

Laryngeal tuberculosis: proposal of Speech-Language Pathology intervention in voice disorders following pharmacological treatment

Tuberculose laríngea: proposta de intervenção fonoaudiológica nas sequelas de voz após o tratamento farmacológico

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ABSTRACT

Tuberculosis is a disease that has been present throughout history. In the XIX century the agent that causes the disease was discovered and named *mycobacterium tuberculosis*. Laryngeal tuberculosis is one of the possible complications from pulmonary tuberculosis, and the most common symptom is hoarseness, as a result of the healing process of ulcerative laryngeal lesions. The purpose of this study was to verify the effectiveness of speech-language therapy in a case of voice disorder following anti-tuberculosis drug treatment. The methodology used was the case study of the patient J.O.B.S, 39 years old, male, hotel receptionist with an eight-hour workday, former smoker, who had hoarseness, tiredness and dyspnea during speech as main complaints. Speech-language therapy sessions started after Speech-Language Pathology and otolaryngological evaluations, with the aims to reduce the laryngeal tension during phonation, induce supraglottic vocal fold separation, help the smooth movement of the vocal folds, install abdominal breathing, and improve pneumophonic coordination. After 12 sessions, several vocal parameters improved, including decrease of vocal tension during speech, use of abdominal breathing, improvement of pneumophonic coordination, loudness increase, and reduction of the abrupt vocal attack, which reflected in vocal emissions with less effort and more socially accepted. In spite of the limitations caused by the healing of the ulcerative lesions, speech-language therapy was important in this case study, and the patient was satisfied with the results obtained, which had positive influences on his oral communication and social life.

Keywords: Tuberculosis, laryngeal; Laryngeal diseases; Hoarseness; Voice disorders; Voice; Speech therapy

INTRODUCTION

Tuberculosis has afflicted man since before records began but the bacillus which causes the disease, called Koch's bacillus, was only discovered in the mid-nineteenth century^(1,2).

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Up until the mid 1900s, tuberculosis was a prevalent disease of the larynx⁽²⁾. According to some authors, it represented one of the most serious and common complications of pulmonary tuberculosis affecting, on average, 37% of patients and was often fatal⁽³⁻⁵⁾.

After the 1950s, the advent of drugs to treat the disease, coupled with early detection methods, led to laryngeal tuberculosis becoming a highly treatable disease^(2,6,7). These scientific and technological advances reduced laryngeal involvement to 1%, and death to less than 2%, in patients with pulmonary tuberculosis⁽⁷⁾.

With the emergence of AIDS (acquired immunodeficiency syndrome) in the mid 1980s and other immunosuppressive diseases, the incidence of laryngeal tuberculosis steadily rose in this immune system deficient group, which presents a higher risk of developing the disease, particularly secondary to pulmonary compromise^(2,7,8).

The disease predominantly affects male adults, although studies show that mean age at onset can vary greatly^(3,4,9,10).

The literature cites two different theories to explain larynx-

geal contamination. The most widely accepted and reported theory in the majority of studies is the bronchogenic theory. This holds that the larynx is infected through direct contact of the secretion of the bacillus-rich bronchial tree and the mucous of the larynx. In other words, laryngeal compromise is secondary and concomitant to the lung disease^(4,6,7). According to studies, the most commonly affected area in these cases is the posterior part of the larynx⁽¹¹⁾.

It is noteworthy that in the study performed at the Central Hospital of Santa Casa Misericórdia de São Paulo, laryngeal infections were solely due to contact with bacillus-rich lung secretions⁽⁹⁾.

Another theory explaining laryngeal infection is the rarer, so-called hematogenic theory. In these cases the patients do not present concomitant lung compromise but only the laryngeal form of the disease^(2,11). The bacillus spreads via the blood or lymphatic systems and, according to research the lesions are frequently found in the epiglottis and anterior larynx⁽¹¹⁾.

