulas as the aftermath of the injury. Given that most patients were paying out of their pocket, it is possible that part of the delay was associated with the expenditure involved. This also highlights the need for greater awareness in trauma caregivers and ICU physicians regarding tracheal trauma and the benefits of early assessment. All cases of external trauma presented with pneumomediastinum on CT scan. While all patients were operated via cervical incision, usage of T-tubes as a regular component of management was introduced recently.

Conclusion

Tracheal injuries are not common but when they occur they present serious threats that are fatal if not managed early enough. Tracheal injuries may either be penetrating or blunt trauma. When intubation is used to assist respiration, high cuff-pressure may cause tracheal stenosis that can be corrected by bronchoscopy. In a complex urban setting a variable mix of etiologies is to be anticipated. However, disproportionate delay between onset of disease and actual surgical management is a serious concern from the public health perspective and this lacuna needs to be addressed via

physician education. To improve patient outcomes, accurate diagnosis of tracheal injuries should be done in order to develop an appropriate treatment option.

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References

1. Ann Cardiothorac Surg. 2018 Mar;7(2):306-308. doi: 10.21037/acs.2018.03.10. Tracheal stenosis-resection and reconstruction. Auchincloss HG, Mathisen DJ.
2. National Safety Council. Accident facts. Preliminary condensed edition, March, 1983
3. Ann Thorac Surg. 2001 Jun;71(6):2059-65. Blunt tracheobronchial injuries: treatment and outcomes. Kiser AC, O'Brien SM, Detterbeck FC.
4. J Thorac Cardiovasc Surg. 1982 Feb;83(2):235-8. Bullet wounds of the trachea. Symbas PN, Hatcher CR Jr, Vlasis SE.
5. StatPearls. 2019 Jan. Tracheal trauma. Livia M. Santiago-Rosado; Cheryl S. Lewison
6. Management of Tracheobronchial Injuries Tamer Altinok, Atilla Can Eurasian J Med. 2014 Oct; 46(3): 209-215. Published online 2014 Aug 26. doi: 10.5152/eajm.2014.42
7. Update on the diagnosis and treatment of tracheal and bronchial injury Zhengwei Zhao, Tianyi Zhang, Xunliang Yin, Jinbo Zhao, Xiaofei Li, Yongan Zhou J Thorac Dis. 2017 Jan; 9(1): E50-E56. doi: 10.21037/jtd.2017.01.19.