Esophageal Tuberculosis

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Key Points

1. Esophageal tuberculosis is an uncommon form of tuberculosis that usually results from secondary involvement of esophagus by tuberculosis of the mediastinal lymph nodes.
2. Dysphagia is the most common presentation followed by pain, odynophagia, and hematemesis.
3. Endoscopy with biopsy establishes the diagnosis in the majority of cases.
4. Endoscopic ultrasound-guided tissue acquisition can be used if endoscopic biopsies are negative or in cases with submucosal lesions.
5. Antitubercular treatment has excellent outcomes but occasional patients may need endoscopic or surgical intervention to treat complications like fistula.

4.1 Introduction

Tuberculosis (TB) can involve any organ of the human body however due to its inherent nature of some organs being less affected than others. The gastrointestinal tract is a common site of extra-pulmonary TB (EPTB) however esophagus is affected less frequently [1, 2]. Though esophageal TB (Eso-TB) is uncommon, it is

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an important cause of dysphagia in TB endemic areas. The earliest record of esophageal TB (Eso-TB) available is of post mortem recognition by Denovilliers in 1837 [3]. The first antemortem record of a documented case of Eso-TB was back in 1907 by von Shrotter [4]. Since then, to date, more than 300 cases of Eso-TB have been documented in the literature. The prognosis of Eso-TB has improved remarkably due to early diagnosis with the advent of endoscopy and highly effective treatment with antitubercular (ATT) therapy [3, 5].

4.2 Epidemiology

One of the earliest available autopsy studies found that esophagus was involved in 25 patients out of 16,489 tuberculosis cadavers studied; the overall rate of Eso-TB thus was only 0.15% [3]. Another study by Carr et al. showed only one of 1400 tubercular cadavers (0.07%,) had Eso-TB [6]. Similarly in study from India carried out on 11,746 TB cadavers, esophagus involvement was noted in 0.07% cases and Eso-TB constituted 0.2% of abdominal TB [2]. In a study by Marshall et al., Eso-TB constituted 0.3% of diagnosed abdominal TB cases [1]. A recent study from Korea had 2.15% of Eso-TB cases among all abdominal TB cases [7]. The higher number of cases in recent studies and case series can be attributed to improvised detection techniques along with a rise in EPTB cases [8].

Both genders are affected almost equally in Eso-TB. In 300 cases of Eso-TB reviewed, 145 (48.3%) were males and 155 (51.7%) were females. The Eso-TB has been documented throughout the globe but like PTB, it is more common in areas where TB is prevalent like South-east Asia and Africa. Even in the West, majority of cases are the patients who have migrated from TB endemic areas [9–11].

4.3 Classification of Esophageal Tuberculosis

Esophageal tuberculosis is divided into two types for description, i.e., primary and secondary according to pathophysiology [12]. Primary Eso-TB is defined as involvement of the esophagus without the involvement of any other organ in body. Secondary Eso-TB is the involvement of esophagus secondary to the other organs and most often due to spread from the adjacent mediastinal lymph nodes (MLN). Miliary TB, when involves the esophagus, is also considered secondary Eso-TB. Secondary Eso-TB is more commonly observed type and contributes 88.7% of all Eso-TB cases, while the primary form is uncommon and only 33 such cases have been reported in the literature.

4.4 Pathophysiology and Risk Factors

The pathogenesis of Primary Eso-TB is still not clear and multiple plausible ways of involvement of esophagus have been proposed [3, 13]. Primary esophageal involvement may occur due to direct inoculation by swallowing the infected air droplets or one's own infected sputum from a silent pulmonary focus, as a part of miliary spread when esophagus may be the first and sole organ showing manifestations or as a focus of reactivation after silent bacteremia.

Despite common primary TB infections and chest infections, primary esophageal involvement is quite rare. The resistance of esophagus for primary infection may be related to multiple factors like rapid clearance of ingested food or sputum from the esophagus, tubular structure without any mucosal folds, stratified squamous epithelial lining which may be less permeable, sparse lymphatics, and possible protective effect of saliva and salivary enzymes [3, 14]. For secondary Eso-TB, multiple modes of involvement have been described which include an extension from mediastinal lymph nodes, lungs, vertebrae, aortic tuberculosis, or larynx. Secondary Eso-TB may also be due to ingestion of infected sputum from primary pulmonary TB or hematogenous spread (Table 4.1) [3, 12].

Esophageal involvement from the mediastinal lymph nodes is the most common type of involvement. The stages of tubercular lymphadenitis are proliferative lymphadenitis (Stage I), necrosis and fusion of lymph nodes (LN) to each other (Stage II and III), and cavitation due to caseous necrosis (Stage IV) [15]. Esophagus can be involved directly or from retrograde infection from LN via lymphatics. Sometimes LN ruptures into esophagus forming mediastinal sinus leading to drainage of pus. We suggest modified staging to account for fibrosis and calcification which can be easily detected on endoscopic ultrasound (EUS). Apart from this, extension from pulmonary lesions either as direct extension or due to ingested sputum can infect esophagus. Rare reports describes direct extension of the laryngeal tuberculosis into the proximal esophagus [5, 16]. Spine lies in close proximity to the esophagus and Pott's spine can cause simultaneous esophageal involvement [17–19]. Occasional reports have described the esophageal involvement from tubercular pseudo-aneurysm of aorta [20].

Table 4.1 Modes of esophageal involvement in secondary esophageal Tuberculosis

Mode of Involvement	Number (Out of 260 cases studied)	%
Mediastinal LN	247	95.36%
Cervical LN	1	<1%
Abdominal LN	1	<1%
Laryngeal extension	2	<1%
Miliary TB	3	1.15%
Direct extension from lung	3	1.15%
Potts spine/paraspinal abscess	2	<1%
Aortic pseudo-aneurysm	1	<1%

Reported risk factors for Eso-TB include conditions like immunosuppression, malnutrition, overcrowding, and family history of TB which are also applicable to TB infection elsewhere. HIV infection, post-transplant immunosuppressive therapy, and hemodialysis are also risk factors for Eso-TB as noted in the literature [21–23]. Tuberculosis may also afflict diseased esophagus occasionally in the setting of corrosive injury, esophagitis, and carcinoma esophagus.

Pathologically, on gross inspection, three different types of lesions—ulcerative, granular, hypertrophic have been described in esophagus like tubercular lesions elsewhere in gastrointestinal tract [12, 24, 25]. Ulcerative type is usually associated with solitary ulcers but, sometimes multiple ulcers can be seen. By description, ulcers are variable in size and could be large, deep with an irregular border, grayish base, and may be surrounded by small gray nodules. Granular type is uncommon and is associated with miliary type involvement. It may appear as velvety, grayish translucent tubercles which later may enlarge become yellowish, caseate, and can break down to form a proper ulcer. Hypertrophic form is also uncommon and resembles the hypertrophic variety at other places in gastrointestinal tract like at ileocecal region. Esophageal stricture can develop as a sequelae of hypertrophy which may involve a long segment of the esophagus.

