

Acoustic comparison between two different techniques of endoscopic resection of benign laryngeal lesions

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Introduction

Microdebrider as a new technology in the management of laryngeal lesions is a powered rotatory dissection device with suction assistance; it was used before in orthopedic surgery and sinus surgery. The aim of this work was to assess the microdebrider as a tool for excision of benign laryngeal lesions and compare its results (intraoperative and postoperative) with those of microlaryngeal surgery by cold instruments.

Patients and methods

Forty patients with benign vocal fold lesions were included (25 women and 15 men), with age ranging from 24 to 51 years. Group I was subjected to excision of lesions by the conventional instruments. Group II was subjected to excision of lesions by the microdebrider. Each patient was subjected to the protocol of voice assessment preoperatively and 3 weeks postoperatively. The patients were assessed subjectively by Voice Problem Self-Assessment Scale and objectively by laryngoscopy, stroboscopy, and acoustic analysis.

Results

No significant difference in the acoustic parameters between the two groups was observed, but there was significant difference between the preoperative and the postoperative acoustic parameters for each group. Postoperative parameters satisfactorily improved with resolution of the lesions in both groups.

Conclusion

The microdebrider was determined to be a safe, accurate, and reliable method in removal of benign vocal fold lesions but does not offer major advantages compared with the standard instruments.

Keywords:

benign laryngeal lesions, microdebrider, microlaryngeal surgery

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Introduction

Benign vocal folds mucosal lesions such as vocal nodules, laryngeal polyps, and contact granuloma are common among patients with voice disorders, being present in about 45–50% of those patients [1,2]. Benign vocal fold lesions are caused mainly by repeated vocal fold trauma (excessive voice use) [3]. Surgical management of benign laryngeal lesions include laser ablation and cold knife excision [3]. Dealing with vocal fold lesions presents challenge to physicians; most studies reported good results applying laser surgery to vocal fold lesions [4,5]. However, other studies have indicated that cold knife surgery has the benefit of protecting vocal fold from thermal injury [6,7]. Microdebrider as a new technology in management of laryngeal lesions is a powered rotatory dissection device with suction assistance, which is designed to minimize trauma to the surrounding tissues [8,9]. Its application in laryngeal surgery is relatively new, but it has been in use for decades in orthopedic and temporomandibular joint surgery [9]. This electrically powered instrument combines suction and irrigation

functions with an oscillating blade within a protected sheath that provides continuous suction [10]. The microdebrider is able to remove tissues within a tight space and allows an unobstructed operative field. Microdebrider use in endoscopic sinus surgery was first reported in 1996, and it was subsequently adapted for laryngeal applications in 1999. Its first use in the larynx was as an effective debulking tool for laryngeal papillomas and later for various other laryngeal disorders [11]. More delicate laryngeal surgery using smaller blades at low rotational speeds has been mentioned for epithelial lesions, including polyps and granulomas; its use in the treatment of Reinke's edema was first described in 2000 [10,11]. The procedure is performed under indirect visualization through a video monitor; the 0 and 30° telescope attached to the video camera is held in one hand, whereas the other hand holds the hand piece similar to a pencil. The blade is inserted under endoscopic guidance; alternatively, a video laryngoscope, which allows bimanual tissue manipulation with excellent visualization of small glottis and supraglottic lesions, can be used in selected cases [9]. The cutting tip engages the free edge of the

lesion and should always be in view. Gentle rotational movements of the wrist allow removal of the lesion; the resected tissue from the microdebrider can be collected for histological analysis [12].

Patients and methods

Patients

This study was conducted as a prospective randomized, double-blind clinical trial on 40 patients aged 18 years and above, attending the ENT Department of Alexandria Main University Hospital, presenting with voice complaints or respiratory distress, and diagnosed as benign laryngeal lesions, and the decision was made to proceed with a surgical intervention. The inclusion criteria were patients presenting with voice complaints and diagnosed as benign laryngeal lesions namely polyps, nodules, granuloma, papilloma, or cyst, patients not responding to voice therapy, and patients who are fit for general anesthesia. The exclusion criteria were patients with malignant laryngeal lesions, with acute inflammatory laryngeal pathology, under the age of 18 years, or who refused consent to participate in the study.

