

Bamboo Nodes on a Series of 15 Patients: Vocal Fold Lesion as a Sign of Autoimmune Disease and Microphonotrauma

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Summary: Objectives. Bamboo nodes are band-like submucosal deposits of the middle third of the vocal fold. They are often related to connective tissue disorders, but can also precede them. The aim of this study was to report our experience with conservative treatment of those rare lesions.

Methods. This is a retrospective series of 15 patients consulting for hoarseness and presenting bamboo nodes from 2010 to 2016.

Results. All patients were women of mean age of 38 years with a moderate or high degree of daily vocal effort. Nine patients (60%) presented with known autoimmune disease at the phoniatic appointment. The other patients (40%) benefited from a systematic biological research for autoimmune disease, which retrieved two poorly symptomatic connective tissue disorders.

Patients were clinically improved by speech therapy (53%) or by an optimization or introduction of immunosuppressive treatment (46%). A spontaneous improvement was observed for three patients after voice rest (one after retirement, one after professional change, and last one after resuming professional singing). In our series, no phonosurgery was performed.

The vocal profile at last appointment found a moderate Voice Handicap Index at 35.3/120, a low maximum time of phonation at 13.6 seconds, and a high jitter at 1.4, sign of instability of the vibrator.

Conclusion. This series emphasizes the importance of diagnosing bamboo nodes in middle-aged female presenting an autoimmune disease. Vice versa for each patient with bamboo nodes, a systematic autoimmune check-up has to be realized to detect a biological asymptomatic autoimmune disease.

Key Words: Bamboo nodes–Connective tissue disorder–Dysphonia–Conservative treatment–Autoimmune disease.

INTRODUCTION

Bamboo nodes are creamy-yellow, transverse, band-like deposits in the middle third of the vocal cords, giving the appearance of a bamboo node. They are frequently bilateral, although they may be asymmetric. During phonation, the mucosal wave oscillation is usually disturbed at the site of the bamboo nodes. This pathology always concerns women.¹ The first description of bamboo nodes was traced back to 1993 by Hosako et al,^{2,3} who differentiated bamboo node-like lesions from typical solid rheumatic nodes. They are also distinct from typical vocal fold nodules. Bamboo nodes are frequently related to an autoimmune disease. They mainly appear in connective tissue diseases such as systemic lupus erythematosus, rheumatoid arthritis, Sjögren disease, autoimmune hepatitis, Hashimoto thyroiditis, and progressive systemic sclerosis. Occasionally, bamboo nodes can be isolated, with serologic abnormalities as the only finding.⁴

The typical anatomopathologic findings of bamboo nodes are submucosal inflammatory lesions of granulomatous lesions and fibrinoid necrosis. Immunoglobulin G-positive cells are detected in these lesions in immunohistochemical examinations.⁵

Nevertheless, this pathology remains a poorly known laryngeal manifestation. They are frequently mistaken for common phonotraumatic nodules, described as bilaterally symmetrical benign white callous-like growths at the midpoint of the vocal folds induced by vocal abuse.⁶ Reports in literature about bamboo nodes concern mainly isolated cases, with a single series of 19 cases.⁷

Bamboo nodes belong to laryngeal manifestations of autoimmune diseases. Other types have been described in literature such as cricoarytenoid arthritis, laryngeal mucosal inflammation, epiglottitis, laryngeal edema, and rheumatoid vocal fold nodules.^{1,7} Rheumatoid vocal fold nodules are described as submucosal or subcutaneous masses mainly of the posterior part of the vocal folds.

The pathophysiology of bamboo nodes involves two related theories: (1) an organ-specific autoimmune process with antibody deposits or (2) repeated microphonotrauma, as the lesion is located in the midpoint of the vocal folds, the site of maximal aerodynamic and muscular forces.⁸

Therapeutic options include speech therapy and treatment of the causative autoimmune disease, mainly steroids and immunosuppressive medication. These two conservative treatments should be tried first.⁷ Local corticoid injections in the vocal fold may also be an option. Phonosurgery⁷ with limited reduction or careful excision of the lesion should be proposed only as a last resort in cases of controlled underlying disease or persistence of the disease in spite of well-followed speech therapy and medical treatment.