4.5 Clinical Presentation

Tuberculosis is the great masquerader and the Eso-TB is no exception. It could present with a myriad of symptoms depending on the site and morphology of involvement as also any underlying complication. The most common symptom is dysphagia followed by retrosternal pain. Pain sometimes may be felt in the epigastrium and can be perceived as discomfort only. Odynophagia is another common symptom and possibly due to the ulcerative nature of the disease. Hematemesis also is seen in a significant number of patients (Table 4.2). Hematemesis in these patients either indicates spontaneous rupture of bulge with ulcer formation or aorto-esophageal fistula. Bleeding from ulceration is usually small in amount and self-limited, while that from aorto-esophageal fistula is a massive and fulminant type [5, 26]. Those

Table 4.2 Symptoms and their frequency (From pooled data of 300 patients)

Symptom	No of patients (Out of 300 cases studied)	%
Dysphagia	249	83
Odynophagia	50	16.66
Pain-mostly retrosternal	92	30.66
Pain-epigastrium	3	1
Hematemesis	14	4.6
Cough on swallow	14	4.6
Anorexia	39	13
Weight loss	72	24
Fever	50	16.66

patients who have broncho/tracheoesophageal fistula can have cough on swallow which can be more common with liquids. Those with esophagocutaneous fistula, swallowed food can be seen coming through percutaneous sinus tract. Twenty-five percent of patients have constitutional symptoms, weight loss being most common followed by fever and anorexia. Clinical examination can reveal peripheral, especially neck lymphadenopathy and lung lesions in a few patients.

4.6 Differential Diagnosis

1. **Esophageal Carcinoma:** Most common differential diagnosis for Eso-TB is esophageal carcinoma. The endoscopic appearance with histopathology is helpful in differentiating them.
2. **Esophageal Crohn's disease:** Common endoscopic findings include aphthous ulcers, serpiginous ulcers, nodules, pseudo polyps, and skip lesions. Ultimate differentiation may require additional clinical features, other organ involvement and histopathology [27].
3. **Syphilis:** Involvement depends upon stage of syphilis. Generally, punched-out ulcers with regular borders are seen in syphilis. In late stages stricture formation or fistula formations is also common. Overall, syphilis is rare nowadays and serological tests confirm the diagnosis.
4. **Sarcoidosis:** In sarcoidosis, **the** most common site of involvement is the lower esophagus. Involvement is likely due to infiltration of mucosa and submucosa, or muscle layer or enteric nervous plexus, and very rarely due to extrinsic compression by lymph nodes. Ulcer and LN bulge are very rare [28]. Additionally, in presence of LN, endoscopic ultrasound (EUS) can help further along with fine-needle aspiration cytology (FNAC) to differentiate it from TB [29].
5. **Viral ulcers:** Viral esophagitis is a common cause of esophageal ulcers and should be recognizable as the underlying cause on histology.

4.7 Evaluation and Investigations

4.7.1 Endoscopy

The standard investigation in the patient presenting with esophageal symptoms is upper gastrointestinal endoscopy (UGIE). The first endoscopic description of Eso-TB in 1907 by von Shrotter described two types of lesion—ulcerative and hypertrophic [30]. Another description is from 1940 which described a bulge as a manifestation [31]. The UGIE findings in Eso-TB can vary from mucosal bulge, bulge with ulcer to rarely proliferative growth-like appearance [32]. The bulge with summit ulcer (extrinsic impression on endoscopy with ulcer on its top) is the hallmark of Eso-TB (Fig. 4.1). The ulcer in Eso-TB is usually solitary with slight irregular hanging edges and a grayish base. Also, ulcers are usually deep, shape is usually linear /longitudinal, and are eccentric but rarely may occupy the entire

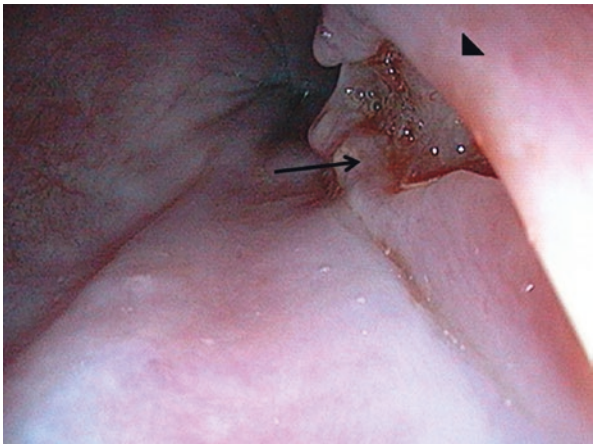

Fig. 4.1 Endoscopic picture showing with bulge (arrowhead) with overlying ulcer (arrow) in mid-esophagus [26]

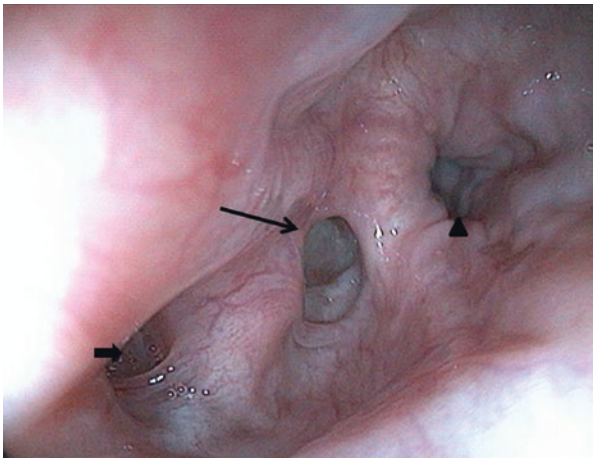

Fig. 4.2 Esophagopulmonary fistula (long arrow—fistula, arrowhead—Esophageal opening, short arrow—diverticulum') [26]

circumference. Occasionally, Eso-TB ulcers are multiple and superficial. The pus discharge may be visible at the center of ulcer in a few cases. In UGIE fistula is usually seen as opening either in ulcer or as a separate opening with smooth margins (Fig. 4.2). The presence of blood clot over the large deep ulcer is alarming as it may indicate aorto-esophageal fistula. The diverticula can occur after healing of active Eso-TB. The stricture as sole finding also has been described. An analysis of 244 cases showed ulcer as the most common finding (29%) followed by bulge with ulcer (22%) and bulge only (19%). More than one descriptive lesion was found in 6% of patients.

