

Voice outcome after cold phonomicrosurgery for minimal-associated pathological lesions of the vocal folds

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Objective

The aim was to assess the voice outcomes of cold phonomicrosurgery for minimal-associated pathological lesions of the vocal folds.

Materials and methods

A total of 26 patients with either unilateral or bilateral minimal-associated pathological lesions of the vocal folds from the Otorhinolaryngology Department in Zagazig University Hospitals between 2013 and 2014 were enrolled in the case group. Cold phonomicrosurgeries were performed. The control group comprised of 20 matched normal individuals. Matching was based on sex, age, and socioeconomic rank.

Results

All patients had videoendoscopic laryngeal evaluations in the preoperative and postoperative periods (3 months after surgery), and the results showed the absence of the lesion in comparison with the preoperative findings in 22 (84.62%) patients. All patients had perceptual voice analysis in the preoperative and postoperative periods (3 months after surgery), with all *P* values below 0.05, indicating statistically significant difference among the cases after the operation.

Conclusion

Although voice therapy is the cornerstone in treating benign vocal fold lesions, phonosurgery has an important role in some lesions.

Keywords:

cold phonomicrosurgery, minimal associated pathological lesions, voice

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Introduction

Minimal-associated pathological lesions (MAPLs) of the vocal folds are common in the general population that affect the vibratory vocal fold function resulting in significant dysphonia, which is often surgically correctable [1]. MAPLs include lesions like vocal polyps, cysts, nodules, and Reinke's edema; they are confined to the superficial lamina propria of the vocal folds [2]. Although voice therapy is the cornerstone in treating the benign vocal fold lesions, phonosurgery has an important role in some lesions [3]. The term phonomicrosurgery was introduced in 1994, the principle of which lies in the maximal preservation of the layered microstructure of the vocal folds, that is, the epithelium and superficial lamina propria [4]. Voice changes owing to MAPLs and voice outcomes after cold phonomicrosurgery can be assessed via analysis of some of patients' voice during interview, videostroboscopic examination, and analysis of certain voice parameters such as self-rating using voice handicap index, auditory perceptual assessment (APA) using GRBAS scale consisting of G (Grade), R (Rough), B (Breathing), A (Asthenia), and S (Strain), and acoustic analysis [5].

Materials and methods

Ethical considerations

Informed written consent was obtained from all the patients, and the Institutional Review Board (IRB) approved the research plan on 1 August 2013.

Methods

A retrospective case series study was conducted on 26 patients with either unilateral or bilateral MAPLs in comparison with a control group of 20 normal individuals in the Otorhinolaryngology Department in Zagazig University Hospitals in the period from August 2013 up to August 2014. The demographic data, clinical features, stroboscopic findings, surgical procedures, and recurrent rate were assessed.

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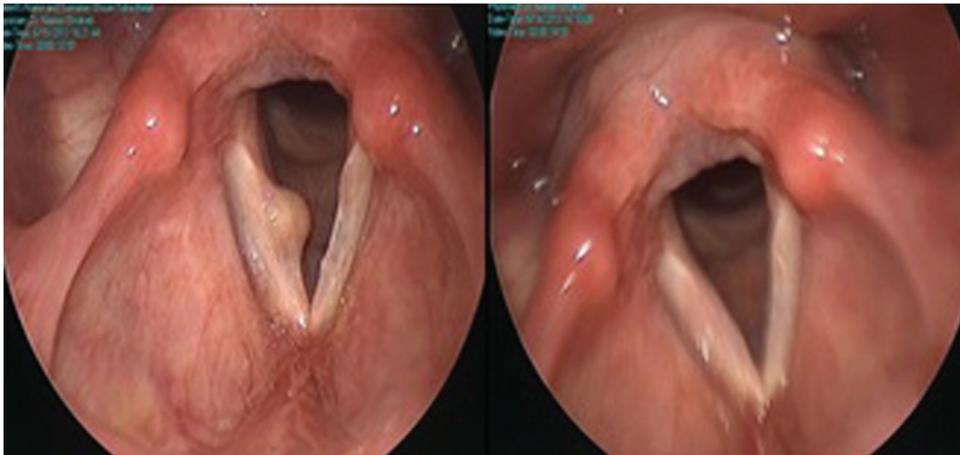
Statistical analysis

Data were collected and entered using the statistic package SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Data were summarized using mean, SD, and range for quantitative variables and percent for qualitative variables. Comparison between groups was done using *t*-test, paired *t*-test, and χ^2 -tests. *P* values less than 0.05 were considered as statistically significant and *P* values less than 0.01 were considered as highly significant. Overall, fourteen patients were males and twelve were females. The age ranged between 13 and 58 years. Only one patient was a male child, 13 years old, whereas all other patients were adult and old patients. Eleven patients presented with vocal fold polyp, six patients with vocal fold cyst, four patients with Reinke's edema, three patients with vocal fold nodules, and one patient with contact granuloma. There was one case with a combined lesion having bilateral Reinke's edema and right polyp.

