Post-Tubercular Upper Airway Stenosis: Our Experience

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Abstract

Aim: This study describes the findings seen in patients suffering from stenosis of the upper airway secondary to tuberculosis (TB) and its management.

Materials and methods: A prospective study was done at a tertiary care hospital between August 2017 and April 2019 on four patients diagnosed with upper airway stenosis secondary to TB.

Results: There were three males and one female, and the age ranged from 18 to 38 years. Rechanneling of the stenosed segment was done using cold instruments and CO₂ laser, used alone or in combination. One patient developed recurrence even after undergoing two procedures which had to be eventually treated by resection anastomosis.

Conclusion: Early diagnosis and treatment with antitubercular medications is the key to prevent the development of airway stenosis. The treatment of stenosis involves surgical intervention using cold instruments and laser, and the chances of getting satisfactory results are good. Regular follow-up of such patients is extremely important.

Clinical significance: Development of airway stenosis secondary to TB is a dreaded sequela of the disease pathology. This entity should be kept as one of the differential diagnoses while evaluating patients with upper airway stenosis in whom the etiology of the condition remains elusive.

Keywords: Airway stenosis, CO₂ laser, Tuberculosis.

Introduction

Tuberculosis (TB) is a major health problem in India. It is transmitted through inhalational route, and the lung is the commonest organ to be affected. According to the World Health Organization (WHO) statistics of 2011, the estimated load of the disease is 2.2 million cases in India out of a global burden of 9.6 million.¹ In India, each year approximately 220,000 deaths are reported due to TB. Between 2006 and 2014, the disease had cost the Indian economy around 340 billion USD.¹ The incidence of TB is rising in India due to multidrug resistant organisms, deteriorating healthcare infrastructure, and overcrowding. The pattern of laryngeal tuberculosis is also changing.

The incidence of laryngeal TB is less than 1% of all TB cases.² Upper airway involvement by the disease is becoming common in India. Healing of tubercular lesion in the upper airway leads to stenosis. Tuberculosis of the larynx may be primary or secondary to a pulmonary lesion. The pathophysiology of upper or lower airway stenosis secondary to tuberculosis is similar. The changes initially begin with infiltration of the bacilli into the mucosa and submucosa which later leads to formation of ulcers, granulation tissue, fibrosis, and in the end an organized stenosis. In trachea and bronchus, the inflammatory changes have lymphocyte infiltration that later develop into caseous necrosis. The necrotic area forms deep craters that later turn into granulation tissue (hypertrophic inflammatory polyps). In advanced stages, fibrous hyperplasia and contracture develops leading to stenosis. The incidence of airway stenosis may be up to 68% in the initial months³,⁴ which rises with prolongation of the disease.⁵ The present article describes our experience as a case series of four patients of upper airway stenosis secondary to tuberculosis. None of the patient was immune-compromised.

Materials and Methods

A study was done on patients visiting the outpatient ear, nose, and throat (ENT) department of a tertiary-care hospital in north India between August 2017 and April 2019, with complaints of cough, throat pain, breathing/swallowing difficulty, voice change, sputum production, fever, and weight loss. The patients were evaluated by a clinical examination, followed by throat endoscopy, blood investigations, radiological examination (X-ray/CT scan of neck and thorax or both), sputum microscopy/ culture, and Mantoux test. A histopathological examination of the tissue sample was done if required. The patients diagnosed with TB were included in the study. The patients with a past history of a surgical procedure in the throat or a history of trauma to the neck were excluded. The objectives of this study were to describe the intraoperative findings, the surgical technique used, the complications encountered, and the postoperative results. An informed consent was obtained from the patients, and an ethical clearance was obtained from the institutional ethics committee.

Case 1

The first case was a 21-year-old gentleman who presented with difficulty in breathing for the past 3 months which had aggravated
in the last 3 days. He had been treated for pulmonary tuberculosis and the same had completed 3 months prior to presentation. A flexible laryngobronchoscopic examination revealed stenosis at the level of second/third tracheal ring with two very small openings, multiple webs, and secretions (Fig. 1). After an informed consent and planning with an anesthetist, the patient was taken up for surgical correction. The surgery was done under total intravenous anesthesia (TIVA) with propofol and fentanyl infusion, and laryngeal mask airway (LMA) of size 3 was used. Through the side channel of LMA, a flexible bronchoscope of size 3.5 mm was inserted. The bronroscope’s working channel was used for delivering 400-micron diode laser fiber.

At the stenosed segment, radial incisions were given at 12-, 3-, and 9-o’clock position. Once a sufficient opening of the airway (around 4–5 mm) was obtained, a suspension laryngoscope was placed. Bougie dilatation with 7/9 mm was done (Fig. 2). Intermittent apnea technique (tube in–tube out technique) was employed during the procedure. After dilatation, 2 mg/mL of Mitomycin-C was applied, and injection triamcinolone acetonide was injected at the periphery of the stenosed site. The patient was discharged the next day with an advice of twice-daily nebulization with budesonide (0.5 mg), ipratropium (500 μg), and levosalbutamol (1.25 mg) for 3 weeks. He was followed regularly at an interval of 3 to 4 weeks in the outpatient department. Flexible scopy of the airway was done at each visit. After 4 months, the patient presented again with difficulty in breathing following an attack of upper respiratory infection. The stenosis was released using a CO2 laser. A silicon sheet (1 mm thick) was placed as a stent (Fig. 6). The patient was followed up for 1 year; she had a satisfactory voice and no breathing difficulty.