With regard to the sites most affected by tuberculosis, the literature evidences that the lesions can be found in any region of the larynx^(3,11). According to some authors, the most commonly affected site is the vocal cord region (50% to 70%) followed by vocal folds (40 to 50%) while the remaining 10 to 15% can involve the epiglottis, aryepiglottic folds, arytenoids, posterior commissure and subglottis⁽¹²⁾. Reports indicate that in simple laryngeal cases the vocal chords are the most affected site (46.7%)⁽²⁾, although another study found laryngeal compromise in (81.8%) of cases⁽¹¹⁾. Similarly, vocal chords are also the main site affected in cases of multiple lesions, followed in descending order by vocal folds, epiglottis, arytenoids and posterior commissure⁽²⁾.

Hoarseness is the most common symptom of laryngeal tuberculosis and according to the references in the literature cited above, this symptom can stem from the fact the vocal cord region is the most frequently compromised^(2,3,10,11).

The literature shows that these alterations in voice quality are related to the formation of fibrous tissue in the layer of the lamina propria, due to the scarring process which can have a negative impact on vocal cord vibrations and compromise voice quality⁽⁶⁾.

Despite numerous detailed descriptions of the features of laryngeal tuberculosis in the national and international literature, reports on disorders of vocal production in individuals with the disease are scant. Thus, the aim of this study was to verify the voice disorders, and the effectiveness of subsequent speech therapy, in a case of laryngeal tuberculosis post pharmacological treatment.

CLINICAL CASE

We report J.O.B.S, a 39-year-old man who had worked eight-hour shifts as a hotel receptionist for the past twenty years. The patient attended the Speech-Language Pathology Clinic of the Santa Casa de São Paulo after referral by the Otorhinolaryngology sector of the same institution, having completed pharmacological treatment for pulmonary and laryngeal tuberculosis and been medically discharged. The patient reported having taken the medications for nine months

and noted slight improvements in quality of voice production after the treatment course. Speech-Language Pathology anamnesis revealed the main complaint of the patient was persistent hoarseness, in addition to fatigue and dyspnea during speech and frequent throat catarrh. The patient stated a 14-year history of smoking with consumption, on average, of ten cigarettes per day, ceasing the habit upon tuberculosis diagnosis. He drank socially an average of three times per week. He reported no family history of tuberculosis. The patient also reported intense use of voice during the working day and an intake of around one liter of water per day.

The GRBASI scale was used to analyse voice quality in the initial auditory perceptive assessment. The voice sample was assessed by three speech specialists with more than three years' experience so as to check inter- and intra-evaluator reliability. Based on the assessment of the speech therapists, degree of global dysphonia (G) and roughness (R) was classified as moderate, breathiness (B) and Asthenia (A) were classified as absent, Strain (S) was classified as moderate, and Instability (I) was present at low levels (G2R2B0A0S2I1). Pitch was adequate. Loudness was classified as low with limited modulation for high tones. Sudden vocal fold closure was present. Resonance was classified as laryngeopharyngeal and slight nasal compensation was evident. Mean maximum phonation time (MPT) was reduced (9"). Moderate pneumophonic incoordination was observed. Articulation was classified as partially accurate. Speech rate and rhythm were assessed as being adequate for the purposes of the discourse. Breathing mode was classified as oronasal and breathing type was upper. The position of the larynx in the throat was adequate with both horizontal and vertical mobility. Voice fatigue and moderate effort for phonation were observed.

The initial acoustic analysis was performed with the aid of Praat software and yielded the following results: mean fundamental frequency of 111.8 Hz; number of voice breaks of 6 (NVB), jitter 0.5%; shimmer 1.1dB and forms were well defined.

