

Original Research Article

Screening: a unique study of otorhinolaryngeal manifestations in 400 patients of pulmonary tuberculosis being diagnosed and treated under revised national tuberculosis control programme

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ABSTRACT

Background: Tuberculosis (TB) is primarily a disease of lungs but can affect any part of the body. Among extrapulmonary TB, tuberculosis of otorhinolaryngeal region is uncommon but not rare. Despite the best efforts of the RNTCP, tuberculosis is still a major health problem in India. In our study screening of the pulmonary tuberculosis patients was done to know the incidence and pattern of otorhinolaryngeal manifestations and also to know the treatment outcome after follow up of patient till completion of DOTS therapy under RNTCP.

Methods: This study included 400 pulmonary tuberculosis patients, both sputum positive and sputum negative (200 patients in each group) of newly treated (ND) and previously treated (PT) categories. After complete history, physical and local examination, suspected patients were evaluated for otorhinolaryngeal manifestations of tuberculosis. The diagnosis was confirmed after culture swabs, fine needle aspiration cytology (FNAC) and biopsy for histopathological examination (HPE).

Results: Out of total 400 patients majority of patients belong to 21-30 years age group. Out of total 400 patients, 5 (1.25%) patients were having laryngeal tuberculosis, 1 (0.25%) patient of tubercular otitis media and 2 (0.5%) patients were having nasal TB. Results of our study are consistent with previously done studies despite RNTCP treatment. The treatment outcome was good after completion of ATT.

Conclusions: Every patient of pulmonary TB with complaint related to otorhinolaryngeal region should be examined and followed up with high suspicion of ENT related tuberculosis.

Keywords: Pulmonary tuberculosis, Laryngeal tuberculosis, Tubercular otitis media, Nasal tuberculosis, RNTCP, ATT

INTRODUCTION

TB is a global problem caused by *Mycobacterium tuberculosis*, a slow-growing strict aerobic bacillus. It forms granulomas with caseous necrosis due to the cell response of involved tissues.¹ It has the sole natural reservoir, the human body and is transmitted via airborne particles, released into the air by talking, coughing or sneezing by a patient with contagious tuberculosis.

Anybody can be affected by the bacillus and extra-pulmonary involvement is usually secondary to pulmonary involvement and may be difficult to diagnose.² Factors such as increase in the prevalence of human immunodeficiency virus (HIV), incidence of people living in poor social and economic conditions, resistance to anti-tuberculosis therapy and the development of resistant bacilli, drug dependency,

diabetes and alcoholism has led to the increase in incidence of disease in past 20 years.^{1,2}

Though *M. tuberculosis* infection can occur in all tissues of the body, pulmonary tuberculosis infection is overwhelmingly the most common type of infection representing approximately 80% of all cases of tuberculosis.³ Among the forms of involvement in extrapulmonary tuberculosis are the otorhinolaryngological manifestations of this disease, mainly represented by cervical lymphadenopathy, laryngeal tuberculosis, tuberculous otitis media, tubercular involvement of the nasal and oral cavity and oropharynx.⁴ Symptoms and signs of tuberculosis of this region can mimic malignancy and hence, an early diagnosis is essential. The diagnosis of TB is mainly based on a positive mycobacterial smear and culture or the histopathological presence of a chronic/caseating granuloma.³

The successful management of patients with otorhinolaryngologic tuberculosis depends on high clinical suspicion, prompt diagnosis and early initiation of antituberculous therapy. Simultaneous involvement of anatomically related multiple organs by tuberculosis should be kept in mind.¹ In the present study we have determined the incidence and pattern of otorhinolaryngeal manifestations in pulmonary tuberculosis patients. We have also compared the otorhinolaryngeal manifestations among sputum positive and sputum negative pulmonary tuberculosis patients and their treatment outcome with follow up of the patients till completion of ATT.

METHODS

A prospective observational study was carried out on 400 patients of pulmonary TB diagnosed and treated under RNTCP presented to the OPD of the department of ENT, Ram Lal eye and ENT hospital and those randomly referred from chest and TB hospital attached to government medical college, Amritsar.

Study sample

The study sample consisted of total 400 patients out of which 200 sputum positive and 200 sputum negative cases were enrolled from March 2014 to August 2016. The study period was extended till the projected number achieved.