Table 4.3 Classification of endoscopic lesions in esophageal tuberculosis

Type of Endoscopic lesion	Endoscopic appearance	Underlying Pathophysiology	Mimic	Incidence (244 patients)
Type I	Smooth extrinsic impression/bulge in lumen. Subtle redness and few nodules occasionally can be seen	Mostly secondary ETB causing extrinsic pressure effect. Rare variety of primary presenting as esophageal mesenchymal tumor.	Esophageal submucosal tumor	50 (19.37%)
Type II	Bulge with summit ulcer: Extrinsic impression with ulcer at top of it. Sometimes pus exuding from it can be seen.	Rupture of mucosa and may be of underlying LN. Pus may discharge from caseating LN	Malignancy	59 (22.86%)
Type III	Linear/longitudinally oriented ulcer Usually deep Shaggy/irregular edges Hanging/rolled down edges Grayish base Usually occupy 1/4 to 1/3 of circumference	Pressure relieved by rupture; pus may be drained out. Ulcer is in fully developed stage.	Malignancy/ infective ulcer	75 (29.06%)
Type IV Rare can present alone but mostly accompany first three types	a. Fistula	Mediastinal or bronchial communication		17 (6.5%)
	b. Diverticulum	Indicate healed lesion		5 (1.9%)
	c. Polyp			4 (1.5%)
	d. Stricture			9 (3.5%)
	e. Mass or ulcero-proliferative growth or polypoidal growth	Mostly indicate hypertrophic variety		6 (2.3%)
	f. Nodularity			3 (1.1%)

The most common part of esophagus involved is the mid-esophagus. In 255 reviewed patients of Eso-TB, mid-esophagus was involved in 80% of cases followed by lower esophagus in 10% and upper esophagus was involved only in 5.5% of patients with rest having multiple sites of involvement. We propose a classification for endoscopic appearance of esophageal TB secondary to MLN (Table 4.3).

Enhanced Imaging Role of narrow-band imaging (NBI) during endoscopy has been described in one case with a small tubercle-like structure detected on intact mucosa. Intrapapillary capillary loops were partly preserved but extended by the

granule while the arborescent vessels that run deeper part of mucosa were obscured by the presence of the granule. Further characterization in future might help to better target biopsies to increase the yield [33].

Endoscopic Biopsy The reported yield of endoscopic biopsy is variable possibly due to differences in the nature of the underlying lesion, variable techniques used, and number of biopsies obtained. One study describes that a single session of biopsy yield was only 50%, which was enhanced to 100% by repeated biopsies with requirement of up to 3 sessions [34]. One study also described the role of endoscopic cytology with yield more than biopsy [35]. This series predominantly constitute primary Eso-TB and also, in our experience base of ulcer can give good yield considering bacterial nature of disease with dominant activity at the center. So, to maximize yield biopsy should be obtained both from the base of ulcer and edges. An old series also depicted the use of FNAC under endoscopic vision with good yield but with the availability of endosonography (EUS), it appears to be obsolete. The endoscopic biopsies in 124 patients on histopathology showed 74% biopsies had some findings (caseating granuloma in 41.12%, non-caseating granulomas in 33%) which helped in diagnosing Eso-TB. On subset analysis of 59 patients, if additional bacteriological studies are applied to biopsies like Polymerase Chain Reaction (PCR), AFB stain and TB culture yield can go up to 96%. So, it is recommended to do a biopsy in all patients in which some mucosal abnormality is detected. As per our opinion, one should do a biopsy both from edges and base with minimum of 4–6 biopsies [19]. Also, AFB staining in histopathological examination (HPE) should be done along with bacteriological investigations like PCR/culture if available to maximize yield as it complements HPE.

4.7.2 Endoscopic Ultrasound (EUS)

Endoscopic ultrasound is a boon for mediastinal pathologies and so for esophageal TB diagnosis. Safety and efficacy of EUS for mediastinal LN evaluation and tissue acquisition are well established [29]. Primary Eso-TB can manifest as esophageal thickening or pure submucosal lesion mimicking gastrointestinal stromal tumor/Leiomyoma/neuroendocrine tumor [36–38]. One case report describes diffuse thickening of esophagus with loss of wall layer mimicking carcinoma. Eso-TB may also involve vessels with loss of fat plane further adding confusion. Henceforth, FNAC or fine-needle aspiration biopsy (FNAB) is an important tool and tissue sampling can resolve the dilemma. This also can avoid unnecessary surgery. EUS may also show a pure intramural lesion arising from second/third/fourth layer and is generally hypoechoic, heterogenous with or without hyperechoic strands [39]. There is no characteristic visual finding on EUS and given the rarity of disease, it is important to perform EUS guided FNAC/FNAB to avoid unnecessary surgery [40, 41]. EUS is of special importance in submucosal lesions (endoscopy shows bulge only) and becomes investigation of choice for evaluation.

It is the mediastinal LN tuberculosis that manifests as secondary esophageal involvement mostly. By far, subcarinal, right tracheobronchial and left hilar groups are commonly involved [42–44]. Radial EUS can describe lymph nodal enlargement and esophageal wall involvement but tissue cannot be obtained with it; that is why it is the linear EUS that is used for evaluation and sampling [45, 46]. Three good-quality series have demonstrated and established the role of EUS with FNAC/FNAB in ETB [47–49]. Various visual features have also been described for the same. We have modified and categorized them according to stages of LN involvement and given in Table 4.4 [15, 50]. Most common finding is mediastinal LN with encroaching esophageal wall layer (Fig. 4.3). Disruption of adventitia with thickening of wall leading to disruption of wall layer structure is usually seen [15, 49]. Overall, EUS has an excellent correlation with LN stages of TB. Esophageal wall disruption was seen in almost 43–50% of cases [47, 48]. Calcification is rarely seen but hyperechoic strands and foci (spots and straps) are common and highly suggestive of tuberculosis [47]. We suggest a description system devised by Fujiwara et al. for future descriptions of LN to provide uniform reporting [51]. Diagnostic yield of

Table 4.4 Classification categories of EUS Findings of mediastinal LN in TB with esophageal involvement

