Esophagobronchial fistulae: Diagnosis by MDCT with oral contrast swallow examination of a benign and a malignant cause

Rahul G Hegde, Tushar M Kalekar, Meenakshi I Gajbhiye, Amol S Bandgar, Shephali S Pawar, Gopal J Khadse
Department of Radiology, Byramjee Jeejeebhoy Medical College and Sassoon General Hospital, Pune, India

Correspondence: Dr. Rahul G Hegde, B/B-8, Ganga Park, Koregaon Park Annexe, Mundhwa Road, Pune - 411 036, Maharashtra, India.
E-mail: rahulhegde@gmail.com

Abstract

We report two cases of esophagobronchial fistulae diagnosed by Multi-detector computed tomography (MDCT) oral contrast swallow examination. It is helpful to supplement the CT study with an oral contrast swallow as it aids in confirmation of a suspected fistula and also demonstrates the fistula tract better. We present the clinical details and the imaging findings on MDCT of two cases of esophagobronchial fistulae – one secondary to chronic chest tuberculosis and the other secondary to a squamous cell carcinoma of the upper esophagus – followed by discussion of the etiology, pathogenesis, and imaging of these fistulae.

Key words: Esophagobronchial; fistula, MDCT; oral contrast swallow

Introduction

Fistulae between the upper respiratory and gastrointestinal tracts are uncommon in adults. Whereas developmental anomaly is the commonest cause in infancy and childhood, the etiology in adults is most frequently secondary to an esophageal malignancy.\[1\]

We report two cases of esophagobronchial fistulae – one secondary to chronic chest tuberculosis and the other secondary to a squamous cell carcinoma of the upper esophagus diagnosed by Multi-detector computed tomography (MDCT). Traditionally, fluoroscopy with oral contrast swallow examination has been the mainstay radiological investigation for the diagnosis of these fistulae.\[2\] However, it can be an inconvenient study with need for multiple projections to adequately demonstrate the fistula and its course. Also, being a luminal study, the cause of the fistula is not adequately evaluated. CT, on the other hand, can detect wall thickening and abnormal enhancement.

It is helpful to supplement the CT study with an oral contrast swallow. Use of the various post-processing features like thick maximum intensity projections (MIPs) and volume rendering techniques (VRTs) enables better detection and depiction of these fistulae. Use of virtual endoscopy also guides the clinician for the conventional endoscopy which would be needed for biopsy and treatment.

Case Reports

Case 1
A 15-year-old male presented with cough, mucopurulent expectoration, and dyspnea since 3 months. There was history of exacerbation of cough after swallowing. This finding of swallow–cough sequence has been referred to
as Ono's sign. A chest radiograph revealed complete opacification of the right hemithorax with volume loss suggesting complete collapse of the right lung with mediastinal shift to the right [Figure 1]. A plain and intravenous contrast-enhanced CT study with oral contrast swallow was performed on a 128-slice MDCT scanner (Siemens Somatom Definition AS, Erlangen, Germany). The study revealed complete collapse of the right lung with irregular dilated ectatic bronchi in the right lower lobe [Figure 2]. There was stenosis and diffuse narrowing of the right mainstem bronchus with nodularity of the mucosa seen best on the virtual bronchoscopy [Figure 3]. The right main pulmonary artery (MPA) was narrow in caliber. There was a resultant significant shift of the mediastinum and heart to the right. An air-filled tract was noted extending from one of the right lower lobar bronchi toward the posterior mediastinum with ill-defined soft tissue around it. The possibility of an esophagobronchial fistula was suspected, and we did a CT oral contrast swallow study to detect it. Oral contrast swallow study performed with the patient in right decubitus position using diluted non-ionic iodinated contrast medium (1:20 dilution of iohexol with normal saline). It depicted the site and the fistula tract between the right lateral wall of the esophagus and one of the ectatic bronchi in the right lower lobe of the lung. Thick MIP images and VRT processing demonstrated the fistula site and tract [Figures 4 and 5]. Right adrenal gland calcification was also noted. These imaging findings led us to conclude that these changes were most likely the sequelae of chronic tuberculosis. The patient underwent an open right pneumonectomy with repair of the fistula. Histology of the lung specimen revealed distorted bronchioles with diffuse and focal dense infiltration by mononuclear cells.
and giant cells. Lymph nodes with prominent germinal centers were also seen.