Sampling technique

Random sampling technique was used in this study. Based on the expected incidence of sputum positive and sputum negative cases visiting to the ENT OPD and that referred from chest and TB unit. In ENT OPD total around 12-18 cases of pulmonary TB visited per month as we had OPD every other day. So on an average 180 patients visited ENT OPD over the year. Finally we

decided to take a study sample of 400 cases. This sample size was neither too small nor too large to study.

Statistical analysis

That was done by using descriptive statistics in SPSS version 13.00 IBM company, USA and Microsoft excel software 2013 version.

The patients, with age more than 10 years and less than 70 years were recruited in the study after an informed consent based on following inclusion and exclusion criteria and approval of ethical committee was taken. Total 400 patients with sputum negative and sputum positive (200 patients each) pulmonary tuberculosis including both newly diagnosed (ND) and previously treated (PT) categories diagnosed and treated under RNTCP were included in this study.

Patients of pulmonary TB presented with persistent ear discharge, decreased hearing, nasal obstruction or discharge, epistaxis and hoarseness or change of voice or any other ear, nasal or throat complaints were also included in this study. Patients of pulmonary tuberculosis with cervical lymphadenitis, age <10 and >70 years, systemic disorders like hypertension, diabetes and human immunodeficiency virus positive patients were excluded in the study.

After taking informed consent and detailed history, general physical examination and complete local ear, nose and throat examination was done in all cases and findings were recorded. All routine investigations including audiological and radiological investigations wherever needed were done. After completing all the examination and investigations, if there was any patient with abnormal findings of ear, nose and throat region was managed accordingly. Wherever needed, culture swab or biopsy was taken from suspected site of lesion. Patients of pulmonary TB with positive otorhinolaryngological clinical findings were followed up at one week, two weeks, four weeks and then at 2 months, 4 months and at the completion of ATT.

RESULTS

In this study of 400 patients, the maximum number of patients (30.3%) fell in 21 to 30 years. The age of patients ranged from 10-70 years, mean age of presentation being 35±18.978. The present study showed male predominance with 61.8% males.

Table 1 shows that out of total 400 patients, total 86 (21.5%) patients presented with otorhinolaryngeal symptoms out of which 34 (8.5%) presented with ear, 08 (2%) presented with nasal and 44 (11%) presented with throat complaints. No patient presented with oral complaints. This table also shows that ENT symptoms were significantly more in sputum positive 57 (28.5%)

patients as compared to sputum negative 29 (14.5%) group.

The patients with ear complaints presented with aural fullness 10 (2.5%), ear discharge 9 (2.25%), tinnitus 07

(1.75%), vertigo 7 (1.75%) and hearing loss 1 (0.25%) patients and so total 34 (8.5%) patients presented with ear symptoms. Ear symptoms were more in sputum positive 23 (11.5%) as compared to sputum negative 11 (5.5%) group out of 200 (100%) patients for each group.

Table 1: Distribution of patients according to ear, nose, oral cavity and throat symptoms (n=400).

Group	Sputum positive			Sputum negative			Total (total 1+total 2) (n=400) (%)
	ND (%)	PT (%)	Total 1 (n=200) (%)	ND (%)	PT (%)	Total 2 (n=200) (%)	
Ear	10 (5.0)	13 (6.5)	23 (11.5)	04 (2)	07 (3.5)	11 (5.5)	34 (8.5)
Nose	03 (1.5)	02 (1.0)	05 (2.5)	02 (1.0)	01 (0.5)	03 (1.5)	08 (2)
Oral cavity	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Throat	11 (5.5)	18 (9.0)	29 (14.5)	07 (3.5)	08 (4.0)	15 (7.5)	44 (11)
Total	24 (12)	33 (16.5)	57 (28.5)	13 (6.5)	12 (6.0)	29 (14.5)	86 (21.5)

Table 2: Distribution of patients according to ear examination (n=400).

Aural findings	Sputum positive			Sputum negative			Total (total 1+total 2) (n=400) (%)
	ND (%)	PT (%)	Total 1 (n=200) (%)	ND (%)	PT (%)	Total 2 (n=200) (%)	
Retracted TM	3 (1.5)	5 (2.5)	8 (4)	2 (1)	2 (1)	4 (2)	12 (3)
Discharge In EAC	2 (1)	1 (0.5)	3 (1.5)	0 (0)	0 (0)	0 (0)	3 (0.75)
Single perforation	5 (2.5)	2 (1)	7 (3.5)	2 (0.5)	0 (0)	2 (0.5)	9 (2.25)
Multiple perforations	1 (0.5)	0 (0)	1 (0.5)	1 (0.5)	0 (0)	1 (0.5)	2 (0.5)
CHL	5 (2.5)	2 (1)	7 (3.5)	0 (0)	0 (0)	0 (0)	7 (1.75)
SNHL	0 (0)	0 (0)	0 (0)	1 (0.5)	0 (0)	1 (0.5)	1 (0.25)

