

Tracheo-Innominate Artery Fistula – A Surgical and Hemodynamic Emergency



MEDICAL SCIENCE

KEYWORDS : Tracheo-innominate artery fistula, High riding innominate artery, Tracheostomy.

Dr. DipakRanjanNayak	Professor in ENT, Kasturba Medical College, Manipal, Manipal University, Karnataka, India.
Dr. Ajay M Bhandarkar	Assistant Professor in ENT, Kasturba Medical College, Manipal, Manipal University, Karnataka, India.
DrS Ganesh Kamath	Professor and Head of Cardiothoracic surgery, Kasturba Medical College, Manipal, Manipal University, Karnataka, India.
DrRamyaNayak	Senior Resident in Pediatrics, Melaka Manipal Medical College, Manipal Campus, Manipal University, India.
Dr Amrutha Gudiseva	Junior Resident in ENT, Kasturba Medical College, Manipal, Manipal University, India
Dr Susan A Thomas	Junior Resident in ENT, Kasturba Medical College, Manipal, Manipal University, Karnataka, India.

ABSTRACT

Tracheoinnominate artery fistula is a rare complication occurring in less than 1% of tracheostomies. It presents as a surgical emergency because of the massive amount of bleeding associated with it. Management of tracheoinnominate artery fistula requires expertise in identifying the fistula site and also providing emergency fluid management in the form of blood and its substitutes. We present a successful management of such a case.

Introduction:

The innominate artery is the first branch of the aortic arch and divides into the right common carotid and subclavian artery, behind the right sternoclavicular joint.¹ Normally, the innominate artery crosses the trachea between the 6th and 13th ring, commonly at the 9th tracheal ring.^{2,3} A high-lying innominate artery is the one which crosses the trachea at level of 4th ring or above or lies above the level of sternal notch.³ Its incidence has been documented to be around 12%. Other anatomical variations of innominate artery include - the artery may sometimes traverse between the thyroid cartilage and the first tracheal ring and a Bovine arch in which the left common carotid artery arises from the innominate artery, seen in 7% to 27% of aortic vasculatures.⁴ The most common cause of tracheo-innominate artery fistula (TIAF) is low level placement of the tracheostomy tube or a high lying innominate artery. Infection around the stoma and the malignant invasion of a vessel near the trachea could also be the possible etiologies of the fistula. It is a rare complication seen in less than 1% of tracheostomies.⁵ The survival rate following this complication has been reported around 14.3%, and this is mostly confined to the patients who received immediate surgical intervention.⁵ We describe the case of a successfully treated tracheo-innominate artery fistula.

Case presentation:

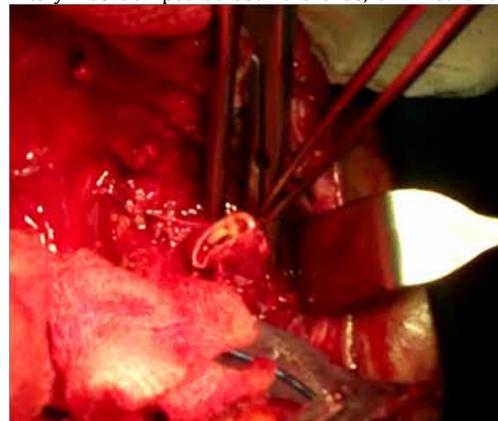
A 24-year-old lady presented to the emergency triage with alleged history of partial hanging. At the time of presentation, patient was unconscious and was not maintaining oxygen saturation on room air. She was unable to move both the upper and lower limbs and the deep tendon reflexes were sluggish. Chest examination revealed bilateral crepitations. Patient was intubated and started on intravenous antibiotics and steroids. On the second day of intubation, she improved and was able to move all four limbs and obey commands. On the 14th day of intubation, patient underwent elective tracheostomy as there was poor respiratory effort and prolonged period of intubation. During the tracheostomy, high right innominate artery was found obscuring the view of the trachea and it was retracted downwards and a high tracheostomy was performed. On the third postoperative day, a sentinel bleed was noted. On the fourth postoperative day, patient developed massive bleeding from the tracheostomy site with resultant hypotensive shock and cardiac arrest. Patient underwent emergency exploration and midline sternotomy with ligation of the innominate artery. Intra-operatively right innominate artery was passing across the trachea

just below the tracheostoma and there was active bleeding from a rent of 2 cm size in the right innominate artery (FIGURE 1).



Figure 1: Tracheo-innominate artery fistula - rent of 2 cm size in the right innominate artery.

Artery was clamped at both the ends, trimmed and sutured



(FIGURE 2). Figure 2: Right innominate artery sutured after excising the fistulous rent in the artery.

The wall of the artery showed necrosis, hence the primary repair was abandoned. Total blood loss was 1100 ml. The patient was resuscitated with colloids, crystalloids and blood. Patient was stabilized hemodynamically and shifted to ICU. There was no further bleeding from the stoma and all the peripheral pulses were palpable. Residual neurological deficit was absent. Fourteen days after exploration, the patient was weaned off the tracheostomy and was discharged without any neurological deficit.