The aim of this report was to relate our experience with conservative treatment of these rare lesions.

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MATERIAL AND METHODS

In this retrospective bicentric study, in a tertiary referral center and medical office, the medical charts of patients examined for hoarseness from 2010 to 2016 were reviewed. Patients with a diagnosis of dysphonia related to bamboo nodes were included. Patients with rheumatoid vocal fold nodules and with a follow-up of less than 6 months were excluded. Their medical history was collected including age at diagnosis, sex, comorbidities such as autoimmune disease, medication, and symptoms.

All patients underwent a direct observation of the larynx with a rigid indirect laryngoscopy, and distinctive vibratory patterns were investigated by means of laryngeal videostroboscopy.

All patients were proposed a follow-up appointment in June or July 2016, which was considered as the date of the last follow-up. A complete vocal profile was established at this appointment, including the voice scale of Hirano (GRBAS) (9), Voice Handicap Index (VHI) in French,⁹ jitter,¹⁰ maximum time of phonation, as well as an evaluation of the reading, projected, calling, and singing voice. Unfortunately, we did not have complete data of vocal profile at diagnosis; therefore, no comparison of vocal profile could be made. All patients were referred to an internist who performed a blood examination searching for autoimmune diseases including antinuclear factor, anti-extractable nuclear antigens antibodies, anti-DNA antibodies, complement C3, C4, CH50, anticytoplasmic antibodies of polynuclear cells, rheumatoid factor, electrophoresis of plasma proteins, immunoelectrophoresis of plasma proteins, anti-cyclic citrullinated peptide antibody, 24-hour proteinuria, angiotensin-converting enzyme, and phosphocalcic exploration.

Statistics

Most of the data were collected retrospectively. Demographic and clinical features were described by using frequencies and percentages. The statistical methods applied for qualitative parameters included Fisher exact test with significance set at $P < 0.05$, and quantitative parameters were assessed using Student *t* test. The XLstat (version 2015) statistical program was used.

RESULTS

Fifteen patients presenting typical bamboo nodes (Figure 1) were included; they were all female with a mean age of 38 years at diagnosis. The mean time for follow-up was 28 months. They all had an intensive use of their voice; 40% were voice professionals. Sixty percent of the patients (nine patients) had a medical history of autoimmune disease. The 40% who had no history of autoimmune disease all benefited from a biological autoimmune test; two patients (13.3%) were diagnosed with an autoimmune disease as a result of biological tests including a poorly symptomatic rheumatoid arthritis and a poorly symptomatic systemic lupus erythematosus associated to Sjögren disease. Consequently, 11 patients (73.3%), with a mean age of 35 at diagnosis, presented with the following autoimmune diseases (isolated or multiple): systemic lupus erythematosus (five patients, 33.3%), rheumatoid arthritis (four patients, 26.6%), Sjögren disease (four patients, 26.6%), and one patient with an ankylosing spondylitis, and one last patient with a primary sclerosing cholangitis associated with Crohn disease.

