

Original Research Article

Vocal outcomes after video assisted cold knife endolaryngeal phonosurgery of benign vocal fold lesions

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ABSTRACT

Background: This study focuses on therapeutic possibilities in managing benign superficial vocal fold lesions with video assisted cold knife endolaryngeal phonosurgery.

Methods: Fifty patients with benign vocal fold lesions presented to us between September 2013 and October 2015 who failed conservative therapy were subjected to video assisted cold knife endolaryngeal phonosurgery. The pre and postoperative results were evaluated based on voice rating by visual analogue scale and GRBAS scale.

Results: Encouraging results were achieved with cold knife endolaryngeal surgery as 96.3% of patients were symptom free without any recurrence after single operation. Most of them have achieved >90% of voice outcome by 1 month postoperatively based on voice assessment and laryngoscopic evaluation.

Conclusions: Using a telescope with high definition video system for performing phonosurgery is economic, enables the surgeon to acquire static images and video sequences. Cold knife endoscopic laryngeal surgery is possibly a better option for addressing BVFLs.

Keywords: Cold knife, Video assisted, Phonosurgery, Vocal fold, Telescope, Voice assessment

INTRODUCTION

Hoarseness can be defined as the change in normal voice quality and invariably the earliest manifestation of largest variety of conditions affecting the voice apparatus. Benign lesions of the larynx are of interest and importance to the laryngologist, not only because of the symptoms which they produce by interference with the normal functions of the vocal mechanism or by obstruction of the respiratory tract but because of the necessity of distinguishing them from malignant laryngeal lesions. More than half of patients presenting with hoarseness show benign vocal fold changes. The clinician should be familiar with the anatomy, modern diagnostic and therapeutic possibilities in order to ensure an optimal and patient specific management.

Phonosurgery refers to any surgery designed to improve or restore the voice. Endolaryngeal phonosurgery is one of the newer surgical modality in armamentarium of the otolaryngologist. The underlying premises of phono microsurgery is that optimal voice production will be achieved, if there is maximal preservation of the vocal fold's structure.

Introduction of suspension laryngoscopy by Killian in 1911 and use of microscope in laryngeal surgery by Albrecht in 1954 led to a new era of precession with stable magnified field. Most of the benign vocal fold lesions are confined to the superficial lamina propria. Phonosurgery was coined to designate the functional laryngeal surgery with the maintenance and improvement of vocal function as a goal by Hans von Lenden and

Godfrey Arnold in 1963 and in 1964 the conventional cold knife technique was developed by Kleinsasser.¹ In 1972 endoscopic laryngeal microsurgery was established by Jako et al.² The vocal fold microsurgery became a new standard of care to remove pathology in these cases without scar formation.³ Laryngeal microflap surgery using infusion and flap technique has been a great improvement over the conventional microlaryngeal technique with vocal fold stripping as it avoids injury to deep layers of lamina propria stimulating fibroblasts and causing scar formation with poor voice quality.⁴

In operating laryngoscopy for improved vision a binocular microscope is positioned between the operator and the laryngoscope. This interferes, to some degree, with the introduction of instruments, particularly if the surgeon is using bimanual manipulation. Using a telescope with high-definition video system an enlarged image from the anatomy was produced and viewed from a convenient distance. The manipulations are unobstructed, and simultaneous records can be obtained.

This article focuses on the benign vocal fold lesions and explores the therapeutic possibilities with video assisted cold knife endoscopic laryngeal surgery in managing these pathologies.

METHODS

This study was conducted on patients of both sex of age group 18 to 60 years presenting with chronic change in voice to the hospital MGMMC and M.Y. Hospital Indore during the study period of two years, from October 2013 to September 2015. Sample size was calculated on the basis of simple random sampling. All patients excluding those with nasopharyngeal, laryngeal malignancies and neurological disorders were subjected to routine detailed clinical history, general physical examination, indirect laryngoscopy, perceptual assessment of voice using GRBAS scale and visual analogue scale, vocal fold imaging by video telarlaryngoscopic examination with help of rigid 90 degree laryngoscope being preceded by a brief explanation of the procedure. All the patients were given conservative medical and voice therapy. 50 patients with failed conservative therapy were subjected to endolaryngeal phonosurgery using conventional technique.

