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Review Article

Endobronchial Tuberculosis: Diagnostic and Therapeutic Challenges for Interventional Pulmonologist

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Abstract

Pulmonary tuberculosis is the second most common infectious killer, claiming more than one million lives each year. The tuberculosis is common worldwide, but it is endemic in some parts of the world, such as Asia and Africa. The documented cases of endobronchial tuberculosis are less than that the magnitude of the problem because bronchoscopy and high resolution computed tomography is usually not performed in all cases of suspected or confirmed pulmonary tuberculosis. The complications and late sequelae are major challenges where infrastructure and expertise in Interventional bronchoscopy are warranted.

Key-words: Endobronchial TB, Bronchoscopy, Interventional Pulmonology, Endobronchial granuloma, Airway stenosis, Airway stent.

INTRODUCTION

Endobronchial tuberculosis (EBTB) is defined as a tuberculous infection of the tracheobronchial tree with microbial and histopathological evidence [1]. The pulmonary tuberculosis is endemic in most parts of the world, especially in Asian and African countries. In 2018, an estimated 10 million people suffered from tuberculosis and 1.5 million died, with 44% of cases in South-East-Asia and 24% in Africa [2]. The true incidence of the endobronchial tuberculosis is still unknown, as bronchoscopy or CT chest is not performed in all patients of tuberculosis. Since the availability of antituberculous therapy, the reported incidence of EBTB in pulmonary TB patients varies greatly, ranging from 6% to 54% in various studies [3-6].

Endobronchial tuberculosis found more commonly in young and female patients [3], but some studies showed a greater incidence in men [7]. The many patients of endobronchial tuberculosis are sputum AFB positive. Still, diagnosis is difficult in cases of undetectable AFB in sputum, because histopathology of endobronchial lesions always does not show classical granuloma of tuberculosis. The low incidence of classical systemic features of tuberculosis such as anorexia, weight loss and night sweats, make the diagnosis of endobronchial tuberculosis confusing. These patients have a good response to standard antituberculosis treatment. Still, in some patients, the natural course of the disease leads to airway stenosis and obstruction, which is an emerging challenge to Interventional bronchoscopist.

DISCUSSION

Pulmonary tuberculosis is common worldwide, especially in third world countries. Since 2007, TB has been the leading cause of death from a single infectious agent, ranking above HIV/AIDS [2]. Despite the introduction of the modern and effective antituberculosis treatment, the tuberculosis is a major cause of morbidity and mortality and claiming more than one million die each year worldwide. However, the mortality rate has decreased by 45% since 1990. More than two billion people are estimated to be infected with M. tuberculosis [8, 9]. According to the recent WHO report, in 2019, 10 million individuals became ill with TB, and 1.5 million died. Most of the cases occurred in South-East-Asia (44%) and the African regions (24%) [2].

The Endobronchial tuberculosis is a Mycobacterium tuberculosis infection of the tracheobronchial tree with microbiological or histopathological evidence of tuberculosis, with or

without parenchymal involvement. Morton first described the involvement of the trachea and major bronchi by tuberculosis in 1698 [10]. Since that, the natural course and spectrum of endobronchial tuberculosis are more precisely described in light of the advent of flexible and rigid bronchoscopy.

In the pre-chemotherapy era, tracheobronchitis or endobronchial involvement was reported in 10% to 37% of patients with tuberculosis [11, 12] and 40% to 80% in autopsy reports [13]. In an old study, endobronchial tuberculosis was reported in about 10% to 40% of patients with active tuberculosis[14].

The exact pathogenesis of the development of endobronchial tuberculosis is still controversial; however, some potential mechanism has been described [15], such as (1) direct extension from adjacent parenchymal focus; (2) implantation of organisms from the infected sputum; (3) hematogenous dissemination; (4) lymph node erosion into the bronchus; and (5) through lymphatic drainage from parenchyma to the peribronchial region. In children, endobronchial tuberculosis is usually occurring due to erosion of the lymph node into adjacent bronchus due to its narrow lumen and the delicate wall of the bronchus [16], however, perforation of a tuberculous lymph node into the bronchi has also been considered in some adults [17]. The hematogenous and lymphatic route of EBTB spread is found a very uncommon mode. Jung et al. classified EBTB by the number of involved levels [5]. Single-level EBTB was defined when only one site of the trachea, main bronchus or lobar bronchus was involved. EBTB that involved two or more bronchial levels was defined as multiple-level EBTB, whereas that occurred proximal to the lobar bronchi was defined as central EBTB which commonly causes symptomatic stenosis [5].