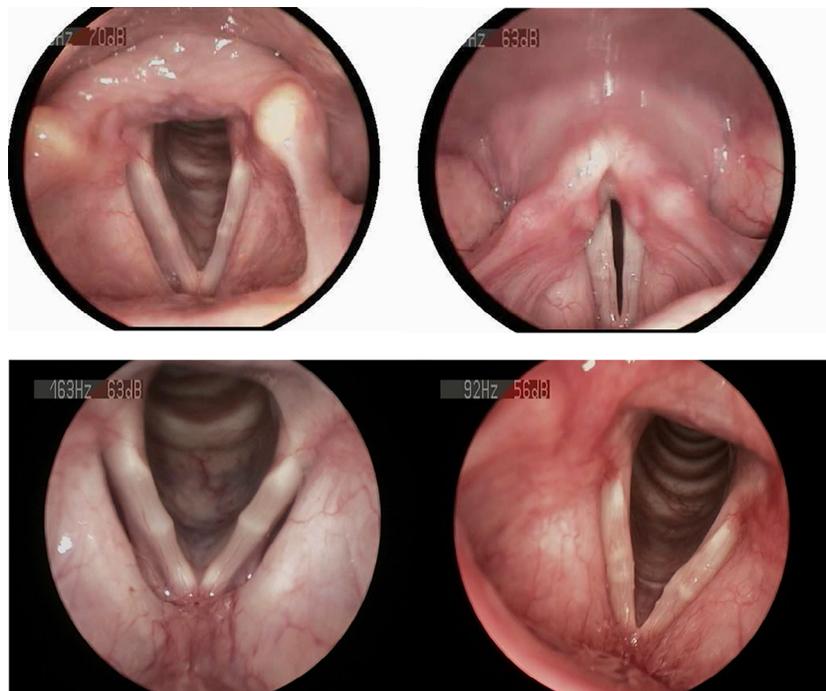


FIGURE 1. Examples of bamboo nodes under rigid indirect laryngoscopy: mainly bilateral, creamy-yellow, transverse, band-like deposits in the middle third of the vocal cords.

Speech therapy was proposed to all patients as therapeutic management. In cases of autoimmune disease, specific autoimmune treatment was introduced or sometimes modified. One patient, a professional singer, was proposed steroid injections in the vocal fold because of persistence of hoarseness despite speech therapy and modification of autoimmune disease treatment. None of the patients in this study had phonosurgery for bamboo nodes.

Clinically, 13 patients (87%) reported vocal improvement at their follow-up appointment. This improvement was confirmed with laryngoscopy in 40% of the cases (Figures 2 and 3). Of the two patients who failed to improve, one had a bad interaction with the speech therapist, the other had insufficient speech therapy follow-up. Fifty-three percent of patients (eight patients) showed improvement with speech therapy (of which six were treated by speech therapy alone). Five patients (33.3%) improved exclusively by modifying their autoimmune disease

treatment, mainly by introducing methotrexate (acide 4-amino-10-méthylfolique), mycophenolate mofetil (Cellcept), or hydroxychloroquine (Plaquenil). Two patients (13%) improved by associating speech therapy with the modification of autoimmune disease treatment. Finally, three patients (20%) improved by voice rest (two patients by voice rest alone: one patient improved after retirement and one after a change in professional activity; the last patient after resuming professional singing because of failure of other treatments).

The complete vocal profile at the last summoned appointment was detailed in Table 1. As most of the patients showed an improvement in their voice, the “Global Grade” of GRBAS (9) was low at 1.15/3 and the VHI was moderate at 35.3. However, the maximum time of phonation was still low at 13.6 seconds and the jitter at 1.4%, demonstrating the remaining instability of the vibrator. The evaluation of the reading,