Category	EUS Description				Classification correlate [50] (Jones and Campbell)	Pathology correlate [15] (Liu FG)
	Lymph Node		Border	Esophageal wall		
Type I	Hypoechoic	Homogenous	Distinct	May compress but adventitia intact	Stage I. firm discrete	Stage I. lymphocyte infiltration and capillary proliferation
Type II	Hypoechoic	Heterogenous	Fused with each other, matted, Indistinct	Adventitia breached Five-layer structure may be lost Incrassated wall	Stage II. Rubbery fixed to surrounding tissue	Stage II/ III. LN with necrosis ongoing with membrane disruption
Type III	Hypoechoic	Anechoic areas within	Fused with each other, matted, Indistinct	Adventitia breached, Five-layer structure may be lost, Incrassated wall	Stage III. Abscess	Stage IV. Necrosis abscess formation
Type IV	Hypoechoic	Hyperechoic strands and foci (spots and straps) with or without shadowing	Peripheral calcification may be present	Adventitia breached, Five-layer structure may be lost, Incrassated wall	–	Fibrosis and calcification

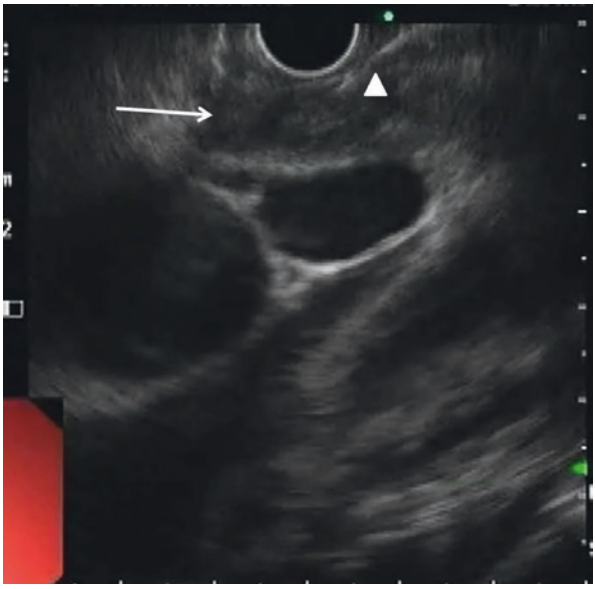

Fig. 4.3 Endoscopic ultrasound showing subcarinal lymph node (arrow—lymph node, arrowhead—FNAC needle) [26]

EUS FNAC is 72–100%. The study reported 72% yield had used sclerotherapy needle in one-third cases which might have resulted in the lower yield. One study which has used FNAB has shown a yield of 94.3%. The average yield in EUS FNAC/FNAB in 81 patients studied was 88%.

Secondary Eso-TB must always be distinguished from esophageal cancer and submucosal tumors. Esophageal cancer originates from the first (mucosal) layer and the findings include disruption of mucosal layer integrity, homogeneous or heterogeneous hypoechoic lesions are noted without hyperechoic spots and strands and no thickening of the esophageal adventitia. The metastatic lymph nodes generally do not adhere to or fuse with the esophageal adventitia which is common in TB. Esophageal mesenchymal tumors originate from the esophageal muscular layer. These benign tumors show a smooth and glossy surface of the mucosal membrane at endoscopy and a mucosal bridge and blood capillary network are frequently seen. At EUS, homogeneous hypoechoic lesions of fusiform or almost round shape are detected; the borders are clear, and the esophageal adventitia is intact, without thickening; and no swelling can be detected in the mediastinal lymph nodes. Rare submucosal tumors of the esophagus, such as neuro-fibrosarcoma and leiomyosarcoma are difficult to distinguish from Eso-TB especially of primary variety [15]. Therefore, EUS guided tissue acquisition plays an important role in establishing a definitive diagnosis of Eso-TB [36, 39, 47–49]. Another differential diagnosis is sarcoidosis in which LN is usually larger, uniform size, homogenous hypoechoic with slight vascularity. Classical hyperechoic strands and foci of TB are absent. Also, sarcoid LN rarely invades esophageal wall [29].

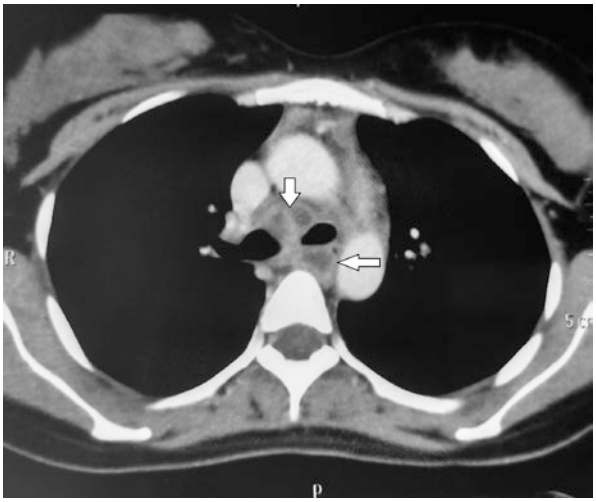

Fig. 4.4 Computed tomography scan showing subcarinal lymph node mostly necrotic compressing esophagus to the extent it cannot be identified separately (down arrow—subcarinal lymph node, right arrow—lymph node compressing esophagus)

4.7.3 Routine Investigations

Routine blood investigations can reveal elevated ESR. Chest roentgenogram can reveal abnormality in 44% (46 out of 104) patients like wide mediastinum, parenchymal abnormalities and should be routinely done. Mantoux test (Tuberculin skin sensitivity) though not diagnostic can be positive in 72% of patients (44 out of 61) [11, 26, 52, 53]. Computed tomography (CT) of chest and abdomen is important to rule out secondary nature of TB and simultaneous involvement of other organs. CT findings can be enhanced with oral contrast addition especially in presence of fistulous complications. CT may demonstrate mediastinal lymphadenopathy, lung parenchymal abnormality, and esophageal thickening (Fig. 4.4). Additionally, complications like mediastino-esophageal fistula/tracheoesophageal fistula/aorto-esophageal fistula can be easily delineated as mentioned above.

Barium swallow, rarely used nowadays, may show extrinsic compression/bulge/mucosal irregularity correlating to endoscopic findings (Fig. 4.5) [54]. Also, fistulas can be very well delineated by barium swallow along with stricture.