The patients of EBTB usually present with cough, with or without expectoration, dyspnea, wheezing and hemoptysis. The typical constitutional symptoms of tuberculosis, such as fever, anorexia, weight loss and night sweats are present in very few patients [1, 7], which make the diagnosis of EBTB delayed and confusing. Bronchorrhea [18] and expectoration of tracheal cartilage have also been reported in endobronchial tuberculosis [19]. The life-threatening sequelae of endobronchial tuberculosis, such as compromised central airway and failed endotracheal intubation and death has been reported [20, 21].

Some non-specific findings, such as stridor, localized wheezing and absent breath sounds are attributed to the complication and sequelae of EBTB, such as bronchostenosis and atelectasis. The non-specific presentation of EBTB frequently gives the suspicion of asthma, malignancy and foreign body aspiration.

The diagnosis of EBTB on the clinical ground is not straight forward, and it requires microbiological and/or histopathological evidence of M. tuberculosis. The sputum of these patients does not always show the AFB, and in these scenarios, the role of the bronchoscopy is imperative. Nevertheless, sputum for AFB stain and culture is the first investigation, and all patients of suspected EBTB should be subjected for sputum examination. In various studies, AFB was found in only 16-53% of EBTB patients, despite an accurate sputum examination [22, 23]. In one of the recent studies, including 23 biopsies proven cases, all patients were sputum smear-negative [24]. The bronchoscopy plays an important role in the diagnosis of suspected EBTB, where clinical findings, sputum smear and chest x-ray findings are not consistent with tuberculosis. The fibreoptic bronchoscopy provides details of bronchial tree abnormalities suggestive of endobronchial TB, as well as an excellent material for diagnosis of suspected cases of pulmonary TB, especially when sputum smears are negative for AFB [24]. Based on bronchoscopic appearance, endobronchial TB is divided into seven subtypes, namely, (i) actively caseating, (ii) edematous-hyperemic, (iii) fibrostenotic, (iv) tumorous, (v) granular, (vi) ulcerative, and (vii) nonspecific bronchitis [3]. Chung and Lee found actively caseating type (43.0%) is the most common type of the lesion and the ulcerative type (2.7%) as the least common form[3].

EBTB may affect any part of the tracheobronchial tree, but primary bronchi, bilateral superior lobar bronchi and right middle lobar bronchus are the commonly affected sites [25]. Here the role of bronchoscopy and pulmonologist is very crucial, because, the accurate identification of the type of endobronchial lesion would guide us to predict treatment outcome and future complications because cure of some endobronchial lesions without sequelae is extremely rare. The yield of the endobronchial biopsy is always higher than the fine needle aspiration in EBTB.

The pulmonary function test has utility in patients who are presenting with asthma-like symptoms. The most common ventilatory defect in EBTB is usually restrictive (47%), followed by the normal pulmonary function, mixed pattern, and obstructive pattern [26]. The predominance of a restrictive pattern might be due to the complete obstruction of the bronchial tree or due to the chronic inflammatory changes and bronchiectatic changes of the parenchyma beyond the stenosis[27].

The chest X-ray has a minimal contribution in the diagnosis of EBTB, until unless atelectasis secondary to bronchial obstruction, obstructive pneumonia and any associated parenchymal involvement. In a retrospective study by Lee and Chung, 10% of the patients diagnosed to have endobronchial tuberculosis did not show any abnormality on chest films[26].

The HRCT plays an important role as an adjunct of fibreoptic bronchoscopy in identifying the location of the lesion, lymphadenopathy, lesions adjacent to the airway wall and extent of bronchostenosis. The CT scan more precisely defines the endobronchial spread of TB, such as "tree-in-bud" appearance in HRCT. In different studies, endobronchial involvement in pulmonary tuberculosis was reported in 95% to 97% of cases with HRCT scanning [28, 29].

The standard treatment of EBTB is anti-tubercular drugs (HRZE), same as parenchymal tuberculosis. Still, the main challenges of EBTB to Interventional bronchoscopist are the complications and sequelae of endobronchial TB. The major complicating events are lobar or lung collapse, stridor with impending airway obstruction and obstructive pneumonitis, where urgent or planned bronchoscopy is essentially required. The bronchoscopic management of EBTB is in the form of balloon dilatation, stenting (SEMS and silicone stent), laser, electrosurgery, cryotherapy and airways reconstruction. To deal with endobronchial lesions, expertise in flexible as well as rigid bronchoscopy is essential.