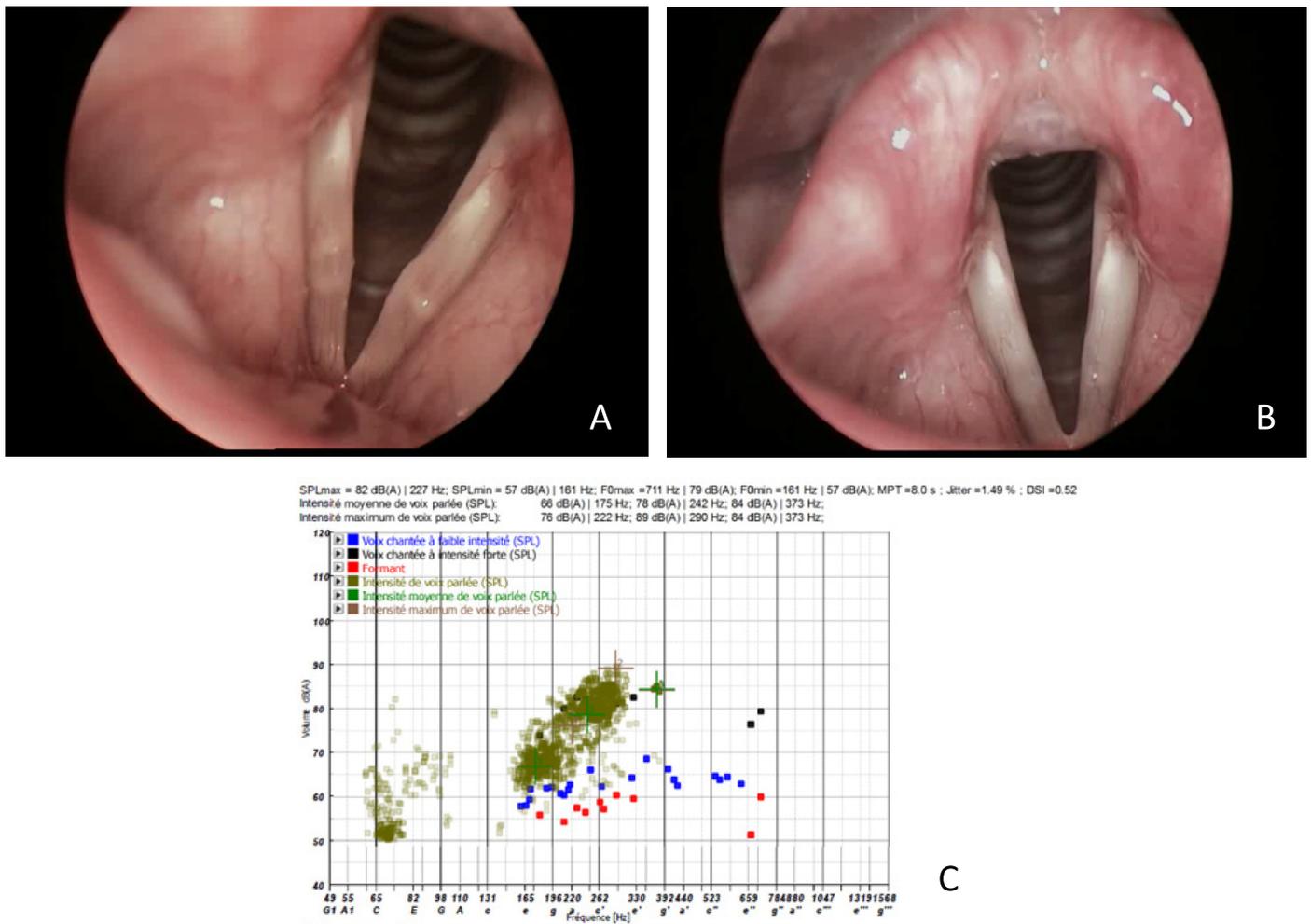


FIGURE 2. First example of a 30-year-old woman presenting with Sjögren disease with atypical rheumatoid arthritis consulting for dysphonia: (A) bamboo nodes at diagnosis: one left and two right submucosal transversal lesions at rigid laryngoscopy and a decreased vibration of the vocal cord in regard of the lesion at stroboscopy; (B) clinical and laryngoscopic improvement 2 years later after introduction of methotrexate; no speech therapy performed. (C) Phonetogram (using DiVAS Voice Range Profile) after 2 years of methotrexate: the voice range profile of the speaking (green cloud) and singing voices (blue and black points) in terms of sound pressure level measurements (decibel) and frequency (Hertz) is in the limits of normal female voice. Vocal intensity rises as frequency goes up as in normal voice measurements.