After Speech-Language Pathology evaluation, the patient was referred for another otorhinolaryngologic assessment to compare against findings before and after speech therapy sessions. During the pre-speech therapy otorhinolaryngologic assessment, nasofibrolaryngoscopy and videolaryngostroboscopy were performed. The results showed intense involvement of vocal folds in phonation, precluding visualization of the vocal cords. After the otorhinolaryngologic assessment, the twelve sessions of weekly speech therapy were commenced, each lasting thirty minutes as outlined in the methods of this study. The aim of the speech therapy was to lessen strain on phonation, induce supraglottic vocal fold separation, improve mobility of vocal cords, stimulate abdominal breathing, improve pneumophonic coordination, besides discussing good and bad habits of vocal health with the patient.

After completion of the twelve speech therapy sessions, the patient underwent a Speech-Language Pathology reevaluation and the voice sample was reassessed by the same evaluators that analyzed the initial sample. The auditory perceptive reassessment using the GRBASI scale found global dysphonia (G) and roughness (R) to be again classified as moderate whereas

Table 1. Comparison of parameters of voice assessment pre and post speech therapy

Voice parameters assessed	Pre speech therapy	Post speech therapy
GRBASI	G2R2B0A0S2I1	G2R2B1A0S1I0
Voice quality	Moderate strain-hoarseness and slight wheezing	Moderate hoarseness, slight breathiness and slight strain
Pitch	Adequate with modulation limited to high tones	Adequate with modulation limited to high tones
Loudness	Sudden	Adequate
Sudden vocal cord closure	Sudden	Isochronic
MPT	9"	13"
PC	Moderate PI	Slight PI
Breathing type	Upper	Lower
Breathing mode	Oronasal	Oronasal
Voice fatigue on phonation	Present	Absent
Voice effort on phonation	Moderate	Slight

Legend: G = Global degree of dysphonia; R = roughness; B = breathiness; A = asthenia; S = strain; I = instability; 0=absent; 1=slight; 2=moderate; MPT = Maximum Phonation Time; PC = Pneumophonic Coordination; PI = Pneumophonic Incoordination

breathiness (B), not observed in the initial assessment, presented to a slight degree, and asthenia (A) continued to be absent, strain (S) was reduced to slight while no instability (I) was observed (G2R2B1A0S1I0). With regard to other reassessed vocal parameters, pitch remained adequate. An improvement in loudness was seen, changing from low to adequate. Sudden vocal fold closure evolved to isochronic. Resonance remained classified as laryngeopharyngeal although nasal compensation was no longer evident. Mean maximum phonation time (MPT) continued to be short although this rose by four seconds (13"). Pneumophonic incoordination was lessened, being reclassified as slight. Articulation remained partially accurate. Speech rate and rhythm continued to be adequate for the purposes of the discourse. Breathing mode remained classified as oronasal although the upper breathing was reclassified as lower (abdominal). The position of the larynx in the throat continued adequate with horizontal and vertical mobility. Voice fatigue disappeared and moderate effort was reduced to slight for phonation (Table 1).

The post speech therapy acoustic analysis showed a reduction in average fundamental frequency from 111.8 Hz to 104 Hz. Voice breaks fell from six to five while jitter increased from 0.5% to 1%. Similarly, shimmer rose slightly from 1.1 dB to 1.4 dB and despite still being well defined, forms presented points of disruption, suggestive of breathiness (Table 2).

During the otorhinolaryngologic reassessment after the twelve speech therapy sessions, the same exams used in the first evaluation were reapplied (nasofibrolaryngoscopy and videolaryngostroboscopy). Reduced involvement of vocal folds in phonation was noted, allowing observation of the glottis, although the vibration of vocal cord mucus was not seen, with anteroposterior cleft evident on phonation.

Post speech therapy, the patient reported being satisfied with the improvements achieved, citing that he no longer felt tired during speech or needed to make so much effort during speech production, and perceived improvements in his voice quality.

It is important to point out that the patient signed the free and informed consent term, thereby authorizing the performance and publication of this study along with its results pursuant to Resolution 196/96.

