CLINICAL REPORT

Post Tracheostomy Carotid-Tracheal Fistula

Sudhin Shylendran · Vinit Baliyan ·
Ajay K. Yadav · Atin Kumar · Shivanand Gamanagatti

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Abstract Tracheostomy is the life saving procedure in patients presenting with upper airway obstruction. The procedure is also performed in patients on chronic ventilatory support. It is generally considered a safe procedure with a low complication rate. Vascular injuries are the most serious and life threatening complications. Injury to a high lying innominate artery is the most frequent vascular injury in such cases. Injury to other vessels e.g. carotid arteries is less frequent. We are presenting one such rare type of vascular injury with a fistulous communication between trachea and carotid artery leading to massive hemoptysis.

Keywords Tracheostomy · Carotid-tracheal fistula · Hemoptysis

Introduction

Tracheostomy is a routinely performed life saving surgical procedure to secure the airway in certain emergent situation and also as an elective procedure. Although considered

to be safe and reliable, incidence of major vascular complications range from 0.1 to 1 % [1]. Among the vascular causes, fistulous communication between the trachea and the innominate vessel referred to as Tracheo innominate fistula (TIF) is well documented [2]. The literature contains only a few references of other major vessels communicating with trachea all of which have an equally fatal outcome if not aggressively managed.

Case Report

A 64 year old lady was admitted in the neurosurgical ICU following a fall from stairs and sustaining severe head injury. The patient was put on ventilatory support with hypothermia and ICP monitoring. However her condition continued to deteriorate and percutaneous tracheostomy was performed in view of the continuous ventilatory support. About 2 weeks post tracheostomy, she suffered massive bleeding of approximately 500 ml from the tracheostomy site and into the oral cavity which was aspirated. Following fiber optic bronchoscopy a diagnosis of TIF was suspected and computed tomographic angiography (CTA) of the neck including the chest was performed to identify the source of the bleed and chest status.

The CTA was performed by using a 128 CT scanner scanning from the base of skull to upper abdomen. Scanning parameters were 120 kv, 350 mA, 0.6 mm slice thickness, 1.0 mm reconstruction interval and pitch of 0.938. Intravenous injection of 75 ml of non ionic iodinated contrast media (iohexol, Omnipaque 300, GE Healthcare Inc, Princeton, NJ, USA) was administered using automated syringe injector at rate of 4 ml/s, with bolus tracking technique.

Additional multiplanar reconstructions (MPRs), maximum-intensity projections (MIPs) and 3-dimensional

S. Shylendran · V. Baliyan · A. K. Yadav · A. Kumar (✉) ·
S. Gamanagatti
Department of Radiodiagnosis, All India Institute of Medical
Sciences, New Delhi 110029, India
e-mail: dratinkumar@gmail.com

S. Shylendran
e-mail: sudhinalavil@gmail.com

V. Baliyan
e-mail: vinitbaliyan12@gmail.com

A. K. Yadav
e-mail: ajayyadav_01@hotmail.com

S. Gamanagatti
e-mail: shiv223@rediffmail.com

Fig. 1 CT angiogram images. **a** Axial image showing a small pseudo-aneurysm (*arrow*) arising from the posterior wall of the right carotid artery closely abutting the trachea with the tracheostomy tube in situ and rim of pretracheal hematoma. **b** Sagittal reformatted image

showing right carotid artery pseudo-aneurysm fistulising into the trachea at the site of tracheostomy. **c** Volume rendered image with bone subtraction showing a pseudoaneurysm of right carotid artery (*arrow*)

volume rendered (3D VR) images were created using the Syngo.via work station.

The CTA revealed a small contrast filled out pouching arising from the posterior wall of the right common carotid artery just after its origin from the brachiocephalic (innominate) artery (Fig. 1a) with adjacent thin rim of hematoma in the surrounding pretracheal space. The common carotid pseudo aneurysm measuring approximately 4 mm in diameter had a wide neck fistulising into the anterior wall of the trachea with the stem of the tracheostomy tube in situ (Fig. 1b). Further post processing of the images and removal of the overlying structures demonstrated the site of fistulous communication more clearly (Fig. 1c).

Considering the poor general condition of the patient, open surgical repair was not feasible. Hence an emergent endovascular stenting of the involved vessel was planned. Unfortunately before the patient could be taken for the procedure, she suffered another massive bout of bleeding from the tracheostomy site and due to hemodynamic instability later collapsed and could not be revived.

Discussion

Tracheo arterial fistula (TAF) is a rare complication following a tracheostomy placement. Any bleeding around the tracheostomy site or hemoptysis occurring within 3 days to 6 weeks after the procedure should indicate a TIF until proven otherwise [3]. Other uncommon causes of vascular fistula are from carotid artery as in our case and inferior thyroid artery [4]. The vulnerability of major vessels to injury during percutaneous dilatational tracheostomy is related to the close proximity of the major arteries and veins in the pretracheal space.

The exact pathogenesis of TAF is not fully understood. The two main mechanisms can produce erosive pressure

sufficient to lead to fistula formation. Firstly, the mechanical force generated by either the tube cuff or tube tip and secondly the pressure generated beneath the angulated neck of the tracheostomy tube [2, 5]. Both situations can produce ischaemia extending anteriorly through the tracheal mucosa leading to infection or endotracheal granuloma resulting in inflammation and fistula formation into the adjacent vessel [6, 7]. Other risk factors include low tracheostomy placed below the third tracheal cartilage. High riding innominate artery (Fig. 2) is also a cause of TIF [8].

Although rigid and fiber optic bronchoscopy are the diagnostic procedures of choice, CTA is increasingly being used for surgical planning to identify TIF [9]. To the best of our knowledge this is the first reported case clearly illustrating the site of TCF with CTA and demonstrating its role in planning of endovascular management. Previous

Fig. 2 CE-CT Coronal image of high riding innominate artery in close relation with trachea (*arrow*)

reported case of TCF following tracheostomy was by JR Schenken et al. in 1954 [7].

Use of this non invasive imaging technique with multiplanar and 3D reconstructions has been described prior to repair of TIF [10]. If an endovascular repair is being considered as was in our case, a CTA will be invaluable in precisely demonstration the site of communication the length of stent required and landing zone available for stent placement. With the exquisite anatomical detail rendered and volumetric data acquisition multiple phase CT has become invaluable prior to open surgical repair also. Visualization of TIF with catheter angiography is well documented [11] however CT angiography is a more desirable due to the reduced radiation dose and faster acquisition.

In conclusion this is the first case report of TCF following tracheostomy clearly visualized using CTA. We recommend CT angiography and its various image post processing techniques to diagnose TAF and guide in emergent intervention of this catastrophic condition which is otherwise uniformly fatal.

Conflict of interest No conflict on interests.

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