The study comprised of patients with a male: female ratio of 1.94:1 and the commonest age group involved was 41-50 years. The average duration of the symptoms was 10 months. The most common associated complaint was vocal fatigue (44%) followed by foreign body sensation (36%). The history of vocal abuse or excessive use of voice was seen in 48% patients, 30% of patients had history of laryngopharyngeal reflux and 28% were chronic smokers and 24% of cases had history of recurrent URTI. Patients were diagnosed with vocal nodules (13), vocal polyps (18), vocal cysts (12), vocal fold papilloma (2), glottis web (3), subepithelial mass

with vocal fold scarring (1) and arytenoid granuloma (1). All were subjected to endolaryngeal surgery and histopathological evaluation.

The pre and postoperative results were based on voice rating GRBAS scale ranging from normal (grade 0), mild dysphonia (grade 1), moderate (grade 2), severe dysphonia (grade 3). In required cases after rigid laryngoscopic evaluation patient were subjected to direct suspension laryngoscopy under general anesthesia and the lesions were palpated to determine the depth and nature of lesions and if required addressed with endoscopic laryngeal surgery and histopathological evaluation.

Operative technique

The patient is placed in Boyce's position on the operating table under general anesthesia with smallest possible endotracheal tube, with a hyperextended head, attached to a laryngo-suspension apparatus. Rigid 00 and 700 telescope were used attached to the laryngoscope with the camera head mounted on the proximal end of the telescope, illumination is provided by a cold light source, and images are displayed on a HD monitor.

The glottis is evaluated and the procedures are performed under adequate magnification. Subepithelial infusion of 1: 10,000 adrenaline with 2% lidocaine solution is given in the Reinke's space causing distension and vasoconstriction of microvasculature thus hydrodissecting the lesion from the underlying superficial lamina propria or vocal ligament. Over injection is avoided so as to prevent distortion of margin of the lesion.

Cordotomy is typically performed at the superior and lateral border of lesion i.e. at the junction of normal and abnormal tissue to avoid traumatizing any uninvolved portion of vocal fold. The epithelium is freed at the anterior and posterior limits of dissection so as to prevent accidental stripping beyond the intended resection limit and the mucosal flap is elevated using blunt dissection, the lesion is excised subepithelially by both blunt and sharp dissection with preservation of mucosal flap. The mucosal flap is then redraped to cover the underlying superficial lamina propria while taking out the neurosurgical patties placed in the subglottis. Hemostasis is achieved with adrenaline packs.

After the mucosal flap has been redraped, palpation of the vocal fold should be performed to determine if there is any residual submucosal pathology. Due caution are taken not to over-aggressively remove of any residual lesion which can result in significant scar formation as well as a permanent deformity of the free edge of the vocal fold. All specimens are sent for histopathological diagnosis and the results are consistent with the diagnosis of benign superficial vocal fold lesions.

Small nodules and polyps are grasped and excised using a truncated approach. In case of arytenoid granuloma the dissection done between the granuloma and the underlying perichondrium after putting gentle traction medially thus avoiding pressure on uninvolved tissue and the lesion is excised and the base is cauterized. Solitary adult onset laryngeal papilloma are dissected by pulling the lesion medially with gentle pressure thus forming a mucosal tent between the lesion and the underlying superficial lamina propria or the vocal ligament creating a mini microflap. The subepithelial fibrous mass and vocal fold scarring is addressed by lateral microflap technique performing a superior cordotomy and the fibrous tissue dissected out from the underlying vocal ligament. Resection of anterior glottic web using the traditional instruments are accomplished by dividing one edge near a vocal fold allowing the free edge to fold on its base on other side and the edge is left free.

Postoperative voice care

Postoperative care includes absolute voice rest for 7 days with antireflux medication. Post operatively systemic steroid is prescribed. Tincture benzoin inhalation is advised to reduce local inflammation. Patient are advised voice therapy, vocal hygiene techniques. Hydration and humidification are advised and followed at regular intervals for any complication and smoothness of recovery. Post therapeutic video assisted rigid laryngoscopy and voice evaluation is done in follow up cases after 1 month and a second follow up after 3 months.