Discussion:

TIAF is a rare complication occurring in less than 1% of tracheostomies,⁶ resulting from erosion of the innominate artery due to a low level placement of the tracheostomy tube or high lying innominate artery. The pathology in TIAF formation is mucosal necrosis due to constant pressure exerted by the elbow, tip or cuff of the tracheostomy tube on the tracheal wall.¹ The capillary pressure in the trachea normally is about 20 - 30 mm Hg. The mucosal blood flow decreases at pressure of 22 to 24 mm Hg and becomes totally obstructed at 35 to 37 mm Hg.^{1,3,5} So high cuff pressures cause necrosis and erosion of the tracheal wall, which extends by eroding into the adjacent innominate arterial wall forming the tracheo-innominate fistula. Most patients being bed ridden will be referred for bleeding from tracheostoma, most often within 21 days of tracheostomy with a peak incidence at 7-14 days post procedure.^{1,3} Immediate management involves maintenance of a patent airway, control of bleeding and basic cardiopulmonary resuscitation. Hyperinflation of the tracheostomy cuff may temporarily control the bleeding, but surgical management is the only life-saving procedure.^{5,6} Bronchoscopy has been indicated as the diagnostic procedure of choice, whereas CT-angiography, arteriography can be helpful in surgical planning by identifying the fistula and the responsible vessel.⁷ But these investigations are less sensitive (20-30%) and not of much help during the episode of acute haemorrhage.⁶ Surgical correction includes two techniques. One is maintaining flow by either direct repair of the defect or by interposition grafting, and the other is interrupting flow by simple ligation or resection of the innominate artery. Flow can be maintained by autologous vein bypass graft between the aorta and the carotid artery, or between the opposite subclavian artery and the carotid artery, provided the stump pressure is less than 50 mmHg. Most authors prefer interruption of flow over reconstruction of the artery for maintaining the flow as the latter has a high risk of rebleeding (60-80%).⁶ Therefore, ligation of the innominate artery is the treatment of choice due

to decreased rate of rebleeding and mortality. The preventive principles involved in breakdown of repair site and subsequent infection are: (1) Monofilament suture to approximate the arterial edges, (2) Healthy arterial wall approximation, (3) Infection control by broad spectrum antibiotics, and (4) Arterial excision of adequate length and approximation of the healthy edges such that the sutured site is not close to the area of erosion.³ Several studies reported the risk of neurologic sequelae or vascular complications in approximately 10% of patients after ligation. But the risk of stroke is quite low because the subclavian artery is filled with significant retrograde flow from the right vertebral artery. The complication rates increase with other coexistent pathologies like atherosclerosis or stenosis or occlusion of the right common carotid artery, right vertebral artery, and/or left common carotid artery.⁶ Therefore the option of ligation of the innominate artery should be considered in these cases. Delayed vascular reconstruction can be done with synthetic graft in a carotid-to-carotid or subclavian-to-subclavian or right axillofemoral arterial bypass, which brings back normal pulses both in the right innominate and carotid arteries.⁵ The mortality rate of TIAF, if not surgically treated, approaches 100%. However, in promptly resuscitated patients, 25% can survive this complication.³

Conclusion:

TIAF complicates 1% of tracheostomies, most common etiology being a high lying innominate artery or a low placed tracheostoma. Immediate management includes control of bleeding and resuscitation. Definite management is surgical division of the artery and ligation of the healthy ends. This complication carries high mortality with survival reserved to those who receive immediate definite surgical management.

REFERENCE

1. Grant CA, Dempsey G, Harrison J, Jones T (2006). Tracheo-innominate artery fistula after percutaneous tracheostomy: three case reports and a clinical review. *Br J Anaesth* 96 (1):127-31.
2. Kapural L, Sprung J, Gluncic I, Kapural M et al (1999). Tracheo-innominate artery fistula after tracheostomy. *Anesth Analg* 88:777-80.
3. Chittithavorn V, Rergkiliang C, Chetpaophan A, Vasinanukorn V (2006). Tracheo-innominate artery fistula in children with high-lying innominate artery. *Asian Cardiovascular and Thoracic Annals* 14: 514.
4. Upadhyaya PK, Bertellotti R, Laeeq A, and Sugimoto A (2008). Beware of the aberrant innominate artery. *Ann Thorac Surg* 85:653-4.
5. Hazarika P, Kamath SG, Balakrishnan R, Girish R et al (2012 July). Tracheo-innominate artery fistula: a rare complication in a laryngectomized patient. *J Laryngol Otol* 116:562-4.
6. Seung WB, Lee HY, Park YS (2012 Dec). Successful treatment of tracheoinnominate artery fistula following tracheostomy in a patient with cerebrovascular disease. *J Korean Neurosurg Soc* 52:547-50.
7. Vaidya N, Strauchler D, Guelfguat M (2013). Computed tomography angiography diagnosis of tracheoinnominate fistula: a case report and review of literature. *Quant Imaging Med Surg* 3(2):121-5.