All participants in the study were exposed to the voice assessment protocol applied in our phoniatric unit in the Otorhinolaryngology Department in Zagazig University Hospitals, which was done preoperatively and three months after surgery passing through three levels [6]:

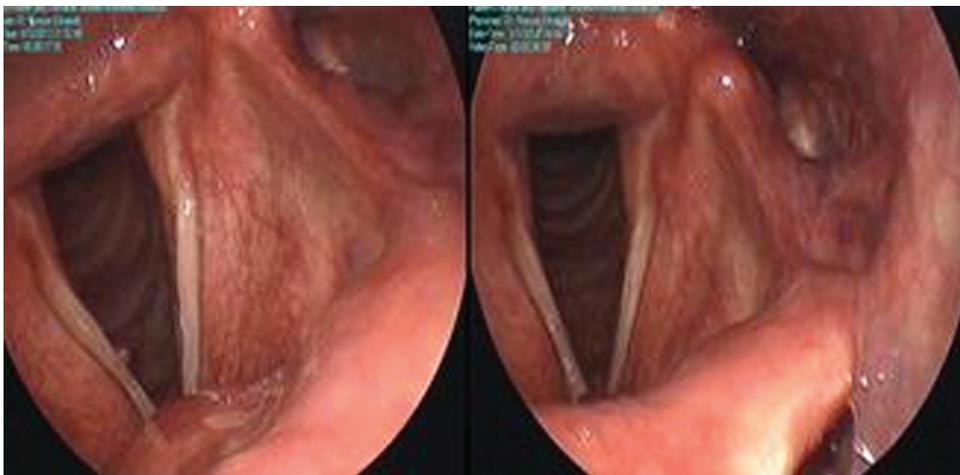
- (1) Elementary diagnostic procedures: this included thorough history taking and APA of the patient's voice with careful ENT and laryngeal examination.
- (2) Clinical diagnostic aids: this level includes videolaryngoscopy (Figs 1 and 2) using either flexible nasofibroscope or rigid 90° laryngoscope connected to a camera in association with stroboscopic light. Then documentation of the APA was done by means of high-fidelity voice recording. The recordings were done in a sound-treated room to minimize environmental noise. The recorded materials for all patients were

Figure 1



A 50-year-old female patient with right vocal fold cyst preoperatively (left) and 3 months postoperatively (right) by videolaryngoscopy.

Figure 2



A 49-year-old male patient with right vocal fold polyp preoperatively (left) and 3 months postoperatively (right), showed by videolaryngoscopy.

rated using the modified GRBAS scale which was confirmed by three experienced phoniatricians. This scale comprised a four-point scale (0–3) (0 for normal, 3 for severe) for determining the overall grade of dysphonia.

- (3) Additional instrumental measures: this level of assessment included acoustic analysis of voice using the Vocal Assessment Software. The following parameters were analyzed automatically: average F0, jitter%, Shimmer%, F0 tremor, and noise to harmonic ratio. Maximal phonation time could be measured simultaneously during the same task.

As a part of assessment, subjective judgments of vocal quality parameters were done including the following:

- (1) Pitch (adequate, too high, or too low).
- (2) Loudness (adequate, too loud, or too soft).
- (3) Presence of roughness, straining, and breathiness (none, mild, moderate, or severe).

Each patient also was asked to evaluate his or her voice after treatment compared with how it was before treatment (same, better, or worse). To improve the voice-related symptoms, therapy focuses on treating or controlling the underlying risk factors preoperatively and postoperatively including, smoking, gastroesophageal reflux, voice abuse or overuse, and postnasal discharge. Voice therapy was given postoperatively for some cases with residual dysphonia. For all types of lesions intraoperatively, general anesthesia is induced using endotracheal intubation with a reasonably small diameter is preferred in order not to block the surgeon's view of the larynx. A local surface decongestant adrenaline 1 : 10 000 was used for all cases. A local infiltration of adrenaline 1 : 200 000 was done in cases of vocal fold cyst to facilitate cyst removal. Surgical microscope is used. Microinstruments were used including special knives, forceps, dissectors, and scissors that are usually around 22 cm in length with a very small working end in addition to special suction tips and microcautery. Endoscopic assessment of the field was done using a 0° telescope, but this does not allow binocular vision with a difficult handling of instruments. Video camera system was used for documentation.