Voice evaluation

A standard voice sample is obtained preoperatively and in follow-up settings using a set of high-quality voice recordings in a sound-proof room. Patient's voice evaluation is done by perceptual analysis using GRBAS scale and visual analogue scale. The GRBAS scale consisting of G (grade), R (roughness), B (breathiness), A (asthenia), S (strain) factors is adopted using a four-point grading system (0 = normal, 1 = slight, 2 = moderate, 3 = extreme). The behavioral scales asthenicity and strain are less reliable thus only the remaining simplified scale GRB is used to quantify voice quality. A visual analogue scale (VAS) is used to assess the patient's own evaluation of the social acceptability of his or her voice. The patients are asked to rate his/her voice on a 10.0 cm line by marking a slash mark at a point appropriate to them. A score of 0 indicated a totally acceptable voice and a score of 10 indicated a totally unacceptable voice. Maximum phonation time and S/Z ratio are also noted. All the patients attended the first follow-up setting one month and 3 months after surgery.

RESULTS

The males comprised 66% of patients in the study with a male: female ratio of 1.94:1 and the commonest age

group involved was 41-50 years. The average duration of the symptoms was 10 months. The most common associated complaint was vocal fatigue (44%) followed by foreign body sensation (36%). The history of vocal abuse or excessive use of voice was seen in 48% patients, 30% of patients had history of laryngopharyngeal reflux and 28% were chronic smokers and 24% of cases had history of recurrent URTI.



Figure 1: Endoscopic picture of right vocal cyst in a 29 year male vendor with history of vocal overuse and rec URTI with complaint of change in voice for 6 months. The cyst was separated from underlying vocal ligament by hydrodissection. The cyst along with its complete wall was removed by microflap technique and the mucosal fold was reposed over the raw area.

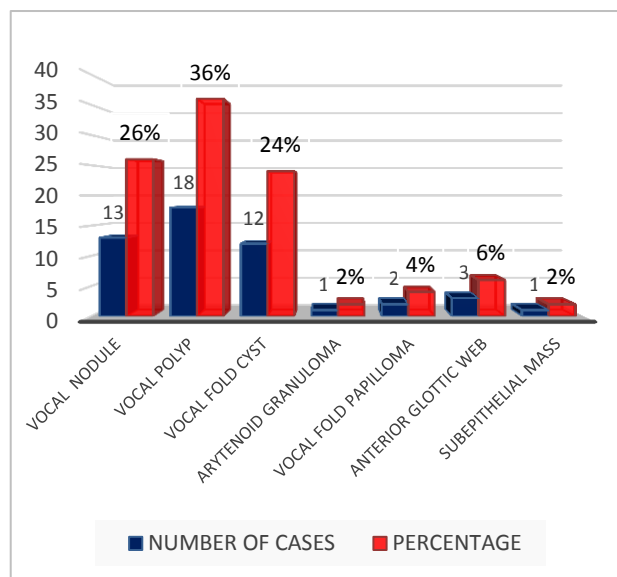


Figure 2: Benign vocal fold lesions evaluated by rigid laryngoscopy and direct suspension laryngoscopy.

In this study non vocal professionals were the group most affected and the incidence was the maximum among housewives 32% followed by laborers (20%), in case of vocal professionals, teachers were the group commonly affected (16%) followed by vendors (12%), singers (8%) and students (8%). All the cases subjected to endoscopic laryngeal surgery were totally symptom free with no recurrence. However, 1 case of vocal fold papilloma was partially free of symptoms and recurrence of lesion occurred because of noncompliance of the patient.

Table 1: Voice analysis at first follow up at 1 month.