Table 2 shows that on examination of ears, 12 (3%) patients presented with retracted TM, 03 (0.75%) ear discharge, 9 (2.25%) were having central perforation in tympanic membrane, 2 (0.5%) multiple perforations having 1 (0.25%) patient with ear discharge and 1 (0.25%) with dry ear (Figure 1). 7 (1.75%) patients presented with mild conductive hearing loss, 1 (0.25%) presented with sensorineural hearing loss. The aural swab for culture and sensitivity was taken in 3 (0.75%) patients presented with active ear discharge and biopsy was taken in 2 (0.5%) patients that included 1 (0.25%) presented with central perforation and 1 (0.25%) with multiple perforation after the ear was dry and after taking consent for ear surgery.

The report of aural swab for culture and sensitivity was showing tubercular growth in 1 (0.25%) patient and 2 (0.5%) were showing no growth. The report of biopsy taken in 2 (0.5%) showed chronic inflammatory pathology.

Only 1 (0.25%) patient of sputum positive group ND category presented with bilateral hearing loss on PTA examination it was found to have severe bilateral sensory neural hearing loss and on complete history it was found that the patient had history of injection amikacin administration continuously for 20 days from a local quack for the respiratory disease that was diagnosed to be

tuberculosis later on. That patient was advised hearing aids. Total 14 (3.5%) patients complained of tinnitus and vertigo, out of which 8 (2%) were from sputum positive and 6 (1.5%) were sputum negative previously treated category on injection streptomycin.



Figure 1: TOM with multiple perforations of tympanic membrane.

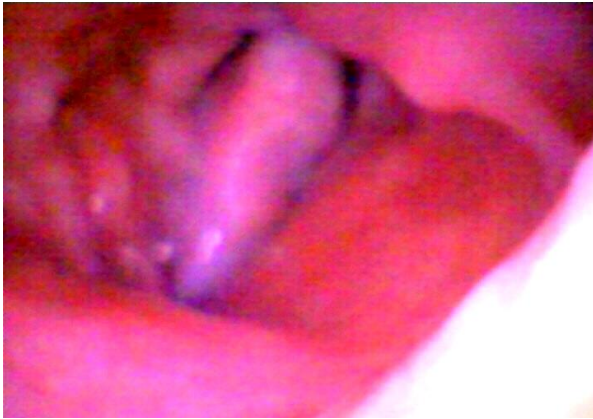


Figure 2: Polypoidal mass in glottic part of larynx that was confirmed as spindle cell carcinoma.

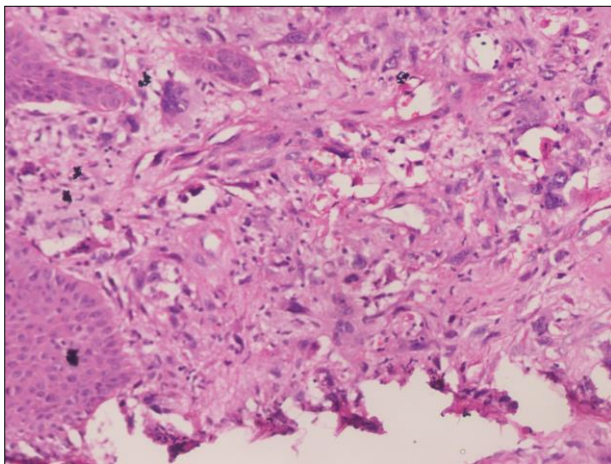


Figure 3: Histopathology of polypoidal mass showing spindle cell sarcomatous variant of squamous cell carcinoma.

Total 8 (2%) patients presented with nasal complaints were epistaxis in 4 (1%), nasal obstruction in 3 (0.75%) and nasal discharge in 1 (0.25%). Table 3 shows the anterior rhinoscopic examination of the patients presented with nasal complaints.