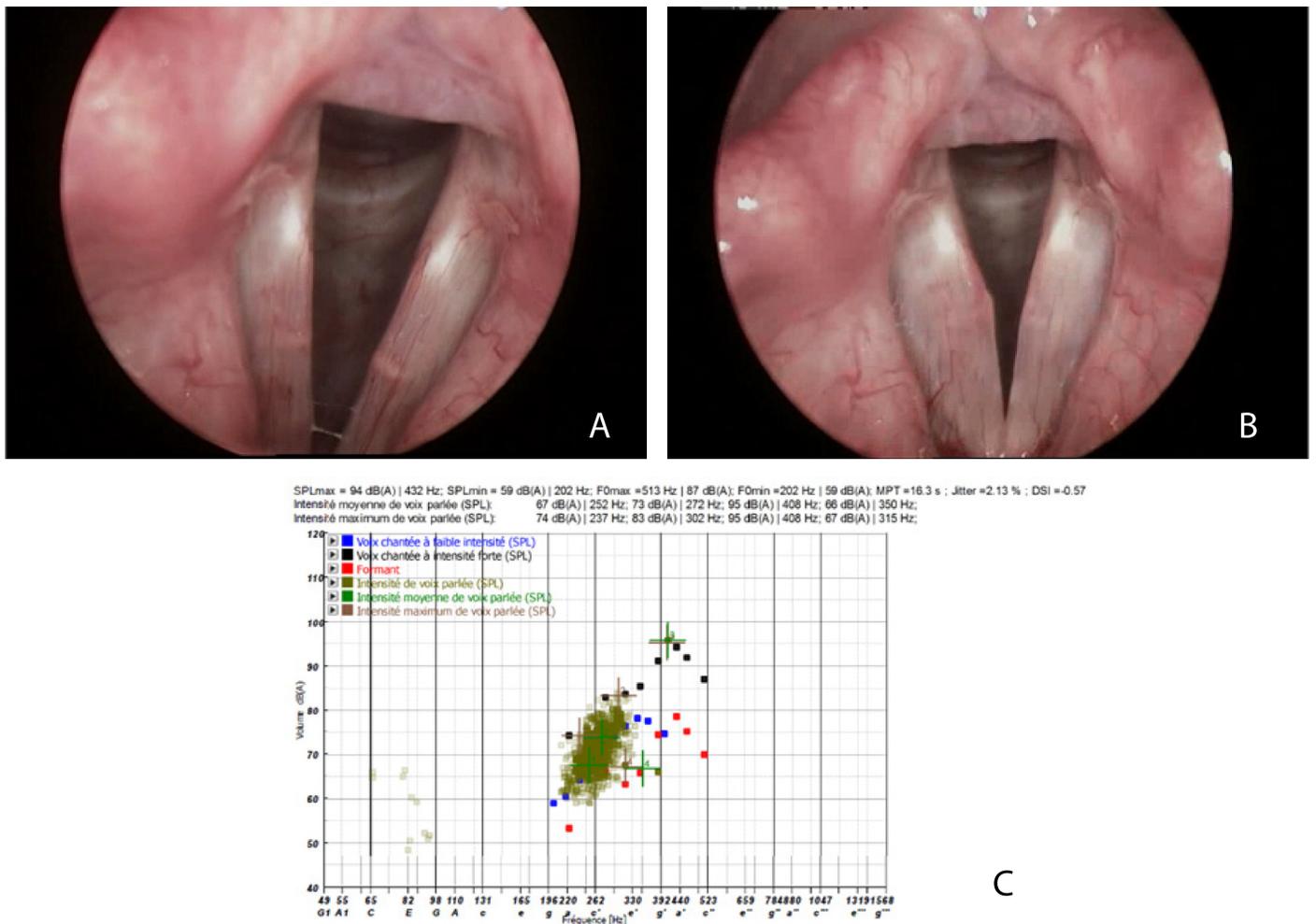


FIGURE 3. Second example of a 44-year-old nurse presenting with Raynaud syndrome and recurrent hoarseness with voice forcing: (A) diagnosis of bamboo nodes at laryngeal videostroboscopy: bilateral submucosal transversal lesions. (B) One year later: clinical improvement of symptoms after speech therapy and regression of the cordal lesion. (C) Phonetogram (using DiVAS Voice Range Profile) after 1 year of speech therapy: the voice range profile of the speaking (green cloud) and singing voices (blue and black points) in terms of sound pressure level measurements (decibel) and frequency (Hertz) is in the limits of normal female voice, but is not as extended as in normal voice measurements (less than two octaves). Conversational ambitus is also less extended (less than a fifth).

projected, calling, and singing voice was in the limits of a normal female voice.