Parameter	Pre-operative mean±SD n=50	Postoperative value mean±SD n=50	P value
Maximum phonation time (sec)	5.45±0.69	6.15±0.75	<0.005
G of GRBAS Scale	2.30±0.79	0.36±0.48	<0.001
R of GRBAS Scale	2.27±0.70	0.33±0.49	<0.001
B of GRBAS Scale	1.67±0.62	0.27±0.46	<0.001
Visual analogue scale (VAS)	8.53±0.64	1.40±0.72	<0.001

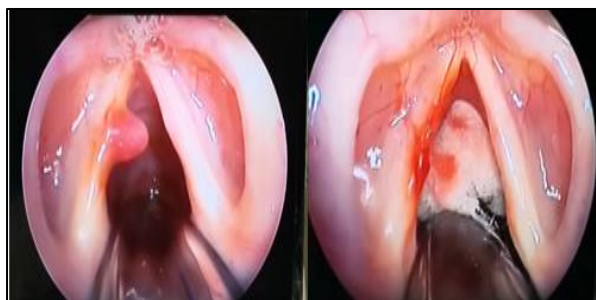


Figure 3: Intra op endolaryngoscopic picture of a 38 year old house wife presented to us with 8 months of change in voice with h/o vocal abuse and recurrent upper respiratory tract infection showed a unilateral post haemorrhagic vocal fold cyst of left vocal fold with resolving haemorrhage and minimal contact induced swelling of right vocal fold.

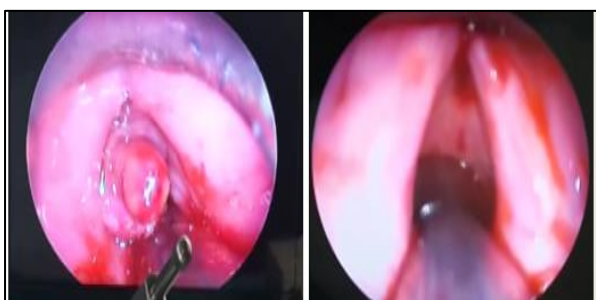


Figure 4: This is an intraop direct endolaryngeal picture showing a broad based right vocal fold polyp partially obscuring the left vocal fold in a 42 year teacher with 1 year history of progressive dysphonia, patient was subjected to video assisted endolaryngeal surgery and the polyp was resected out.

As per GRBAS scale, out of 50 patients operated all had good outcome of voice as shown in table 1 and 2 on follow up at 1 month and 3 months respectively. Although there was minimal improvement in terms of maximum phonation time and S/Z Ratio postoperatively at first follow up at 1 month, significant improvement was noted in terms of visual analogue scale with $p < 0.001$. There was no noticeable difference in the improvement in the visual analogue scale rating at first and second follow up. On perceptual analysis with GRB Scale significant statistical improvement was recorded with $p < 0.001$ for each parameter with significant decrease in the value of parameters postoperatively. There was not much of difference in improvement of the GRB parameters between the first and second follow up.



Figure 4: Intra op endolaryngoscopic picture of a 24 year old house wife presented to us with 6 months of change in voice with h/o vocal abuse and recurrent upper respiratory tract infection shows a typical sessile unilateral post haemorrhagic polyp of left vocal fold with a vascular blush at its base anteriorly. Polyp was resected using cold microlaryngeal instruments with a truncated approach.

On rigid laryngoscopic evaluation post operatively the vocal fold edges were normal with no postoperative scarring. Postoperative recovery was smooth and no complication was noted. The present study showed encouraging results with endolaryngeal surgery with cold instruments as 96.3% of patients were normal without any recurrence after single operation.

DISCUSSION

The management of patients presenting with voice disorders is complex and often controversial. An expert knowledge of diagnostic and therapeutic possibilities is clearly required, but often good quality evidence is lacking as to the best treatment for the individual patient. More than half of patients with voice disorder have benign vocal fold changes and their treatment is often a combination of conservative and interventional measures. To this end, ENT surgeons with an interest in voice disorders rarely work alone, and a multidisciplinary team consisting of, amongst others, speech and language therapists allows for the best possible patient care.

Improved understanding of Surgical management must leave a clean surgical bed with no scarring during the healing process. Due to advances in technique and a better functional understanding of the vocal folds, vocal fold stripping is now obsolete. Careful microsurgical dissection should be restricted to the lesion with minimal disruption of surrounding tissue. It must follow the lines of forces of the vocal folds, respecting the lamina propria and the basement membrane zones and preserving as much epithelium as possible.