4.7.4 Diagnosis

The case of Eso-TB can be defined as a confirmed (microbiologically positive) case if bacteriological proof [Acid Fast Bacilli (AFB) in tissue, positive culture or PCR for Mycobacterium TB (MTB)] is present. In absence of

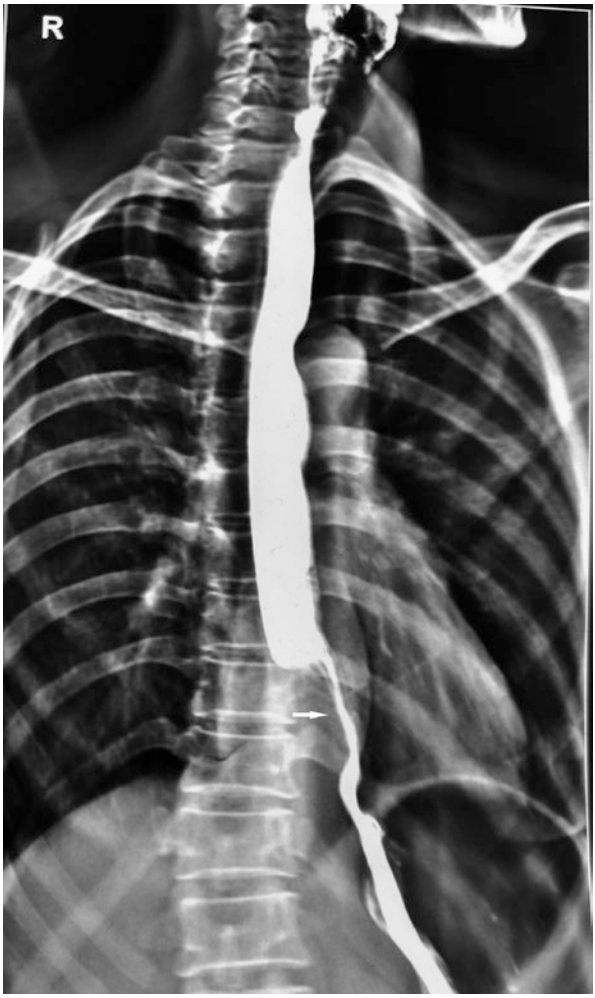

Fig. 4.5 Barium swallow depicting extrinsic compression in lower esophagus (arrow) with mucosal irregularities in lower part (arrowhead)

microbiological positivity but in presence of caseating granulomas or non-caseating granulomas on histopathology the cases are labeled as probable (or clinically diagnosed) cases which must be followed up closely to demonstrate a response to ATT. The easiest and most commonly used techniques for obtaining tissue are endoscopy and endoscopic ultrasound. Alternatively, bronchoscopy, CT guided FNAC of mediastinal LN or vertebral column lesion can be done as per clinical presentation.

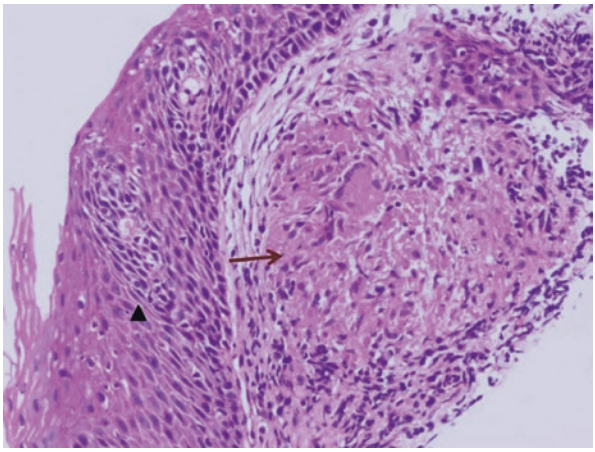

Fig. 4.6 H& E stain at 20× magnification showing stratified squamous epithelium with caseating well-defined epitheloid granuloma [26]

4.7.5 Pathological and Microbiology

Overall histopathology yield (from endoscopic biopsies/autopsy/surgical specimens) is high and is around 83% (142 out of 171 patients, caseating granuloma—86, non-caseating—56) (Fig. 4.6). Overall, tissue AFB positivity rate is 46% (analyzed in 71 patients of whom 35 were positive). Tissue culture for mycobacterium tuberculosis is proven method with excellent results but sparingly used in practice due to availability and delayed results and also lack of suspicion of underlying TB on initial endoscopy. Limited data of 14 patients show high positivity rate of 92% [55]. There are few reports which used PCR for *Mycobacterium tuberculosis* as an additional modality. Overall, PCR test positivity rate is 64% (data available for 17 patients, 11 are positive) [18, 37, 45, 46, 56–66]. Recently, nested PCR with automatic amplification which is a cartridge-based technique called as Gene Xpert has been increasingly used for tuberculosis. To date only five cases are available which used this technique with excellent results with 80% sensitivity [26, 67].

4.8 Complications

Eso-TB can result in complications if not diagnosed and treated timely. Overall, complications were seen in 17% of Eso-TB patients (53/300). The complications are as described below:

1. *Mediastinoesophageal fistula*: Mediastinal LN turns into abscess and then ruptures into esophagus. This is the most common complication occurring in 6% of patients. CT can show air in mediastinum with or without air fluid level. No specific treatment is generally required [5, 26, 68–70].

2. *Tracheoesophageal fistula (TEF)*: Mediastinal LN erodes into trachea/bronchus on one side and esophagus on another, thus leading to fistula formation. Most common involved area is right main bronchus but left-sided involvement is well documented [9, 71, 72]. Earlier, it was thought to be only can be treated with surgery as shown in a review of 26 cases, 22 of which required surgery [73]. In our review of 300 cases, 12 (4%) had TEF. Most TEF patients were treated with ATT and improved [9, 26, 54, 74–77]. Surgery and endoscopic interventions are helpful in cases for whom ATT fails.
3. *Aorto-esophageal fistula*: In presence of TB aorta can be involved in four ways by either erosion of esophageal (or mediastinal lymph node) into the aorta or vice versa. [78–80]
4. *Pleuroesophageal fistula:* Fistula can be formed between esophagus and pleura if LN rupture into pleura on one side and esophagus on the other. Similarly, primary pleural involvement with secondary esophageal involvement can also lead to pleuroesophageal fistula formation [81].
5. *Esophagoesophageal fistula*: Esophageal involvement can lead to tunneling with rupture at two different points leading to esophagoesophageal fistula [70].
6. *Stricture*: Esophageal stricture is relatively uncommon in esophageal tuberculosis. Eccentric rather than concentric involvement, secondary nature of involvement, and rapid healing on treatment may contribute to less amount of periesophageal fibrosis and hence low stricture rate in Eso-TB. Nonetheless, if it formed dilatation with ATT or surgical reconstruction can be tried if not resolved with ATT [12].
7. *Perforation:* Esophagus can perforate as a result of Eso-TB leading to catastrophe events. It can rupture either into the mediastinum or into the abdomen [24].
8. *Esophagocutaneous fistula*: This is an extremely rare complication and only two cases have been reported. The classical feature in this is swallowed food comes out through cutaneous opening. In both documented cases, the fistula healed with ATT [82–84].