During treatment or after cure, the sequelae of EBTB in the form of tracheobronchial stenosis is frequently required bronchoscopic intervention. Balloon dilatation and self-expanding stent (SEMS) insertion are described as an effective treatment for bronchostenosis [30]. We recommend to use silicone stents, rather than self-expanding metallic stents because the ingrowth of granulation tissue at the stent ends is a well-known problem, and it requires stent removal and resizing or reinsertion, which could be a difficult task in case of metallic stents. The role of steroids in the prevention of endobronchial granulation formation and bronchial stenosis is still controversial. However, some studies demonstrated that the addition of oral steroid with standard antitubercular treatment; prevent the bronchostenosis to some extent [31, 32]. Verhaeghe et al. [33] have demonstrated rapid healing and complete resolution of endobronchial tuberculosis by local endoscopic injection of corticosteroids in different sittings.

The role of topical application of mitomycin-C in restenosis due to granulation tissue has been studied in endobronchial TB [34], endobronchial sarcoidosis [35] and post-lung transplant [36], and it was found efficacious in prevention and progression of granulation tissue at the stent ends. Mitomycin-C (MMC) is an antineoplastic antibiotic that inhibits fibroblast proliferation, modulating wound healing and scarring. The topical application of mitomycin-C at granulation area can be achieved by rigid or flexible bronchoscopy. By rigid bronchoscopy, it is quite easy, and it can directly apply a mitomycin soaked pledget or cotton swab at the desired area. Still, with flexible bronchoscopy, we recommend inserting the bronchoscope with an assembled and protruded biopsy forceps holding mitomycin soaked pledget, through an ET tube, as mitomycin-C should not come in contact with the upper airway mucosa and vocal cords. The recommended dose of mitomycin-C is 0.5-1mg/ml, and the application time is 2-5 minutes.

The balloon dilatation of stenosis is a minimally invasive alternative to the surgical bronchoplasty. It can carry out through flexible or rigid bronchoscopy, and usually, no general anaesthesia required while using a flexible bronchoscope. The rigid bronchoscope has an extra advantage of dilatation of stenosis by its shear mechanic, while carefully manipulating during the procedure. The care must be taken always there because the chances of bronchial rupture are high. Some patients required multiple sessions of dilatation and followed by stent insertion. The endobronchial ultrasound (EBUS) can help to evaluate the extent of involvement of the tracheobronchial wall and cartilage. Endobronchial ultrasound findings, such as cartilage destruction and persistent hyper- trophic tissue after ablation therapy could be associated with a higher chance of recurrence[37].

Tracheobronchial stent and balloon dilatation can be done sequentially in a single setting after sputum smear proves to be negative for AFB. In our settings, silicone Dumon stent insertion is the standard practice in tubercular stenosis. The silicone stent insertion always needs a rigid bronchoscopy and general anaesthesia. After implantation of silicone stent, review bronchoscopy after some time, always required given need for removal of the stent or deal with new granulation tissue. Although, both metallic and silicone stents have some unwanted complications, such as retained secretions, colonization of stent material, stent migration or fractures, and development of granulation tissue in long term use [38]. To combat these complications, an ideal stent material has yet to develop.

Some heat-based therapies like electrocautery, argon plasma coagulation (APC), and laser therapy can be performed through flexible as well as rigid bronchoscopy. These modalities are successfully used in benign tumour debulking, recanalization and making a way through the stenosis by radial incision. We are using here the latest version of laser (Nd: YAP), which is cheaper than Nd: YAG laser, though, both require skilled training and proper patient selection. The Laser can cut, coagulate and vaporize the tissues. The Nd: YAP laser is more portable and has better coagulating properties than Nd: YAG laser. The risk of endobronchial fire is always there with heat based therapies, which can be reduced by maintaining Fio2 less than 40% during the procedure, avoiding inflammable anaesthetic agents and combustible

materials like PVC endotracheal tube and silicone stents. The cryotherapy and APC can achieve almost the same results for restoring the airway patency with the lowest risk of perforation compare to other therapies.

A study from our institute has demonstrated the benefit of laser bronchoscopy in patients with high-risk endobronchial obstructive lesions[39]. Severe tracheobronchial stenosis, which causes repeated pulmonary infection, severe bronchiectasis and lung collapse, or frequent hemoptysis may require thoracic surgery like pneumonectomy or lobectomy[40].