For vocal fold cyst, an incision was made on the upper surface of the vocal fold lateral to the lesion, and flap was elevated, followed by dissection of the wall of the cyst from the surface mucosa and the vocal ligament. Then the cyst was removed, and then the flap was re-draped.

For vocal fold polyp, the lesion may be grasped with a delicate forceps or preferably stabilized with a fine

suction. The mucosa is cut sharply rather than ripped, limiting resection to the area of pathology.

For vocal fold nodules, the lesion is grasped at its thinnest point and stretched medially and gently, and the nodule is sectioned with microscissors.

For Reinke's edema, an incision was made on the superior surface of the vocal fold; the incision was extended with upturned microscissors, incising the epithelium lateral to polypoid area, elevating the mucosa as a flap, reducing the gelatinous matrix that forms the bulk of the abnormal vocal fold, re-draping the flap, and trimming the excess mucosa.

For vocal fold granuloma, the lesion may be removed by cutting across the base. Removal should be limited, leaving the base or pedicle undisturbed.

For all cases, strict vocal rest for 7 days was recommended, and phonation is resumed under the supervision of a phoniatrician. Voice therapy was given postoperatively for some cases with residual dysphonia including all cases of Reinke's edema, two cases of vocal fold polyps, and one case of vocal fold nodules. The medical treatment was based essentially on paracetamol as an analgesic and oral antibiotics for 6–10 days. Antireflux therapy was given for 1 month.

Results

A total of 26 patients were included in this study in comparison with a control group of 20 normal individuals.

The age ranged between 13 and 58 years, with mean of 37 years. Overall, 14 (53.8%) patients were males and 12 (46.2%) patients were females. The lesion distribution is shown in Table 1.

Table 1 Lesion distribution among the study

Lesion	Frequency (%)
Cyst	6 (23.0)
Left cyst	3 (11.5)
Right cyst	3 (11.5)
Polyp	11 (42.2)
Right polyp	5 (19.2)
Left polyp	6 (23.0)
Bilateral nodules	3 (11.5)
Bilateral Reinke's	4 (15.4)
Left contact granuloma	1 (3.8)
Bilateral Reinke's+right polyp	1 (3.8)
Total	26 (100.0)

Table 2 Preoperative and postoperative grade of dysphonia

Dysphonia grade	Preoperative [n (%)]	Postoperative [n (%)]	Total [n (%)]	χ^2
0	0 (0.0)	14 (53.8)	14 (26.9)	
I	4 (15.4)	10 (38.5)	14 (26.9)	
II	5 (19.2)	2 (7.7)	7 (13.5)	
III	17 (65.4)	0 (0.0)	17 (32.7)	34.8**
Total count and %	26 (100.0)	26 (100.0)	52 (100.0)	

**Highly significant.

Table 3 Preoperative and postoperative acoustic analysis data

	Mean	N	SD	Paired t test
Hab.F0 cycle (s)	201.1277	26	68.66819	2.494*
Habitual F0 post	175.5115	26	53.04991	
Jitter	1.2300	26	1.31270	3.073*
Jitter post	0.4681	26	0.25254	
Shimmer	3.9135	26	1.73235	4.229**
Shimmer post	2.1452	26	0.68100	
HNR	18.6827	26	7.21513	4.240**
HNR post	24.2438	26	4.20391	
F0 Tremors	7.0858	26	5.39768	4.729**
F0 Tremors post	2.1396	26	1.81464	
MPT	10.7308	26	5.66786	10.942**
MPT post	22.4615	26	2.95609	

*Significant difference. **Highly significant difference.

The three cases with vocal fold nodules were selected for surgery after fulfilling at least one of the criteria for surgical removal (longstanding, large sized >2.5 and elevated >0.9 mm, fibrosed, asymmetrical or after failed course of voice therapy).

Voice therapy sessions were indicated for cases with remaining dysphonia after surgery.