Table 2. Comparison of aspects of acoustic analysis pre and post speech therapy

Aspects assessed	Pre speech therapy	Post speech therapy
Mean fundamental frequency	111.873 Hz	104.251 Hz
Voice breaks	6	5
Jitter (rap)	0.632%	1%
Shimmer (local, dB)	1.156 dB	1.450 dB
Forms	Defined	Defined, with points of deletion mapping

Legend: Jitter = disturbance in frequency; Shimmer = disturbance in intensity

DISCUSSION

Dysphonia is the most frequently reported disorder in laryngeal tuberculosis cases^(9,13). The patient was therefore referred to the Speech therapy service of the institution in which the study was run, to undergo assessment and speech therapy sessions for voice rehabilitation if deemed necessary.

It is important to point out that the speech therapy intervention was only started following completion of the course of medication treatment, given the disease is infectious and has a high index of contamination⁽⁹⁾.

In the case reported, the patient's initial complaint was persistent hoarseness, fatigue and lack of air during speech, even after end of course of medications.

In view of the patient's complaint, and of data from Speech-Language Pathology and otorhinolaryngologic evaluations, one of the goals of the therapeutic process was to lessen the effort used in speech production. After speech therapy sessions, a decrease in use of vocal folds was noted, which had been employed in an attempt to boost speech production.

The reduced effort needed to produce speech contributed to improvements in voice quality, evidenced by reduced strain and disappearance of roughness which was present in the patient's voice at initial assessment.

The reduced amount of effort used to produce speech

through engagement of the vocal folds may have been a factor contributing to the slight breathiness observed in the final assessment.

A study in the literature reveals similar results with regard to voice quality, whereby roughness disappears and breathiness worsens. The authors state that voice breathiness may stem from irreversible fibrotic change in the lamina propria of the vocal folds which prevent sufficient mucus flow⁽⁶⁾, a phenomenon not visible in the present case in which only the cleft could be seen.

Also concerning voice quality, our results showed that the parameter roughness on the GRBASI scale remained moderate. This data suggests that despite reduced involvement of the vocal folds during speech, they still constitute the patient's sound source. It is important to make clear that on the initial auditory-perceptive evaluation, the parameter roughness was represented by a rough voice, slightly moderate wheezing whereas on the post therapy assessment this parameter indicated a more stable voice classified as moderate hoarseness.

With regard to loudness, the auditory perceptive analysis found this to be increased even after the speech therapy sessions, despite the reduced involvement of vocal folds and the detection of a cleft on phonation. The increased loudness may be explained by cure of the disease in the lungs coupled with the breathing exercises carried out during therapy sessions, which led to a shift in breathing type to lower with abdominal support. According to the literature, pulmonary tuberculosis can cause a reduction in loudness since the expiratory air volume is the source of the aerodynamic energy for phonation⁽³⁾.

The remedying of breathing, together with the curing of pulmonary disease, may also have contributed to the reduced level of pneumophonic incoordination and to the longer maximum phonation time.

The improvement in coordination among breathing, phonation and articulation functions plus the increase in maximum phonation time are conducive for the more balanced emission observed, and enable the patient to feel less out of breath and fatigued when speaking, both of which numbered among complaints at initial assessment.

After the speech therapy sessions, the resonance became laryngeopharyngeal without nasal compensation. This modification can be correlated to changes in the mechanisms employed by the patient in an attempt to produce speech since it is known that changes in size and shape of the vocal tract lead to alterations in resonance⁽³⁾.

In relation to sudden vocal cord closure, it is important to emphasize that this can be linked to the strain applied by the patient during phonation. Akin to the reduction of both strain used for speech production and vocal fold involvement in phonation, vocal cord closure changed from being classified as sudden at the outset of the therapeutic process, to isochronic on the final evaluation.

The acoustic analysis revealed a slight worsening of fundamental frequency. This small pre and post therapy difference

can be ascribed to the reduction in strain during phonation, rendering the structures tauter and able to produce a higher amplitude of vibration.