CONCLUSION

Pulmonary tuberculosis is common worldwide, and endobronchial form of tuberculosis needs special attention as antituberculosis therapy alone is not enough to deal with the sequelae and complications of the EBTB. The role of an interventional pulmonologist is very crucial in dealing with EBTB related airway stenosis, stricture, restenosis and ingrowth of granuloma. We recommend various methods of endobronchial intervention for restoring airway patency, depending upon the available resources and expertise at your facility.

REFERENCES

1. Hoheisel, G., Chan, B. K. M., Chan, C. H. S., Chan, K. S., Teschler, H., & Costabel, U. (1994). Endobronchial tuberculosis: diagnostic features and therapeutic outcome. Respiratory Medicine, 88(8), 593-597.
2. Global Tuberculosis Report. (2019). World Health Organisation 2019. Available online: www.who.int/tb/publications/global_report/en/
3. Chung, H. S., & Lee, J. H. (2000). Bronchoscopic assessment of the evolution of endobronchial tuberculosis. Chest, 117(2), 385-392.
4. Kashyap, S., Mohapatra, P. R., & Saini, V. (2003). Endobronchial tuberculosis. Indian Journal of Chest Diseases and Allied Sciences, 45(4), 247-256.
5. Jung, S. S., Park, H. S., Kim, J. O., & Kim, S. Y. (2015). Incidence and clinical predictors of endobronchial tuberculosis in patients with pulmonary tuberculosis. Respirology, 20(3), 488-495.
6. Bachh, A. A., Gupta, R., Haq, I., & Varudkar, H. G. (2010). Diagnosing sputum/smear-negative pulmonary tuberculosis: Does fibre-optic bronchoscopy play a significant role?. Lung India: official organ of Indian Chest Society, 27(2), 58.
7. Ip, M. S., So, S. Y., Lam, W. K., & Mok, C. K. (1986). Endobronchial tuberculosis revisited. Chest, 89(5), 727-730.
8. Lönnroth, K., & Raviglione, M. (2008, October). Global epidemiology of tuberculosis: prospects for control. In Seminars in respiratory and critical care medicine (Vol. 29, No. 05, pp. 481-491). © Thieme Medical Publishers.
9. Dheda, K., Barry, C.E. (2015). 3rd, Maartens G. Tuberculosis. Lancet 2015.
10. Hudson, E.H. (1957). Respiratory tuberculosis : Clinical diagnosis. In : Heaf ERG, ed. Symposium on Tuberculosis. London: Cassell and Co; 321-464
11. Judd, A.R. (1947). Tuberculous tracheobronchitis. J Thorac Surg,16;512-23.
12. Salkin, D., Cadden, A. V., & Edson, R. C. (1943). The natural history of tuberculous tracheobronchitis. American Review of Tuberculosis, 47(4), 351-369.
13. Tetikkurt, C. (2008). Current perspectives on endobronchial tuberculosis. Pneumon, 21(3), 239-245.
14. Kurasawa, T., Kuze, F., Kawai, M., Amitani, R., Murayama, T., Tanaka, E., ... & Yuba, Y. (1992). Diagnosis and management of endobronchial tuberculosis. Internal Medicine, 31(5), 593-598.
15. Smart, J. (1951). Endobronchial tuberculosis. Br J Dis Chest, 45; 61-8.
16. Daly, J. F., Brown, D. S., Lincoln, E. M., & Wilking, V. N. (1952). Endobronchial tuberculosis in children. Diseases of the Chest, 22(4), 380-398.
17. Chang, S. C., Lee, P. Y., & Perng, R. P. (1988). Clinical role of bronchoscopy in adults with intrathoracic tuberculous lymphadenopathy. Chest, 93(2), 314-317.
18. So, S. Y., Lam, W. K., & Sham, M. K. (1984). Bronchorrhoea: a presenting feature of pulmonary tuberculosis. Chest, 86, 642-644.
19. Park, M. J., Woo, I. S., Son, J. W., Lee, S. J., Kim, D. G., Mo, E. K., ... & Jung, K. S. (2000). Endobronchial tuberculosis with expectoration of tracheal cartilages. European Respiratory Journal, 15(4), 800-802.
20. Tse, C. Y., & Natkunam, R. (1988). Serious sequelae of delayed diagnosis of endobronchial tuberculosis. Tubercle, 69(3), 213-216.
21. Kashyap, S., Mohapatra, P. R., & Saini, V. (2003). Endobronchial tuberculosis. Indian Journal of Chest Diseases and Allied Sciences, 45(4), 247-256.
22. Aggarwal, A. N., Gupta, D., Joshi, K., Behera, D., & Jindal, S. K. (1999). Endobronchial involvement in tuberculosis: a report of 24 cases diagnosed by flexible bronchoscopy. Journal of Bronchology & Interventional Pulmonology, 6(4), 247-250.
23. Yu, W., & Rong, Z. (1999). Clinical analysis of 90 cases with endobronchial tuberculosis. Zhonghua jie he he hu xi za zhi= Zhonghua jiehe he huxi zazhi= Chinese journal of tuberculosis and respiratory diseases, 22(7), 396-398.
24. Ozkaya, S., Bilgin, S., Findik, S., Kök, H. Ç., Yuksel, C., & Atıcı, A. G. (2012). Endobronchial tuberculosis: histopathological subsets and microbiological results. Multidisciplinary respiratory medicine, 7(1), 1-6.