Materials and methods

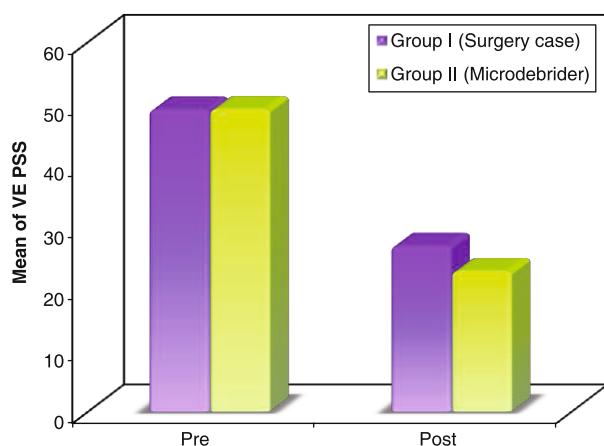
All patients were subjected to history taking including detailed history taking and auditory perceptual assessment using the grade, roughness, breathiness, asthenia and strained (GRBAS) scale and clinical examination including indirect and direct videolaryngoscopy and stroboscopy. Subjective evaluation of voice was performed using Voice Problem Self-Assessment Scale, which is a five-point scale and constitutes four clusters (functional, physical, emotional, and phonathenic). Acoustic analysis of voice

was performed by Multidimensional Voice Program (Model 4305, New Jersey, USA) using Computerized Speech Lab (Model 4300B; Kay Elemetrics Corporation, New Jersey, USA), and informed consent was taken from patients before beginning the study. All patients were randomly divided into two groups depending on the technique used for surgical removal. Group I was subjected to microlaryngeal surgery using the cold instruments and group II was subjected to microlaryngeal surgery excision using the microdebrider (skimmer). After 3 weeks from surgery, patients were re-evaluated using the same protocol of voice assessment.

Results

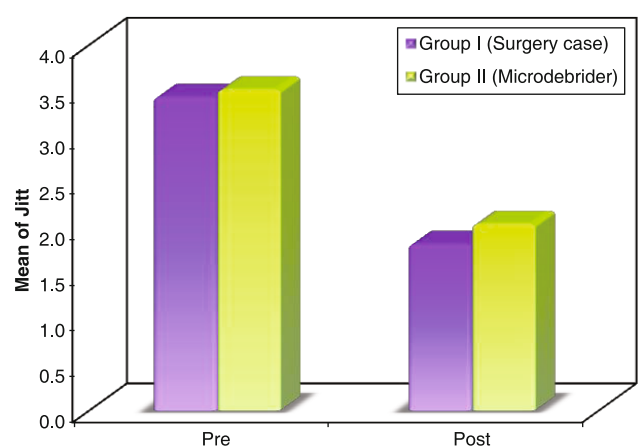
Of the total population, there were 33 cases of vocal fold polyps, three cases of vocal fold nodules, two cases of vocal fold cyst, one case of granuloma, and one case of papilloma. With respect to GRBAS scale, there was no statistically significant difference between the groups neither at baseline, nor after 3 weeks. In Voice Problem Self-Assessment Scale, at the baseline (preoperatively) there was no significant difference between the groups in all parameters of the scale except the emotional and the total clusters where their P values were 0.027 and 0.030, respectively. After 3 weeks, all the clusters showed significant difference between the two groups except the phonathenic parameters ($P = 0.412$). There was no statistically significant difference between the groups after 3 weeks (Fig. 1). There was no statistically significant difference between the groups either at baseline or after 3 weeks with respect to short-term frequency perturbation (Fig. 2). There was general tendency for decline in the parameters; however, this was not enough to yield statistically significant change

Figure 1



Comparison between the two groups regarding the total score of Voice Problem Self-Assessment Scale (VPSS).

Figure 2



Comparison between the two studied groups among the different follow-ups regarding Jitter (Jitt) percent.

in group I and group II. Group II showed significant decline in the amplitude perturbation quotient and shimmer in dB (Fig. 3). With respect to the Dysphonia Severity Index, no significant difference was found between the two groups (Fig. 4). Being a new tool in management of benign laryngeal lesions, the microdebrider was assessed intraoperatively in the following aspects:

- (1) Operative time (measured between introduction and removal of direct laryngology (DL)) ranged from 15 to 25 min in both groups.
- (2) Intraoperative bleeding was less than 100 ml in 40 (100%) patients, which was easily stopped by adrenaline pledgets.
- (3) No safety measures were taken in 40 (100%) patients. No risk for fire damage was observed to both surgeon and patient as occurred in laser microlaryngeal surgery.
- (4) No trauma occurred to the surrounding tissues either in surgery patients or in the microdebrider group.