For the confirmation of tubercular involvement of nose, nasal swabs of all 8 (2%) symptomatic patients were taken for culture and sensitivity and 1 (0.25%) patient with septal perforation, nasal musosal scrapings were taken from septal perforation margins and sent for biopsy. The report of confirmatory tests for nasal tuberculosis showed that only 2 (0.5%) nasal swabs for culture and sensitivity were positive for *M. tuberculosis*, in 1 (0.25%) patient with pale nasal mucosa in ND sputum positive and 1 (0.25%) patient with septal perforation in PT sputum positive, 3 (0.75%) were positive for coagulase negative *Staphylococcus*, 1 (0.25%) was positive for *Staphylococcus aureus* and 02 (0.5%) had shown no growth. The biopsy from septal perforation margins was also suggestive of chronic granulomatous changes.

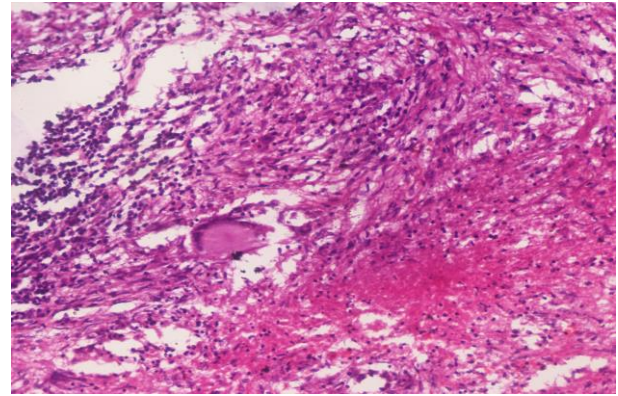


Figure 4: Histopathology of laryngeal tissue showing tubercular pathology.

Total 44 (11%) patients presented with throat complaints. Most common presenting feature was foreign body sensation with throat pain in 21 (5.25%) followed by dysphonia in 20 (5%). Other associated features were odynophagia 15 (3.75%) and difficulty in breathing in 2 (0.5%) patients. The throat complaints were more in sputum positive 30 (15%) as compared to sputum negative 14 (7%) out of 200 patients for each group.

Table 4 shows the site of laryngeal involvement on indirect laryngoscopic examination of the patients with throat complaints. These sites were involved in association with each other.

On direct laryngoscopic examination, oedema with congestion 22 (5.5%) of interarytenoid area was the most common finding, followed by arytenoids, true vocal cords and false vocal cords. Other features were congestion 16 (4%), pallor with oedema 5 (1.5%), erosion of epiglottis, arytenoids and interarytenoid area with purulent secretions 4 (1.0%), fixation of vocal cord 4 (0.1%), polypoidal mass in glottis area 1 (0.25%), supraglottic mass 1 (0.25%), bulge in pyriform sinus 1 (0.25%) and pooling of secretions 2 (0.5%) in pyriform sinus.

Total 4 (0.1%) patients presented with TVC fixation. There was only left VC fixation in all 4 (1.0%) patients and all were from PT category three were sputum positive and one was sputum negative. Out of 4 patients 1 (0.25%) was male and 3 (0.75%) were female. Patients were advised X-ray chest PA view and CT scan chest and neck to know any mediastinal lesion affecting recurrent laryngeal nerve. Two patients had undergone for X-ray chest PA view that was showing fibrotic changes in the hilar and apical parts of the lung on left side and CT chest was showing mediastinal lymphadenopathy. Another female patient with left VC fixation was taken for FNAC lymph node and the report was suggested of metastatic carcinomatous deposits. The report of CT scan was suggested of enlarged supraclavicular and superior mediastinal lymph nodes with lung metastasis. One patient was expired before investigation.

In 1 (0.25%) patient, polypoidal mass was present that was occluding the glottic area and bulge was present in right pyriform sinus (Figure 2). After tracheostomy, biopsy was taken and histopathological report was suggestive of spindle cell variant of squamous cell carcinoma of larynx (Figure 3). Radiotherapy was started as patient refused for surgery. Another patient 1 (0.25%) presented with supraglottic mass. Biopsy was undertaken following tracheostomy and histopathological report was suggestive of squamous cell carcinoma of larynx.

In most of the patients, the laryngeal findings were recovered within initial 2 months of DOTS treatment. Patients in whom recovery was not seen were taken up for biopsy. Out of total patients who underwent biopsy, 5 (1.25%) patients were having tubercular pathology, 2 (0.5%) patients were having chronic inflammatory pathology and 2 (0.25%) patients were having

carcinomatous changes on histopathological examination (Figure 4). So this study showed total 1.25% confirmatory incidence of laryngeal tuberculosis and 0.75% incidence of malignant potential.