4.9 Treatment

Treatment of tuberculosis has evolved from the nineteenth century approach of observation and sanatorium approach to multidrug therapy as of now [25, 85, 86]. Most of the cases treated surgically are either undiagnosed initially or have complications that mandate surgery. ATT is the standard of care with a cure rate of almost 100%. Multidrug-resistant tubercular cases are being reported lately in Eso-TB as well but can be treated with available treatment options. Symptoms improve rapidly with ATT at around 1–6 weeks. Alternate provision for enteral feed like feeding jejunostomy/gastrotomy may be occasionally needed in patients who are already malnourished and/or have a fistulous complication which may preclude oral feeding [77].

4.9.1 Specific Treatment

Presently, only a few cases might require specialized surgical/endoscopic care as per underlying complications. Aorto-esophageal fistula requires urgent surgical intervention and if not treated could be fatal. The endoscopic dilatations might be required for strictures not improving on ATT. In selective cases, surgery is required for stricture and gastric pull up/ colonic interposition has been used [78, 87, 88]. In non-healing symptomatic fistulas, endoscopic management with over the scope clip (OTSC)/self-expanding metallic stent (SEMS) can also be tried prior to surgery [72].

4.9.2 Outcomes

The cure rate of ATT in the latest series has been 100% [5, 26, 48, 89]. Of 300 reviewed patients of Eso-TB, 276 received some sort of treatment. Rest either refused or were lost to follow up or died [70, 90]. Of these 15 received some surgical treatment [81, 91]. Overall, in 286 patients in whom follow-up is available, 265 were cured with a cure rate of 92.60%, 21 died with a mortality rate of 7.40%.

Eso-TB is an uncommon but not a rare entity. With advances in diagnostic modalities (especially cross-sectional imaging, endoscopy, and endoscopic ultrasound) and effective chemotherapy (ATT), the outcome in patients with Eso-TB is usually good.

Conflict of Interest None

References

1. Marshall JB. Tuberculosis of the gastrointestinal tract and peritoneum. Am J Gastroenterol. 1993;88(7):989–99.
2. Pimparkar BD. Abdominal tuberculosis. J Assoc Physicians India. 1977;25(11):801–11.
3. Lockard LB. Esophageal tuberculosis; A critical review. Laryngoscope. 1913;23(5):561–84.
4. Damtew B, Frengley D, Wolinsky E, Spagnuolo PJ. Esophageal tuberculosis: mimicry of gastrointestinal malignancy. Rev Infect Dis. 1987;9(1):140–6.
5. Mokoena T, Shama DM, Ngakane H, Bryer JV. Oesophageal tuberculosis: a review of eleven cases. Postgrad Med J. 1992;68(796):110–5.
6. Carr DT, Spain DM. Tuberculosis in a carcinoma of the Oesophagus. Am Rev Tuberc. 1942;46(3):346–9.
7. Cho J-K, Choi YM, Lee SS, Park HK, Cha RR, Kim WS, et al. Clinical features and outcomes of abdominal tuberculosis in southeastern Korea: 12 years of experience. BMC Infect Dis. 2018;18(1):699.
8. Prakasha SR, Suresh G, D'sa IP, Shetty SS, Kumar SG. Mapping the pattern and trends of Extrapulmonary tuberculosis. J Glob Infect Dis. 2013;5(2):54–9.
9. Dow CJ. Oesophageal tuberculosis: four cases. Gut. 1981;22(3):234–6.
10. Savage PE, Grundy A. Oesophageal tuberculosis: an unusual cause of dysphagia. Br J Radiol. 1984;57(684):1153–5.

11. Bonthala L, Wood E. Oesophageal tuberculosis. BMJ Case Rep. 2011;2011:bcr0920114883.
12. Fahmy AR, Guindi R, Farid A. Tuberculosis of the oesophagus. Thorax. 1969;24(2):254–6.
13. Khuroo MS, Khuroo NS. Abdominal Tuberculosis. In: Madkour MM, editor. Tuberculosis. Berlin: Springer; 2004. p. 659–67.
14. Wang Y, Zhu L, Xia W, Wang F. Anatomy of lymphatic drainage of the esophagus and lymph node metastasis of thoracic esophageal cancer. Cancer Manag Res. 2018;10:6295–303.
15. Han X-M, Yang J-M, Xu L-H, Nie L-M, Zhao Z-S. Endoscopic ultrasonography in esophageal tuberculosis. Endoscopy. 2008;40(08):701–2.
16. Montes I, Larsen E, Haiderer O, Kennedy JH. Tuberculous stricture of the esophagus: report of a patient successfully treated by colon interposition. Chest. 1971;60(2):194–5.
17. Eng J, Sabanathan S. Tuberculosis of the esophagus. Dig Dis and Sci. 1991;36(4):5.
18. Shad S, Aslam Rai A, Bux Soomro G, Hassan LN. Tuberculous Paraspinal abscess invading esophagus: a rare cause of dysphagia. J Coll Physicians Surg Pak. 2018;28(7):566–7.
19. Devarbhavi HC, Alvares JF, Radhikadevi M. Esophageal tuberculosis associated with esophagotracheal or esophagomediastinal fistula: report of 10 cases. Gastrointest Endosc. 2003;57(4):588–92.
20. O'Leary M, Nollet DJ, Blomberg DJ. Rupture of a tuberculous pseudoaneurysm of the innominate artery into the trachea and esophagus: report of a case and review of the literature. Hum Pathol. 1977;8(4):458–67.
21. Castro G, Módena J, Figueiredo J, Martinez R. Esophageal tuberculosis in a patient with acquired immune deficiency syndrome: a rare presentation. Endoscopy. 2006;38(Suppl 2):E27–8.
22. Kumar S, Minz M, Sinha SK, Vaiphei K, Sharma A, Singh S, et al. Esophageal tuberculosis with coexisting opportunistic infections in a renal allograft transplant recipient. Transpl Infect Dis. 2017;19(1):e12640.
23. Damaschin O, Dahmani O, Faibis F, Demachy M-C, Abtahi M, Cucherousset N, et al. Esophageal tuberculosis in a patient on maintenance dialysis: advantages of interferon-gamma release assay. Ren Fail. 2009;31(3):248–50.
24. Rubinstein BM, Pastrana T, Jacobson HG. Tuberculosis of the esophagus. Radiology. 1958;70(3):401–3.
25. Torek F. Tuberculosis of the Œsophagus. Ann Surg. 1931;94(4):794–8.
26. Dahale AS, Kumar A, Srivastava S, Varakanahalli S, Sachdeva S, Puri AS. Esophageal tuberculosis: uncommon of common: esophageal tuberculosis. JGH Open. 2018;2(2):34–8.
27. Geboes K, Janssens J, Rutgeerts P, Vantrappen G. Crohn's disease of the esophagus. J Clin Gastroenterol. 1986;8(1):31–7.
28. Abraham A, Hajar R, Virdi R, Singh J, Mustacchia P. Esophageal sarcoidosis: a review of cases and an update. ISRN Gastroenterol. 2013;2013:836203.
29. Fritscher-Ravens A, Ghanbari A, Topalidis T, Pelling M, Kon O, Patel K, et al. Granulomatous mediastinal adenopathy: can endoscopic ultrasound-guided fine-needle aspiration differentiate between tuberculosis and sarcoidosis? Endoscopy. 2011;43(11):955–61.
30. Vinson PP, Dobson HE. Tuberculous stricture of the Oesophagus. Am Rev Tuberc. 1927;16(1):53–6.
31. Clerf LH. LXVI tuberculous Periesophageal abscess producing stenosis: report of a case. Ann Otol Rhinol Laryngol. 1940;49(3):793–6.
32. Fagundes RB, Dalcin RP, Rocha MP, Moraes CC, Carlotto VS, Wink MO. Esophageal tuberculosis. Endoscopy. 2007;39(Suppl 1):E149.
33. Takaki Y, Yao K, Yano Y, Matsui T, Tanabe H, Haraoka S, et al. Esophageal tuberculosis: a microgranuloma visualized by narrow-band imaging magnifying endoscopy. Endoscopy. 2011;43(Suppl 2):E377–8.
34. Park JH, Kim SU, Sohn JW, Chung IK, Jung MK, Jeon SW, et al. Endoscopic findings and clinical features of esophageal tuberculosis. Scand J Gastroenterol. 2010;45(11):1269–72.
35. Jain SK, Jain S, Jain M, Yaduvanshi A. Esophageal tuberculosis: is it so rare? Report of 12 cases and review of the literature. Am J Gastroenterol. 2002;97(2):287–91.