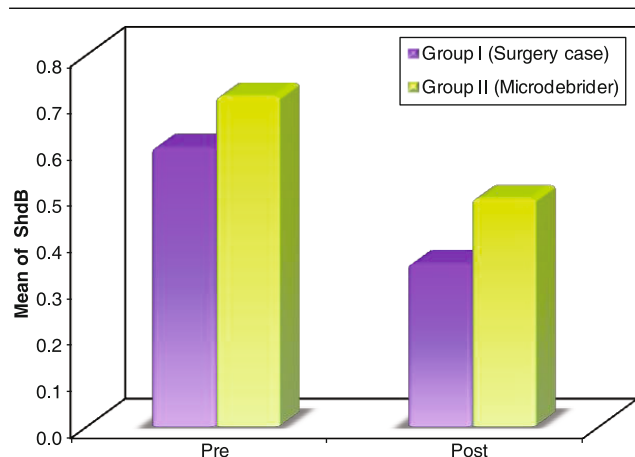
With respect to the postoperative complications, no complications were detected in 40 (100%) patients.

Discussion

In this study, the powered microresectors were used to remove benign laryngeal lesions, with a standard suspension laryngoscope in position; the debrider was used under microscopic guidance. The suction and irrigation were incorporated with an oscillating blade; laryngeal lesions were removed rapidly while the surgeon manipulates the lesion with the blade. This manipulation allowed laryngeal

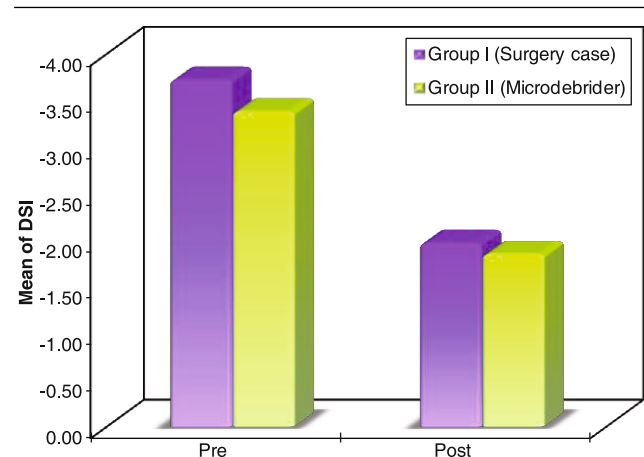
anatomy to be confirmed as much as possible, despite the presence of significant distortion. Thus, the surgeon maintained visual and tactile contact with the laryngeal lesion, maximizing the surgeon's ability to remove disease and minimizing any risk for injury. Pasquale *et al.* [9], in a prospective study, compared the microdebrider with CO₂ laser removal of recurrent respiratory papillomas. On comparison with the CO₂ laser group, the microdebrider group showed similar postoperative pain scores, a greater improvement in voice quality, shorter procedure times, and lower overall procedure costs. Powered surgical instrumentation also allows fast debulking of obstructive laryngeal and tracheal tumors and avoidance of tracheotomy. The microdebrider uses suction to pull laryngeal papillomas into the shaft of the instrument where they are resected by a rotating or oscillating blade. When used appropriately, tissue injury is limited to the mucosal layer of the vocal folds. In contrast, the CO₂ laser uses light energy, which is absorbed and converted to heat energy, causing water molecules within the targeted tissues to vaporize. This process inevitably results in collateral thermal injury to the surrounding and deeper tissues [13,14]. Injury to the deeper structures may significantly alter the vibratory characteristics of the mucosa and lamina propria of the vocal folds, resulting in permanent voice changes. Rogerson *et al.* [15] compared voice outcomes following microdebrider or CO₂ laser treatment of juvenile onset recurrent respiratory papillomatosis. The results of their study suggested that treatment with the microdebrider results in a better immediate and early postoperative voice outcome. Moreover, the data demonstrated a correlation of worsening voice quality with increased exposure to the CO₂ laser.

Figure 3



Comparison between the two studied groups among the different follow-ups regarding shimmer in dB (ShdB).

Figure 4



Comparison between the two studied groups among the different follow-ups regarding Dysphonia Severity Index (DSI).

The present study showed that jitter values declined in both groups across the follow-up. This finding is in agreement with results of Uloza *et al.* [16] and Benninger and Jacobson [17], showing decreasing jitter values after treatment of nodules and polyps. Shimmer is a cycle-to-cycle, short-term perturbation in amplitude of voice. It increases with poor and inconsistent contact between the vocal fold edges [18]. It was reported to relate with the perception of breathiness [19]. The present study showed that there was no statistically significant difference between the groups in the short-term and long-term amplitude perturbation measurements. Shimmer percent showed more decline in group I (the surgery group) than in group II (the microdebrider group) across the follow-ups, although being nonstatistically significant (P value after 3 weeks was 0.914). This study showed that the microdebrider was determined to be a safe, accurate, and reliable method in removal of benign vocal fold lesions but does not offer major advantages compared with the standard instruments.

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Conflicts of interest

None declared.

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