Although most patients found that their voice had improved with treatment and that it was sufficiently efficient for work and

every day activities, they mentioned residual complaints. One of them described that her voice had shifting qualities throughout the day, with, most of the time, a less efficient and more tiresome voice toward the end of the day (vocal fatigue). Long

TABLE 1.
Vocal Profile of the Series including GIRBAS, VHI, MTP, Jitter, and Mean Fundamental in Reading, Projected, and Calling Voice at the Last Summoned Appointment

	Average	Mean Intensity (dB)	Normal Value
GIRBAS (Hirano scale): G or global grade (0–3)	1.15/3		0
Total Voice Handicap Index (VHI)	35.3/120		20 ± 15
Maximum time of phonation (MTP), s	13.6		>20
Jitter, %	1.4		<0.5
Mean fundamental: voice in lecture	199 Hz	for 68.2 dB	
Mean fundamental: projected voice	245 Hz	for 78 dB	
Mean fundamental: calling voice	356 Hz	for 91.7 dB	

or intensive use of voice was frequently mentioned to be vocally tiresome. Singing was sometimes not possible anymore, or high-range notes were very difficult to sing. Several patients also mentioned frequently feeling out of breath when they spoke or having difficulty with long sentences, corresponding to the low maximum time of phonation at 13.6 seconds found in our series. This, however, did not seem to interfere in their everyday life, corresponding to the moderate VHI (35.3).

Several characteristics of the remaining dysphonia also came to light. The voice was, for most patients, breathy with a grating and creaky character, mostly occasionally but also constantly for one of them, corresponding to the high jitter (1.4%). Patients could also describe occasional voice breaks in their speaking and singing voice, sometimes systematically at the beginning or the end of a phrase. For a number of patients, the voice was also strained. Projecting their voice usually made it clearer and more efficient; the therapist could, however, spot signs of straining such as tension mimics in the face, of muscle tension in the jaw or in the neck. A lack of timbre for some of the voices could also be heard. Finally, the voice range also seemed slightly higher than habitual women's voices.

DISCUSSION

This work reports on a series of 15 patients with a rare laryngeal lesion, bamboo nodes, related to systemic disorders, for which speech therapy seems highly effective as there is usually secondary microphonotrauma because of subsequent vocal abuse.

Obviously, treatment by speech therapy and voice rest acts on the mechanical factor (73%), whereas the introduction or modification of systemic autoimmune treatment acts on the causative factor, which might be related to deposits of autoimmune complexes (46 %). This study described middle-aged females with a highly demanding voice use: indeed, Li et al⁵ suggested that bamboo nodes formation might result from deposit of circulating complexes in the midportion of the vocal fold because of microvascular lesions induced by phonation in an autoimmune disease context. Hence, a prerequisite would be the existence of circulating immune complexes, whereas those patients would develop bamboo nodes because of repeated trauma affecting the vasculature. This work reinforced the combination of the two hypotheses, autoimmune and mechanical.

In this study, clinical improvement was achieved in 40% by exclusive speech therapy, 33% by exclusive maximization of autoimmune disease treatment, 13% by the association of speech therapy and modification of autoimmune disease treatment, and finally 20% by voice rest. Therefore, in cases of autoimmune disease, maximization of immunosuppressive treatment should be considered first. We also recommend speech therapy to reverse secondary microphonotrauma. Voice rest may be another treatment option. In the second line, a laryngeal injection of steroids or phonosurgery should be considered as described by Perouse et al.⁸

Vocal rehabilitation with a speech therapist should first include vocal hygiene tips. The general idea relies on breaking the vicious circle of vocal forcing,¹¹ often generated by trying to overcome the presence of lesions, with techniques of global and local relaxation. The "vocal locks" set up by recruiting the extrinsic

laryngeal musculature, as well as more distant muscles, are targeted. Rehabilitation aims to restore effective coupling of the vocal fold during phonation with the smallest possible difference between intra-oral and subglottic pressure, as well as aims to work on the adaptability of the laryngeal resistance with resistance to the air outlet (straw).¹² This contributes to having less traumatizing confrontation of vocal folds during phonation, which in case of vocal fold lesions such as bamboo nodes is important, not to maintain or increase local inflammation. Finally, to overcome the glottal leak, which is sometimes unavoidable in view of the lesions, a work on resonance¹³ and the use of supraglottic cavities can be proposed to increase voice efficiency and avoid falling back into vocal straining.

The progress of most patients was favorable, with 87% showing an improvement in their voice after a follow-up of at least 1 year. We associated this improvement to the conservative management, but cannot rule out spontaneous recovery.