The post therapy increase in the acoustic measurement of disturbance in pitch, i.e. jitter, could be related to the reduction in strain during phonation, favoring the mobility of vocal folds. In the case reported, these structures are responsible for speech production, and since it is widely known these create a deeper toned and hoarser sound, they may be the main factors underlying the greater disturbance in pitch.

With regard to shimmer, i.e. disturbances of intensity, the acoustic analysis showed this to be increased after the speech therapy sessions. This increase could be correlated to the absence of movement of the vocal folds and the reduced involvement of the vocal folds during phonation, hampering stabilizing of intensity.

Notably, a study in the literature also described the finding of increased levels of jitter and shimmer, in which they did not explain the correlates underlying these disturbance measurements⁽⁶⁾.

Another relevant finding on the acoustic analysis, albeit without significant changes before and after the speech therapy sessions, was related to voice breaks. These measurements indicate irregularity of emission or interruption in voice production⁽¹⁴⁾ and as described, the patient's speech was irregular because vocal folds were deployed in an attempt to produce speech.

The final acoustic analysis confirmed the presence of breathiness in the patient's voice, where this repeated in the manner of deletion mapping of forms at some points. This data is in line with the assumptions in the literature holding that forms with interrupted or irregular traces are consistent with a hoarse voice and instability of glottic source⁽¹⁵⁾.

According to the literature, patients with laryngeal tuberculosis who manifest glottic involvement are elected to have the worst results on auditory perception analysis, both before and after speech therapy treatment, since the quality of phonation is heavily influenced by the integrity of the glottic wave⁽³⁾.

To sum up, it is important to emphasize that in spite of the limitations of the therapy imposed by the irreversible fibrotic alterations in the lamina propria of the vocal folds which impede proper movement of the mucus, there were improvements in the parameters which influence speech production, enabling emission which is less forced and more socially acceptable.

FINAL COMMENTS

Despite the limitations outlined, speech therapy proved important in the reported case of laryngeal tuberculosis. The patient was satisfied with the results obtained in as far as improvements in some of the speech parameters were achieved, having a positive impact on oral communication and social interaction of the patient.

RESUMO

A tuberculose é uma doença que esteve presente durante toda história. No século XIX o bacilo causador da doença foi descoberto e denominado bacilo de Koch. A tuberculose laríngea é uma das complicações da tuberculose pulmonar, e o sintoma mais comum é a rouquidão, decorrente ao processo cicatricial das lesões laríngeas. Sendo assim, o objetivo deste estudo foi verificar a efetividade da fonoterapia em um caso de disфония pós-tratamento medicamentoso da tuberculose laríngea. A metodologia utilizada foi o estudo de caso do paciente J.O.B.S, 39 anos, gênero masculino, recepcionista de hotel, com jornada de oito diárias e ex-fumante, que trouxe como queixas principais rouquidão, cansaço e falta de ar durante a fala. Após as avaliações fonoaudiológica e otorrinolaringológica iniciaram-se as sessões de fonoterapia, com objetivo de diminuir a tensão à fonação, induzir o afastamento de pregas vestibulares, favorecer a mobilidade das pregas vocais, instaurar a respiração com apoio abdominal e melhorar a coordenação pneumofonoarticulatória. Após as 12 sessões previstas na metodologia desse estudo, diversos parâmetros vocais apresentaram melhoras, dentre eles a diminuição da tensão à fonação, respiração com apoio abdominal, melhoria da coordenação pneumofonoarticulatória, aumento da *loudness* e diminuição do ataque vocal brusco, que refletiram em uma emissão com menor esforço e mais aceita socialmente. A terapia fonoaudiológica, apesar das limitações decorrentes aos processos cicatriciais das lesões, mostrou-se importante no caso apresentado e o paciente ficou satisfeito com os resultados obtidos, os quais refletiram de forma positiva na comunicação oral e no convívio social do paciente.

Descritores: Tuberculose Laríngea; Doenças da Laringe; Rouquidão; Distúrbios da Voz; Voz; Fonoterapia

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