25. Shahzad, T., & Irfan, M. (2016). Endobronchial tuberculosis—a review. Journal of thoracic disease, 8(12), 3797.
26. Lee, J. H., & Chung, H. S. (2000). Bronchoscopic, radiologic and pulmonary function evaluation of endobronchial tuberculosis. Respirology, 5(4), 411-417.
27. SHIM, Y. S. (1996). Endobronchial tuberculosis. Respirology, 1(2), 95-106.
28. Im, J. G., Itoh, H., Shim, Y. S., Lee, J. H., Ahn, J., Han, M. C., & Noma, S. (1993). Pulmonary tuberculosis: CT findings--early active disease and sequential change with antituberculous therapy. Radiology, 186(3), 653-660.
29. Hatipoğlu, O. N., Osma, E., Manisali, M. E. T. İ. N., Ucan, E. S., Balci, P., Akkoclu, A., ... & Yüksel, C. (1996). High resolution computed tomographic findings in pulmonary tuberculosis. Thorax, 51(4), 397-402.
30. Han, J. K., Im, J. G., Park, J. H., Han, M. C., Kim, Y. W., & Shim, Y. S. (1992). Bronchial stenosis due to endobronchial tuberculosis: successful treatment with self-expanding metallic stent. AJR. American journal of roentgenology, 159(5), 971-972.
31. Takahashi, N., & Horie, T. (1999). Medical treatment for bronchial stenosis due to endobronchial tuberculosis. Kekkaku:[Tuberculosis], 74(12), 885-889.
32. Mariotta, S., Guidi, L., Aquilini, M., Tonnarini, R., & Bisetti, A. (1997). Airway stenosis after tracheo-bronchial tuberculosis. Respiratory medicine, 91(2), 107-110.
33. Verhaeghe, W., Noppen, M., Meysman, M., Monsieur, I., & Vincken, W. (1996). Rapid healing of endobronchial tuberculosis by local endoscopic injection of corticosteroids. Monaldi archives for chest disease= Archivio Monaldi per le malattie del torace, 51(5), 391-393.
34. Penafiel, A., Lee, P., Hsu, A., & Eng, P. (2006). Topical mitomycin-C for obstructing endobronchial granuloma. The Annals of thoracic surgery, 82(3), e22-e23.
35. Lavergne, F., Clerici, C., Sadoun, D., Brauner, M., Battesti, J. P., & Valeyre, D. (1999). Airway obstruction in bronchial sarcoidosis: outcome with treatment. Chest, 116(5), 1194-1199.
36. Erard, A. C., Monnier, P., Spiliopoulos, A., & Nicod, L. (2001). Mitomycin C for control of recurrent bronchial stenosis: a case report. Chest, 120(6), 2103-2105.
37. Murgu, S. D., Colt, H. G., Mukai, D., & Brenner, M. (2010). Multimodal imaging guidance for laser ablation in tracheal stenosis. The Laryngoscope, 120(9), 1840-1846.
38. Bolliger, C. T., Sutedja, T. G., Strausz, J., & Freitag, L. (2006). Therapeutic bronchoscopy with immediate effect: laser, electrocautery, argon plasma coagulation and stents. European Respiratory Journal, 27(6), 1258-1271.
39. Tscheikuna, J. (2001). Laser bronchoscopy: experience at Siriraj Hospital. Journal of the Medical Association of Thailand= Chotmaihet Thangphaet, 84(12), 1661-1666.
40. Wang, H., Lin, H., & Jiang, G. (2008). Pulmonary resection in the treatment of multidrug-resistant tuberculosis: a retrospective study of 56 cases. The Annals of thoracic surgery, 86(5), 1640-1645.