Case 2
A 65-year-old male presented with progressive dysphagia to solids over the past 2 months. An ultrasound of the neck revealed few enlarged lymph nodes which on fine needle aspiration (FNA) revealed neoplastic squamous cells. A plain and intravenous contrast-enhanced CT study with CT oral contrast swallow was performed. There was moderate irregular enhancing wall thickening of the upper and mid thoracic esophagus. There was a loss of fat plane between the esophagus and the carina, left mainstem bronchus, and aorta. A defect was seen in the posterior wall of the proximal left mainstem bronchus suggesting formation of a fistula with the esophagus [Figure 6]. A CT oral contrast swallow study performed in prone position with diluted non-ionic contrast (1:20 dilution of iohexol in normal saline) revealed a small fistula tract between the esophagus and the proximal left mainstem bronchus just distal to the carina [Figure 7]. Post-processing of this contrast swallow study with volume rendering depicted the fistulous communication in 3D [Figure 8].

Discussion
Esophagobronchial fistulae are uncommon and difficult to diagnose. In the elderly, they are most frequently seen with an intrathoracic malignancy and are most commonly associated with malignancy of the esophagus.[1] In a large case series, esophagorespiratory fistula formation was seen in 12.5% of cases of esophageal malignancies.[10] The malignant tissue spreads to involve the tracheal or bronchial wall. Subsequent ulceration and necrosis of the malignant tissue leads to tissue breakdown and fistula formation. Fistulas may also occur secondary to radiotherapy.

Non-malignant causes are infrequent and include trauma (blunt, penetrating, or iatrogenic),[5,6] chronic inflammation (chronic infections like tuberculosis and...
reports have highlighted its role.[21-23] A routine CT study such cases. [16] The best initial agent to use in both these scenarios of perforation or fistula is a non-ionic iodinated contrast agent. Fluoroscopy allows for dynamic evaluation of esophageal motility as well as evaluation of its lumen. Even though barium swallow fluoroscopy examination with barium is the initial investigation of choice for evaluation of dysphagia and suspected fistulae, even though endoscopy is needed for definite evaluation.[3,14,15] If esophageal perforation is suspected, an iodinated contrast medium should be used as barium extravasation can lead to mediastinitis. If there is no frank leak seen, then barium can be given as it produces better radiographic quality being of higher density than iodine. If respiratory fistula is suspected, barium still may be used as small quantity of barium in the tracheobronchial tree is harmless. However, ionic iodinated contrast medium should not be used as they can cause chemical pneumonitis and only non-ionic iodinated contrast medium should be used in such cases.[14] The best initial agent to use in both these scenarios of perforation or fistula is a non-ionic iodinated contrast agent. Fluoroscopy allows for dynamic evaluation of esophageal motility as well as evaluation of its lumen. Even though barium swallow fluoroscopy examination has the advantage of being a real-time study, fistula tracts may not always be detected.[17-19] If detected, depiction of the three-dimensional course of the fistula may be difficult in spite of use of multiple projections. Also, being a luminal study, it would fail to show changes in the wall of the esophagus and in the mediastinum that are shown accurately by CT.

CT has a proven role in the diagnosis of neonatal tracheobronchial fistulae.[20] No large case series has been published about its efficacy in adult fistulae, but few case reports have highlighted its role.[21-23] A routine CT study could miss these fistulae if the fistula tract is collapsed. This drawback can be overcome by performing a CT oral contrast swallow study. A diluted preparation of a non-ionic iodinated contrast agent should be used. The patient should be given a mouthful bolus of the preparation and asked to swallow it promptly on instruction to do so. Since the oral and pharyngeal phases of deglutition take no more than 2 seconds,[24] the acquisition can be triggered immediately after the instruction to the patient to swallow has been given. The patient position may be changed to better opacify the fistula tract as we used prone and right decubitus positions in our cases to better opacify the fistula tracts. A recent study demonstrated that CT contrast swallow was better tolerated and more sensitive than fluoroscopy at detecting post-esophagectomy anastomotic leaks.[25]

Post-processing these studies with maximum-intensity projection and with volume rendering allows a three-dimensional evaluation of the fistula tract.

Conclusion

Supplementing oral contrast swallow to the chest CT protocol in cases where fistulae are suspected can improve the diagnostic ability of CT and also better demonstrate these fistulae. Virtual endoluminal images also guide the endoscopists while performing biopsies or therapeutic interventions.