**Case 3**

A 38-year-old female presented with change in voice of 4 months duration and noisy breathing during sleep. The patient had a past history of taking ATT for 9 months. Airway assessment was done with a flexible scope, and supraglottic and glottic narrowing having a lumen of around 6 mm was seen (Fig. 5). The stenosis was released using a CO2 laser. A silicon sheet (1 mm thick) was placed as a stent (Fig. 6). The patient remained asymptomatic till date.

**Case 4**

A 24-year-old male patient presented for a follow-up visit. He had a history of cough, fever, and loss of appetite 2 years back and was diagnosed with pulmonary tuberculosis. Following this, he was started on ATT. After 9 months of ATT, the patient had developed stridor, a tracheostomy was done, and eventually the patient had completed 12 months of ATT. During the current visit, he complained of a change in voice. A flexible endoscopy of the airway showed an anterior glottis web. He was taken up for laser-assisted release of the web and keel placement. Intraoperatively, the micro-laryngoscopy examination under TIVA showed anterior and posterior glottic stenosis (Fig. 7). The case was managed in a similar way as the previous mentioned patient (case 2).

**Discussion**

Upper airway involvement due to TB is either due to an air-borne spread or secondary due to implantation of the organism from infected sputum or hematogenous dissemination or infection via lymphatics. The pathogenesis of upper airway stenosis secondary to tuberculosis is same as endobronchial (lower airway) stenosis.
The pathological changes involve the mucosa, submucosa, and eventually the cartilage. The end result is fibrosis and stenosis of the airway. Endobronchial and tracheal TB affect the cartilage framework. There are various barriers in the form of muscle and fat planes in the upper airway which makes it less prone to involvement by the disease. TB bacilli affect both the surfaces of the vocal folds.
Upper Airway Stenosis due to Tuberculosis

and there is hyperemia, ulcers, and granulation tissue formation. These lesions respond to ATT and might heal with the formation of a web and sometimes involvement of the crico-arytenoid joint.

Patients with primary laryngeal tuberculosis have a normal chest X-ray. Primary laryngeal involvement is seen in about 19% of TB cases. Laryngeal tuberculosis maybe categorized into four groups, namely, (a) whitish ulcerative lesions (40.9%), (b) nonspecific inflammatory lesions (27.3%), (c) polypoid lesions (22.7%), and (d) ulcerofungative mass lesions (9.1%). In a recent publication on 15 cases of laryngeal tuberculosis by Marina Saldanha et al., two patients had primary laryngeal tuberculosis, and the others had an associated pulmonary involvement. Change in voice was the most common complaint, and ulcerative lesions were the most common finding. In our study, one of four cases had a primary laryngeal lesion (case 2).

Earlier studies have shown that TB mainly involves the posterior larynx. The recent studies point toward a predilection for vocal cords (50–70%) followed by false cords (40–50%), epiglottis, aryepiglottic folds, arytenoids, posterior commissure, and subglottis (10–15%). Lower airway can also be affected by tuberculosis. Tracheobronchial involvement was first described by Richard Morton, an English Physician in 1698. Lower airway involvement evolves from submucosal ulceration to necrosis with subsequent healing leading to a circumferential long segment stenosis. Cases 2 and 4 of our study presented with anterior and posterior glottis stenosis.

Case 1 presented with tracheal stenosis and fibrinous secretions. It occurred after the initial treatment due to perichondritis. Tracheobronchial stenosis due to TB is resistant to medical treatment and requires surgical intervention. There are various procedures for managing bronchial stenosis, including, dilatation, stenting, fiber-guided laser, or cryotherapy. The incidence of restenosis after balloon dilatation is about 37.5%. Persistent bronchial stenosis occurred in 41.8% of the patients. Advanced age of the patient and long duration of complaints before the start of ATT are predictors of bronchial stenosis. Oral steroids do not reduce the frequency of stenosis. Oral steroids do not reduce the unwanted sequel of bronchial stenosis. Advanced age and long duration of complaints before the start of ATT increase the chance of development of airway stenosis. Surgical intervention with limited use of laser, placement of stent, and application of anti-proliferative agents have a definite role to play in the management of airway stenosis. Sometimes multiple surgeries are required to achieve optimum results. Regular follow-up of the patients post-intervention is important to diagnose a recurrence and planning of subsequent management.

**Conclusion**

There are few reports in the literature on glottic and supra-glottic stenosis due to tuberculosis. Any patient with supra-glottic or glottic stenosis of unknown cause should be investigated for tuberculosis. In such cases, history of taking ATT and old chest X-rays with findings suggestive of sarcoidosis, Wegener granulomatosis, amyloidosis, s and relapsing polychondritis help in reaching a logical conclusion.

**Clinical Significance**

An early diagnosis and treatment with ATT not only prevent the deeper effects of tuberculosis on the airway but also reduce the unwanted sequel of bronchial stenosis. Advanced age and long duration of complaints before the start of ATT increase the chance of development of airway stenosis. Oral steroids do not have much role in reducing the stenosis. Surgical intervention with limited use of laser, placement of stent, and application of anti-proliferative agents have a definite role to play in the management of airway stenosis. Sometimes multiple surgeries are required to achieve optimum results. Regular follow-up of the patients post-intervention is important to diagnose a recurrence and planning of subsequent management.

**References**