This study showed that out of total 2% patients of confirmed otorhinolaryngeal tuberculosis, 1.25% patients were of laryngeal tuberculosis, 0.5% patient was of nasal tuberculosis and 0.25% patient was of ear tuberculosis (Table 5).

All patients were treated with DOTS treatment under RNTCP and were followed up till completion of treatment. The signs and symptoms were decreased with ATT and most of them got relieved within 2 months of treatment. ATT was found very effective in the majority of patients.

Table 3: Distribution of patients according to anterior rhinoscopic examination of nose (n=400).

Nasal findings	Sputum positive			Sputum negative			Total (total 1+total 2) (n=400) (%)
	ND (%)	PT (%)	Total 1 (n=200) (%)	ND (%)	PT (%)	Total 2 (n=200) (%)	
Congestion of septum	1 (0.5)	0 (0)	1 (0.5)	2 (1)	0 (0)	2 (1)	3 (0.75)
Pale mucosa	1 (0.5)	0 (0)	1 (0.5)	0 (0)	1 (0.5)	1 (0.5)	2 (0.5)
Pale mucosa with discharge	0 (0)	01 (0.5)	1 (0.5)	0 (0)	0 (0)	0 (0)	1 (0.25)
Inferior turbinate hypertrophy	1 (0.5)	0 (0)	1 (0.5)	0 (0)	0 (0)	0 (0)	1 (0.25)
Septal perforation	0 (0)	01 (0.5)	1 (0.5)	0 (0)	0 (0)	0 (0)	1 (0.25)
Total	3 (1.5)	02 (1)	5 (2.5)	2 (1)	1 (0.5)	3 (1.5)	8 (2)

Table 4: Distribution of patients according to indirect laryngoscopic examination (n=400).

Site of larynx	Sputum positive			Sputum negative			Total (total 1+total 2) (n=400) (%)
	ND (%)	PT (%)	Total 1 (n=200) (%)	ND (%)	PT (%)	Total 2 (n=200) (%)	
Epiglottis	8 (4)	3 (1.5)	11 (5.5)	7(3.5)	4 (2)	11 (5.5)	22 (5.5)
Arytenoids	9 (4.5)	11 (5.5)	20 (10)	9 (4.5)	5 (2.5)	14 (7.0)	34 (8.5)
Interarytenoid area	11 (5.5)	10 (5.0)	21 (10.5)	8 (4)	5 (2.5)	13 (6.5)	34 (8.5)
Aryepiglottic folds	7 (3.5)	4 (2.0)	11 (5.5)	2 (1.0)	3 (1.5)	5 (2.5)	16 (4.0)
False vocal cords	6 (3.0)	5 (2.5)	11 (5.5)	7 (3.5)	4 (2)	11 (5.5)	22 (5.5)
True Vocal Cords	7 (3.5)	13 (6.5)	20 (10)	7 (3.5)	7 (3.5)	14 (7.0)	34 (8.5)
Pyriform Sinus	0 (0)	3 (1.5)	3 (1.5)	0 (0)	1 (0.5)	1 (0.5)	4 (1)

Table 5: Distribution of patients according to otorhinolaryngeal involvement in tuberculosis after confirmatory tests.

Group of patient		Total number of patients (%)	Patients with tubercular pathology			
			Ear (%)	Nose (%)	Larynx (%)	Total (%)
Sputum positive	ND	122 (30.5)	1 (0.25)	1 (0.25)	2 (0.5)	4 (1.0)
	PT	78 (19.5)	0 (0)	1 (0.25)	2 (0.5)	3 (0.75)
Sputum negative	ND	144 (36)	0 (0)	0 (0)	0 (0)	0 (0)
	PT	56 (14)	0 (0)	0 (0)	1 (0.25)	1 (0.25)
Total		400 (100)	1 (0.25)	2 (0.5)	5 (1.25)	8 (2)