Because of our nonsurgical treatment course, we could not present any histologic results, but we built our diagnosis on detailed clinical and vocal examination in accordance with descriptions of "bamboo node-like" lesions in literature.

This series emphasizes the important role of the laryngophoniologist in the detection of bamboo nodes. These unique lesions in the vocal folds are rare, but this diagnostic should be recalled in cases of dysphonia in middle-aged women affected by an autoimmune disease. Especially, patients with a connective tissue disease are concerned, but it has to be enlarged to all autoimmune diseases. Vice versa, for each patient with a diagnosis of bamboo nodes, the patient should be referred to an internist for a systematic autoimmune check-up to detect a possible biological asymptomatic autoimmune disease.

CONCLUSION

Pathophysiological hypothesis of bamboo nodes relies on (1) an intracordal inclusion corresponding to autoimmune complexes; (2) mechanical stress: secondary voice forcing induces alterations and inflammation of the vocal folds.

Our study reinforced the combination of these two hypotheses. On the one hand, there is a clear feminine predominance with a high daily vocal effort and the improvement by speech therapy and voice rest. On the other hand, bamboo nodes are distinct from typical vocal fold nodules, and their association with autoimmune disease is stressed by this series (73.3% of patients had an autoimmune disease).

Dysphonia, discovered in female patients with an autoimmune disease, has to remind the phoniatician to look for bamboo nodes. On the other hand, it is important to diagnose bamboo nodes in middle-aged female patients presenting with hoarseness, as there is an indication to refer them to an internist to perform a systematic autoimmune check-up.

REFERENCES

1. Todic J, Schweizer V, Leuchter I. [Bamboo nodes of vocal folds: case report and review of literature]. *Rev Med Suisse*. 2014;10:1811–1812, 1814–5.
2. Hosako-Naito Y, Tayama N, Niimi S, et al. Diagnosis and pathophysiology of laryngeal deposits in autoimmune disease. *ORL J Otorhinolaryngol Relat Spec*. 1999;61:151–157.

3. Hosako YNM, Mizuno M, Matsunaga A, et al. Laryngeal involvements in systemic lupus erythematosus. *Larynx Jpn.* 1993;6:171–175. [in Japanese].
4. Murano E, Hosako-Naito Y, Tayama N, et al. Bamboo node: primary vocal fold lesion as evidence of autoimmune disease. *J Voice.* 2001;15:441–450.
5. Li L, Saigusa H, Nakazawa Y, et al. A pathological study of bamboo nodule of the vocal fold. *J Voice.* 2009;24:738–741.
6. Woo P, Mendelsohn J, Humphrey D. Rheumatoid nodules of the larynx. *Otolaryngol Head Neck Surg.* 1995;113:147–150.
7. Perouse R, Coulombeau B, Cornut G, et al. [« Bamboo nodes »: a clinical study of 19 cases]. *Rev Laryngol Otol Rhinol (Bord).* 2001;122:299–302.
8. Levi LI, Chevaillier G, Bouche C, et al. Vocal fold bamboo nodes in undifferentiated connective tissue disease. *Rheumatology (Oxford).* 2014;53:1993.
9. Woisard V, Bodin S, Puech M. [The Voice Handicap Index: impact of the translation in French on the validation]. *Rev Laryngol Otol Rhinol (Bord).* 2004;125:307–312.
10. Giovanni A, Estublier N, Robert D, et al. [Objective vocal evaluation of dysphonia by simultaneous measurement of acoustic and aerodynamic parameters with the EVA device]. *Ann Otolaryngol Chir Cervicofac.* 1995;112:85–90.
11. Le Huche F, Allali A. La voix: Pathologie vocale d'origine fonctionnelle, 2ème édition, Tome 2, p51. In Paris: Masson; 2001.
12. Amy de la Bretèque B. L'équilibre et le rayonnement de la voix. p127. In: Solal. Marseille; 1997.
13. Chen SH, Hsiao T-Y, Hsiao L-C, et al. Outcome of resonant voice therapy for female teachers with voice disorders: perceptual, physiological, acoustic, aerodynamic, and functional measurements. *J Voice.* 2007;21:415–425.