36. Sharma V, Rana S, Chhabra P, Sharma R, Gupta N, Bhasin D. Primary esophageal tuberculosis mimicking esophageal cancer with vascular involvement. Endosc Ultrasound. 2016;5(1):61.
37. Mou Y, Zeng H, Wang Q-M, Yi H, Liu W, Wen D, et al. Esophageal tuberculosis initially misdiagnosed by endoscopy as a submucosal tumor. Endoscopy. 2015;47(Suppl 1):E30-1.
38. Li Y-X, Nian W-D, Wang H-H. A case of esophageal tuberculosis with unusual endoscopic feature. Clin and Res Hepatol Gastroenterol. 2018;42(1):e5–6.
39. Seo JH, Kim GH, Jhi JH, Park YJ, Jang YS, Lee BE, et al. Endosonographic features of esophageal tuberculosis presenting as a subepithelial lesion: endoscopic ultrasound in esophageal TB. J Dig Dis. 2017;18(3):185–8.
40. Huang Y. Esophageal tuberculosis mimicking submucosal tumor. Interact Cardiovasc Thorac Surg. 2004;3(2):274–6.
41. Sood D, Singh T, Singh A, Chaudhary A. Esophageal tuberculosis mimicking submucosal leiomyoma- report of a case. Indian J Surg. 2011;73(6):465–6.
42. Bloomberg TJ, Dow CJ. Contemporary mediastinal tuberculosis. Thorax. 1980;35(5):392–6.
43. Liu C-I, Fields WR, Shaw C-I. Tuberculous mediastinal lymphadenopathy in adults. Radiology. 1978;126(2):369–71.
44. Amorosa JK, Smith PR, Cohen JR, Ramsey C, Lyons HA. Tuberculous mediastinal lymphadenitis in the adult. Radiology. 1978;126(2):365–8.
45. Aydin A, Tekin F, Ozutemiz O, Musoglu A. Value of endoscopic ultrasonography for diagnosis of esophageal tuberculosis: report of two cases. Dig Dis Sci. 2006;51(9):1673–6.
46. Marsman W. Dysphagia caused by esophageal tuberculosis. Neth J Med. 2001;58(2):82–5.
47. Rana S, Bhasin D, Rao C, Srinivasan R, Singh K. Tuberculosis presenting as dysphagia: clinical, endoscopic, radiological and endosonographic features. Endosc Ultrasound. 2013;2(2):92.
48. Puri R, Khaliq A, Kumar M, Sud R, Vasdev N. Esophageal tuberculosis: role of endoscopic ultrasound in diagnosis: EUS in esophageal tuberculosis. Dis Eso. 2012;25(2):102–6.
49. Tang Y, Shi W, Sun X, Xi W. Endoscopic ultrasound in diagnosis of esophageal tuberculosis: 10-year experience at a tertiary care center. Dis Eso. 2017;30(8):1–6.
50. Mohapatra PR, Janmeja AK. Tuberculous lymphadenitis. J Assoc Physicians India. 2009;57:585–90.
51. Fujiwara T, Yasufuku K, Nakajima T, Chiyo M, Yoshida S, Suzuki M, et al. The utility of sonographic features during endobronchial ultrasound-guided Transbronchial needle aspiration for lymph node staging in patients with lung cancer: a standard endobronchial ultrasound image classification system. Chest. 2010;138(3):641–7.
52. Al-Idrissi HY, Satti MB, Al-Quorain A, Ibrahim EM, Al-Fiar FZ. Granulomatous oesophagitis: a case of tuberculosis limited to the oesophagus. Ann Trop Med Parasitol. 1987;81(2):129–33.
53. Ch'ng EC, Hooi LN, Halimah Y, Syed J. Oesophageal tuberculosis-an unusual site for tubercular infection. Med J Malaysia. 1997;52(1):91–3.
54. Nagi B, Lal A, Kochhar R, Bhasin DK, Gulati M, Suri S, et al. Imaging of esophageal tuberculosis. A review of 23 cases. Acta Radiol. 2003;44(3):329–33.
55. Brullet E, Font B, Rey M, Ferrer A, Nogueras A. Esophageal tuberculosis: early diagnosis by endoscopy. Endoscopy. 1993;25(7):485.
56. Leung VKS, Chan WH, Chow TL, Luk ISC, Chau TN, Loke TKL. Oesophageal tuberculosis mimicking oesophageal carcinoma. Hong Kong Med J. 2006 Dec;12(6):473–6.
57. Harish K, Gokulan C. Primary oesophageal tuberculosis: a rare entity. Trop Gastroenterol. 2007;28(4):178–9.
58. Fujiwara T, Yoshida Y, Yamada S, Kawamata H, Fujimori T, Imawari M. A case of primary esophageal tuberculosis diagnosed by identification of mycobacteria in paraffin-embedded esophageal biopsy specimens by polymerase chain reaction. J Gastroenterol. 2003;38(1):74–8.
59. Fujiwara Y, Osugi H, Takada N, Takemura M, Lee S, Ueno M, et al. Esophageal tuberculosis presenting with an appearance similar to that of carcinoma of the esophagus. J Gastroenterol. 2003;38(5):477–81.
60. Musoğlu A, Ozütemiz O, Tekin F, Aydin A, Savaş R, Ilter T. Esophageal tuberculosis mimicking esophageal carcinoma. Turk J Gastroenterol. 2005;16(2):105–7.