Only eight (30.8%) patients had a history of smoking, including one female; 22 (84.6%) patients had a history of voice abuse; and 17 (65.4%) patients had a history of gastroesophageal reflux. All patients had videoendoscopic laryngeal evaluation in the preoperative and postoperative periods (3 months after surgery), and the results showed absence of the lesion in comparison with the preoperative findings in 22 (84.62%) patients. Examples are shown in Figs 1 and 2.

There were four (15.38%) cases that showed recurrence, including three cases of Reinke's edema and the case of contact granuloma. There is one case of vocal fold polyp complicated by the formation of a mucosal tag.

Regarding the grade of dysphonia, the results are shown in Table 2, with *P* value of 0.00 indicating statistically highly significant difference among the cases after the operation.

Table 4 Postoperative cases in relation to control group

	Groups	N	Mean±SD	t
Habitual F0 post	Case	26	175.51155±3.0491	264
	Control	20	179.3500±42.9123	
Jitter post	Case	26	0.4681±0.25254	2.852
	Control	20	0.3045±0.04685	
Shimmer post	Case	26	2.1452±0.68100	1.420
	Control	20	2.2050±0.30171	
HNR post	Case	26	24.2438±4.20391	1.570
	Control	20	25.8150±1.71994	
F0 Tremor post	Case	26	2.1396±1.81464	1.531
	Control	20	2.8950±1.24439	
MPT post	Case	26	22.4615±2.95609	1.198
	Control	20	23.3600	

Postoperative cases compared with the control group in acoustic analysis.

All patients had perceptual voice analysis in the preoperative and postoperative periods (3 months after surgery), with all *P* values below 0.05, indicating statistically significant difference among the cases after the operation (Table 3). However, comparison between postoperative and control group results of acoustic analysis revealed nonsignificant differences in all parameters, with *P* values more than 0.05 (Table 4).

Discussion

In this study, MAPLs were found to be more frequent in males (14) than females (12). This observation may be explained by the fact that in Egypt males are more smokers than females. However, most series report a much higher percentage of women with Reinke's edema [7]. Hormone receptors were known to exist in the nucleus and cytoplasm of cells in the vocal fold [8]. These results were confirmed by Koufman and Belafsky [9] who stated that female preponderance of Reinke's edema was hormonally related to sex difference in aerodynamic properties and epithelial susceptibility to inflammatory disease. The age of patients in the present study ranged between 13 and 58 years, with a mean of 37±11.433 years. There was a significant relation between age and MAPLs. Age-related changes in the vessels increase the possibility of thrombosis and decrease blood flow through the vessels, thus also leads to hypoxia and ischemia of

the vocal fold mucosa [10]. All the factors were very intermingled and acting together to cause the development of the laryngeal mucosal lesions. So we can consider MAPLs as a multifactorial disease. In this study, we have selected cold microsurgery as the technique of choice for all our participants after they have fulfilled the criteria for surgery mentioned by other authors [11]. For vocal fold nodules, all our three cases had at least one of the indications of surgery as longstanding large sized more than 2.5 mm and elevated more than 0.9 mm, asymmetrical, or after failed course of voice therapy [11,12].

According to Davies and Jahn [14], once a vocal fold polyp or cyst had been present for some time, it needs surgical removal with no role for voice therapy alone [13]. Regarding Reinke's edema, Kotby [15] mentioned that behavioral readjustment voice therapy can reverse only early Reinke's edema. However, surgery is frequently needed for removal of gross persistent swellings. For contact granuloma, although surgery has high recurrence rate according to Kotby [6], it can be followed by a well-planned program of voice therapy to decrease the incidence of recurrence [14].

All patients had videoendoscopic laryngeal evaluation and perceptual voice analysis in the preoperative and postoperative periods (3 months after surgery). The results showed the absence of the lesion in comparison with the preoperative findings in 22 (84.62%) patients. All patients had perceptual voice analysis in the preoperative and postoperative periods (3 months after surgery), with all *P* values below 0.05, indicating statistically significant difference among the cases after the operation. However, comparing the postoperative results with the results of the control group reveals nonsignificant differences. This indicates that voice parameters returned near to the normal results after surgery.

Conclusion

Although voice therapy is the cornerstone in treating benign vocal fold lesions, phonosurgery has an

important role in some lesions, especially vocal fold polyps, vocal fold cysts, Reinke's edema up to polypoid degeneration, and selected cases of contact granuloma and of vocal fold nodules. We can recommend cold phonosurgery as an important tool for management of MAPLs, with a reasonable technique of voice therapy.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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