References

1. Sebastian S, Parker JO, Lynn RB. Acquired esophagobronchial fistulas in adults. Can Med Assoc J 1969;101:40-2.
2. Spalding AR, Burney DP, Richie RE. Acquired benign bronchoesophageal fistulae in the adult. Ann Thorac Surg 1979;28:378-83.
3. Gerzic Z, Rakic S, Randjelovic T. Acquired benign esophagobronchial fistula: Report of 16 consecutive cases. Ann Thorac Surg 1990;50:724-7.
4. Balazs A, Kupcsulik PK, Galambos Z. Esophagorespiratory fistula: of tumorous origin. Non-operative management of 264 cases in a 20-year period. Eur J Cardiothorac Surg 2008;34:1103-7.
5. Aggarwal D, Mohapatra PR, Malhotra B. Acquired bronchoesophageal fistula. Lung India 2009;26:24-5.
6. Wesselhoeft CW, Jr., Keshishian JM. Acquired nonmalignant esophagotracheal and esophagobronchial fistulas. Ann Thorac Surg 1968;6:187-95.
7. Saxena P, Tam R. Late manifestation of a large congenital tracheoesophageal fistula in an adult. Tex Heart Inst J 2006;33:60-2.
8. Bhargava S, Rastogi R, Agarwal A, Jindal G. Esophagobronchial fistula-A rare complication of aluminium phosphide poisoning. Ann Thorac Med 2011;6:41-2.
9. Diddee R, Ian H Shaw. Acquired tracheo-esophageal fistula in adults. Contin Educ Anaesth Crit Care Pain 2006;6:105-8.
10. Porter JC, Friedland JS, Freedman AR. Tuberculous bronchoesophageal fistulae in patients infected with the human immunodeficiency virus: Three case reports and review. Clin Infect Dis 1994;19:954-7.
11. Lucaya J, Solé S, Badosa J, Manzanares R. Bronchial perforation and bronchoesophageal fistulas: Tuberculous origin in children. AJR Am J Roentgenol 1980;135:525-8.
12. World Health Organization (W.H.O.). Global tuberculosis report 2012. Available from: http://www.who.int/tb/publications/global_report/en/ [Last accessed on 2013 Apr 03].
13. Leon B. Surgical pathology of the head and neck. 2nd ed. USA: CRC Press; 2001.
14. Allen BC, Baker ME, Falk GW. Role of barium esophagography in evaluating dysphagia. Cleve Clin J Med 2009;76:105-11.
15. Darbari A, Suryavanshi A, Tandon S, Chandra G, Singh P. Non malignant Tracheo-ESophageal fistula: Our experience. Indian J Thorac Cardiovasc Surg 2005;21:272-6.
16. Whitehouse GH, Worthington BS. Techniques in diagnostic imaging. 3rd ed. Oxford: Blackwell Science; 1996. p. 526.
17. Wechsler RJ. CT of esophageal-pleural fistulae. AJR Am J Roentgenol 1986;147:907-9.
18. Giménez A, Franquet T, Erasmus JJ, Martínez S, Estrada P. Thoracic complications of esophageal disorders. Radiographics 2002;22 Spec No: S247-58.
19. Tirnaksiz MB, Deschamps C, Allen MS, Johnson DC, Pairolero PC. Effectiveness of screening aqueous contrast swallow in detecting clinically significant anastomotic leaks after esophagectomy. Eur Surg Res 2005;37:123-8.
20. Fitoz S, Atasoy C, Yagmurlu A, Akyar S, Erden A, Dindar H. Three-dimensional CT of congenital esophageal atresia and distal tracheoesophageal fistula in neonates: Preliminary results. AJR Am J Roentgenol 2000;175:1403-7.
21. Chaky DM, Escamilla C, Sheridan PH, Deboer D. Adult bronchoesophageal fistula diagnosed on computed tomography. Radiol Case Rep 2008;3:126.
22. Nigro JJ, Bremner RM, Fuller CB, Theisen J, Ma Y, Starnes VA. Perforating Barrett’s ulcer resulting in a life-threatening esophagobronchial fistula. Ann Thorac Surg 2002;73:302-4.
23. Sakamoto Y, Seki Y, Tanaka N, Nakazawa T, Nobori M. Tracheoesophageal fistula after blunt chest trauma: Successful diagnosis by computed tomography. Thorac Cardiovasc Surg 2000;48:102-3.
24. Palmer JB, Rudin NJ, Lara G, Crompton AW. Coordination of mastication and swallowing. Dysphagia 1992;7:187-200.
25. Upponi S, Ganeshan A, D’Costa H, Betts M, Maynard N, Bungay H, et al. Radiological detection of post-oesophagectomy anastomotic leak: A comparison between multidetector CT and fluoroscopy. Br J Radiol 2008;81:545-8.

Cite this article as: Hegde RG, Kalekar TM, Gajbhiye MI, Bandgar AS, Pawar SS, Khadse GJ. Esophagobronchial fistulae: Diagnosis by MDCT with oral contrast swallow examination of a benign and a malignant cause. Indian J Radiol Imaging 2013;23:168-72.

Source of Support: Nil, Conflict of Interest: None declared.