61. Peixoto PC, Ministro PS, Sadio AD, Cancela EM, Araújo RN, Machado JL, et al. Esophageal tuberculosis: an unusual cause of dysphagia. Gastrointest Endosc. 2009;69(6):1173–6.
62. Welzel TM, Kawan T, Bohle W, Richter GM, Bosse A, Zoller WG. An unusual cause of dysphagia: esophageal tuberculosis. J Gastrointestin Liver Dis. 2010;19(3):321–4.
63. Khanna V, Kumar A, Alexander N, Surendran P. A case report on esophageal tuberculosis – a rare entity. Int J Surg Case Rep. 2017;35:41–3.
64. Khan MS, Maan MHA, Sohail AH, Memon WA. Primary esophageal tuberculosis mimicking esophageal carcinoma on computed tomography: a case report. World J Gastrointest Surg. 2019;11(9):373–80.
65. Jain SS. Esophageal tuberculosis presenting with hematemesis. World J Gastrointest Endosc. 2013;5(11):581.
66. Changal KH, AbH R, Parra R, Khan MA. Esophageal tuberculosis; a rare cause of odynophagia: a case report. Egypt J Chest Dis Tuberc. 2013;62(2):349–51.
67. Prasant P, Kajal N, Dadra R, Nithin K, Kaur J. Esophageal tuberculosis: a rare case report. Int J Mycobacteriol. 2019;8(4):409.
68. Sasikumar C, Utpat K, Desai U, Joshi JM. Esophagomediastinal fistula presenting as drug resistant tuberculosis. Ind J Tuberc. 2020;67(3):363–5.
69. Madi D. An interesting case of dysphagia in a HIV patient. J Clin Diagn Res. 2013;7(3):534–6.
70. de Silva R, Stoopack PM, Raufman JP. Esophageal fistulas associated with mycobacterial infection in patients at risk for AIDS. Radiology. 1990;175(2):449–53.
71. Allen CM, Craze J, Grundy A. Case report: tuberculous broncho-oesophageal fistula in the acquired immunodeficiency syndrome. Clin Radiol. 1991;43(1):60–2.
72. Baijal R, Ramegowda PKH, Jain M, Gupta D, Shah N, Kulkarni S. Clinical profile and management of tuberculous bronchoesophageal fistula. J Dig Endosc. 2013;04(04):103–6.
73. Wigley FM, Murray HW, Mann RB, Saba GP, Kashima H, Mann JJ. Unusual manifestation of tuberculosis: TE fistula. Am J Med. 1976;60(2):310–4.
74. Abid S, Jafri W, Hamid S, Khan H, Hussainy A. Endoscopic features of esophageal tuberculosis. Gastrointest Endosc. 2003;57(6):759–62.
75. Rosario MT, Raso CL, Comer GM. Esophageal tuberculosis. Dig Dis Sci. 1989;34(8):4.
76. McNamara M, Williams CE, Brown TS, Gopichandran TD. Tuberculosis affecting the oesophagus. Clin Radiol. 1987;38(4):419–22.
77. Desai P, Mayenkar P, Northrup TF, Mallela V. Bronchoesophageal fistula due to esophageal tuberculosis. Case Rep Infect Dis. 2019;2019:1–3.
78. Hancock BW, Barnett DB. Case of post-primary tuberculosis and massive haematemesis. Br Med J. 1974;3(5933):722–3.
79. Amonkar GP, Vaideeswar P, Metkar GS. Oesophageal rupture due to tuberculous pseudoaneurysm of the aorta. J Clin Pathol. 2009;62(7):671.
80. Catinella FP, Kittle CF. Tuberculous esophagitis with aortic aneurysm fistula. Ann Thorac Surg. 1988;45(1):87–8.
81. Ni B, Lu X, Gong Q, Zhang W, Li X, Xu H, et al. Surgical outcome of esophageal tuberculosis secondary to mediastinal lymphadenitis in adults: experience from single center in China. J Thorac Dis. 2013;5(4):8.
82. Desai RRP, Keny S, Lawande D. Tubercular esophagocutaneous fistula: rare case report. Indian J Tuberc. 2018;65(2):177–9.
83. Hajong R, Topno N, Baruah AJ, Das R. Tubercular Esophagocutaneous Fistula. Indian J Surg. 2013;75(S1):6–8.
84. Vinodh BN, Sharma SK, Smith-Rohrberg D, Seith A. Tubercular oesophagocutaneous fistula. Indian J Chest Dis Allied Sci. 2006;48(3):209–11.
85. Pellegrini VM. Case of esophageal tuberculosis treated with streptomycin. Arch Ital Otol Rinol Laringol. 1950;61(6):634–8.
86. World Health Organization. Guidelines for treatment of drug-susceptible tuberculosis and patient care: 2017 update. 2017.
87. Fang H-Y, Lin T-S, Cheng C-Y, Talbot AR. Esophageal tuberculosis: a rare presentation with massive hematemesis. Ann Thorac Surg. 1999;68(6):2344–6.

88. Mbiine R, Kabuye R, Lekuya HM, Manyillirah W. Tuberculosis as a primary cause of oesophageal stricture: a case report. J Cardiothorac Surg. 2018;13(1):58.
89. Baijal R, Agal S, Amarapurkar DN, Hr PK, Kotli N, Jain M. Esophageal tuberculosis: an analysis of fourteen cases. J Dig Endosc. 2010;1:14–8.
90. Alataş F, Özdemir N, Işıksoy S, Metintaş M, Erginel S, Harmancı E, et al. An unusual case of esophageal tuberculosis in an adult. Respiration. 1999;66(1):88–90.
91. Eroğlu A, Kürkçüoğlu C, Karaoğlanoğlu N, Yilmaz Ö, Gürsan N. Esophageal tuberculosis abscess: an unusual cause of dysphagia. Dis Eso. 2002;15(1):93–5.