DISCUSSION

Otorhinolaryngeal manifestations were found to be rare in pulmonary TB patients but cannot be ignored as TB of otorhinolaryngeal region is a major health problem. Out of total 400 patients, incidence of laryngeal tuberculosis was 1.25% and found to be more than other otorhinolaryngeal regions. Incidence of nasal tuberculosis was found 0.5% and that of ear tuberculosis was found to be 0.25%. Patients presented with otorhinolaryngeal symptoms were more in sputum positive group, that is, 28.7% as compared to sputum negative group, that is, 14.5% for each group of 200 patients. The present study showed that incidence of otorhinolaryngeal TB was more in sputum positive group 7 (1.75%) than sputum negative group 1 (0.25%). Incidence of pulmonary TB was found to be more in the age group of 21-30 years. But most patients found to have otorhinolaryngeal symptoms presented in age group of 30-65 years. The age groups involved in our study were similar to that in previous studies.^{6,7,19}

Pulmonary TB was found to be more common in males (61.75%) as compared to females (38.25%). Otorhinolaryngeal TB was also found to be more common in males (1.75%) as compared to females (0.25%). All the confirmed (2%) cases of otorhinolaryngeal TB in this study were males except (0.25%) female patient of confirmed laryngeal TB. The patients from urban population (68%) presented more than the rural population patients (32%) in this study. The cause of TB in urban population was that this study was conducted in urban hospital as the rural population is referred to their nearby DOTS centre and other possible cause can be overcrowding in urban population and less awareness in rural population. Our study show same results as previous studies.⁸

Results of our study regarding the symptoms of pulmonary TB and general physical examination were almost similar to previous studies.^{6,9,10} Our study shows that there was strong associated between alcohol, smoking and tuberculosis similar to that of previous studies.¹¹

In patients with otorhinolaryngeal symptoms, majority of the patients presented with throat complaints (11%) followed by ear (8.5%) and nasal (2%) symptoms. No patient presented with oral complaints. The results are similar to study of Michael et al.¹²

EPTB of ear is rare in otorhinolaryngeal region. In this study only 0.25% patient presented with typical features of tubercular otitis media with painless ear discharge, multiple perforations and hearing loss. Though it is rare but aural swab came out positive for *Mycobacterium* and possible cause can be that before visit to our institute patient had not undergone any course of antibiotic treatment. After starting ATT symptoms were relieved. In 2 (0.5%) patients biopsy was taken that showed chronic

inflammatory pathology. Tinnitus and vertigo were complaints of total 13 (3.5%) patients on injection streptomycin and was relieved after decreasing the dose or stopping the drug. Our study shows similar results as that of Ricciardiello et al and Petersen et al.^{13,14}

Nasal TB is very rare in otolaryngology. Only 2 (0.5%) patients were confirmed with nasal TB. In one patient, nasal swab was positive for *Mycobacterium* and in other patient biopsy was taken from septal perforation margins and was sent for histopathological examination that was showing chronic granulomatous pathology. Age of that patient was 32 years which is similar to study of Kim et al.¹⁵ So our study showed 0.5% confirmatory incidence of nasal tuberculosis and results of our study presented with similar incidence of nasal TB as of other studies.^{12,13,16}

In EPTB of otorhinolaryngeal region the most common is laryngeal TB even then it is rare in pulmonary TB. Posterior half of larynx was more commonly involved than anterior half. Oedema with congestion was most common feature followed by only congestion and erosion of posterior larynx was also found. The possible cause of left vocal cord fixation in tubercular patients can be fibrotic lesion in apical region of lungs and mediastinal lymph node enlargement that can involve recurrent laryngeal nerve. This study showed the carcinomatous potential of TB. As male patient of carcinoma was a chronic smoker and alcoholic which can be the possible risk factor with tuberculosis. Other studies of Abdalla et al, Polok et al and Akkara et al showed almost similar results to our study.¹⁷⁻¹⁹

This study also showed that tuberculosis of otorhinolaryngeal regions predominates in sputum positive patients and also predominate in males. The reason for male predominance can be more exposure to smoking and alcohol in males. The present study showed that mortality due to tuberculosis was more in sputum positive category patients.

All patients of pulmonary TB were treated under RNTCP. Symptoms of otorhinolaryngeal regions decreased with every follow up. Oedema and congestion of posterior larynx, dysphonia and other throat symptoms was decreased progressively upto approximately 2 months of follow up. Nasal and aural symptoms were also decreased with progressive time of ATT. So this study also showed that ATT was very effective in decreasing the intensity and frequency of tubercular manifestations in otorhinolaryngeal regions.

CONCLUSION

Any otorhinolaryngeal pathology must be kept suspicious for tubercular pathology that appears to be chronic inflammatory or malignant. ATT was very effective in decreasing the intensity and frequency of tuberculosis manifestations in otorhinolaryngeal regions. Thus it is recommended that all the patients of pulmonary TB on

ATT must undergo complete otorhinolaryngologic examination especially when even a minor complaint of otorhinolaryngeal regions is being given by the patient. Thus both otorhinolaryngologist and experts in pulmonary medicine needs to be very vigilant about extrapulmonary manifestations of tuberculosis and high index of suspicion is required to avoid any misdiagnosis or underdiagnosis of concurrent pathology.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Krishnatreya M, Das K, Sharma A, Sharma JD. Primary laryngeal tuberculosis mimicking supraglottic carcinoma. *Int J Case Rep Imag.* 2013;4(7):354-7.
2. Kulkarni NS, Gopal GS, Ghaisas SG, Gupte NA. Epidemiological considerations and clinical features of ENT tuberculosis. *J Laryngol Otol.* 2001;115(7):555-8.
3. Granich R, Chauhan LS. Status report of the revised national tuberculosis control programme: January 2003. *J Indian Med Assoc.* 2003;101(3):150-1156.
4. Souse RT, Briglia MFS, Lima LCN, Carvalho RS, Teixeira LM, Marciao AHR, et al. Frequency of otorhinolaryngologies manifestations in patients with pulmonary tuberculosis. *Intl Arch Otorhinolaryngol.* 2010;14(2):156-62.
5. Golden MP, Vikram HR. Extrapulmonary tuberculosis: an overview. *Am Fam Physician.* 2005;72(9):1761-8.
6. Sahoo U. A study of the epidemiological pattern of pulmonary tuberculosis patients undergoing treatment at tuberculosis units of Lucknow. *Asian J Biomed Pharma Sci.* 2015;5(44):19-23.
7. Pandurang K, Shenoy VS, Bhojwani K, Alva A, Prasad V, Gandia S. Tuberculosis in the head and neck in india: down but not yet dead. *J Mycobac Dis.* 2014;4(2):148.
8. Banerjee A, Harries AD, Salaniponi FML. Differences in tuberculosis incidence rates in township and in rural populations in Ntcheu District, Malawi. *Transact Royal Soc Trop Med Hyg.* 1999;93(4):392-3.
9. Ddungu H, Johnson JL, Smieja M, MayanjaKizza H. Digital clubbing in tuberculosis-relationship to HIV infection, extent of disease and hypoalbuminemia. *BMC Infect Dis.* 2006;6:45.
10. Gupta KB, Garg S. Use of sputum induction for establishing diagnosis in suspected pulmonary tuberculosis. *Ind J Tubercul.* 2005;52:143-6.
11. Rooth VM, Sridevi S, Sudhakar G. Association between smoking, alcoholism and pulmonary tuberculosis. *Int J Sci Res.* 2015;4(6):516-8.
12. Michael RC, Michael JS. Tuberculosis in otorhinolaryngology: clinical presentation and diagnostic challenges. *Int J Otolaryngol.* 2011;2011(686894):1-4.
13. Ricciardiello F, Martufi S, Cardone M, Cavaliere M, D'Errico P, Iengo M. Otorhinolaryngology-related tuberculosis. *Acta Otorhinolaryngologica Italica.* 2006;26(1):38-42.
14. Petersen L, Rogers C. Aminoglycoside-induced hearing deficits: a review of cochlear ototoxicity. *South Afr Fam Pract.* 2015;57(2):77-82.
15. Kim YM, Kim AY, Park YH, Kim DH, Rha KS. Eight cases of nasal tuberculosis. *Otolaryngol Head Neck Surg.* 2007;137(3):500-4.
16. Wafa A, Olfa BG, Hanen G, Ibtiham B, Sarra Z, Ines H, et al. Extra nodal ENT tuberculosis. *Egypt J Ear Nose Throat Allied Sci.* 2014;15(3):279-82.
17. Abdalla HA, Ahmed N. Clinical manifestation of laryngeal tuberculosis. *Sudan JMS.* 2007;2(4):275-6.
18. Polok A, Namyslowski G, Scierski W, Czecior E, Mrowka-Kata K, Gac B. Tuberculosis within the laryngologic organs. *Pol Merkur Lekarski.* 2005;19(111):473-4.
19. Akkara SA, Singhania A, Akkara AG, Shah A, Adalja M, Chauhan N. A study of manifestations of extrapulmonary tuberculosis in the ENT region. *Indian J Otolaryngol Head Neck Surg.* 2014;66(1):46-50.

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