Delicate microdissection using cold instruments is still the most controlled and appropriate technique for removing most of the benign superficial vocal fold lesions from the vibratory margins of the folds and have been reported to be the safest and the most widely used. In addition it allows for tactile feedback and ability to apply counter-tension while operating.⁴

Since the conversation about the surgical potential for enhancement of vocal fold function between Hans Von Lenden and Godfrey Arnold in a bar of the Roosevelt Hotel in New York in 1963 and Hirano's discovery of the layered microarchitecture of the lamina propria the principles of phonosurgery have undergone significant advances. The current surgical procedures entail the use of the conventional technique, laser, radiofrequency, microdebrider and videoendoscopic assisted instrumentations.

Although the usefulness of laser for some laryngeal procedure is universally accepted, its efficacy for many common laryngeal application is still controversial. The added benefit of a relatively bloodless field is largely countered by the dissipation of heat into the delicate lamina propria with laser. It can also cause tissue loss resulting in limited biopsy results also the thermal injury may cause vocal fold scar during healing resulting in dysphonia. Additional drawbacks of the laser are the increased cost and inherent risks such as laser fire and risks to operating room personnel.

Videoendoscopic laryngeal surgery may be beneficial in patients with difficult laryngeal exposure. The limited dimension of the system does not encumber the operating field, while all long laryngeal surgery instruments may be used; moreover, it is possible to obtain an enlarged view of the vocal cords on the monitor. When the telescope is placed details of lesions are anatomically relevant on the monitor as fine vascularization, nodules and irregularities of mucosa are perfectly visible. This optical system also provides a sense of depth, and light transmission is excellent. Many surgeons use the microscope to obtain a stereoscopic view, but this method with telescopic guided video system has the advantage of allowing initial endoscopic exploration of the larynx with long optics (0° endoscopes). It also allows obtaining a static view that is as good as a surgical microscope when the telescope is positioned with the operating laryngoscope. The cost of the system is modest and the system is not bulky and the

operator can use all instruments for endoscopic laryngeal surgery, with the advantage of not having to go under microscope after preliminary study of the larynx with straight and angled optics. Hormann et al compared carbon dioxide laser and conventional phonosurgery in 44 patients.⁷

The results 3 months after surgery showed an improvement of vocal function when compared with the pre-operative findings. Benninger conducted a prospective randomized trial comparing cold knife microdissection and microspot carbon dioxide laser in 37 patients.⁸ He concluded that both tools were excellent in the management of vocal nodules, polyps, cysts and Reinke's oedema. Omori et al reported very satisfactory results using videoendoscopic laryngeal surgery and specially designed fine tipped forceps and scalpels.⁹ Tsunoda et al also designed detachable forceps to be used with flexible fibre-optic laryngeal surgery in cases where rigid laryngoscopy is contraindicated, reporting good post-operative results.¹⁰

In required cases patients underwent direct telelaryngoscopy and excision of the cordal lesion followed by postoperative voice correction therapy. Following this regime, all the cases were totally symptom free with no recurrence. However 1 case of vocal fold papilloma was partially free of symptoms and recurrence of lesion occurred because of noncompliance of patients. Most of the patient who underwent endoscopic laryngeal surgery have achieved more than 90% of voice outcome by about 1 month following surgery. The results were based on both perceptual voice analysis and postoperative rigid laryngoscopic evaluation.

Postoperative video assisted rigid laryngoscopic evaluation in this series revealed good mucosal healing with straight vocal fold edges, good mid membranous approximation and mucosal wave. As per study by Ragab et al of 25 patients 22 cases with GRBAS grade 3 to 0 and 3 cases with grade 3 to 1 and on VAS mean improvement from 8.56 to 1.24.¹¹ In our study of 50 patients 41 cases with GRBAS grade 3 to 0 and 9 cases with grade 3 to 1. On VAS mean improvement from 8.53 to 1.40. As per study conducted by Phaniendra et al 70% of patient showed improvement on GRBAS scale from grade 3 to 0 and rest from grade 3 to 1 post operatively.¹² As per study conducted by Zhang et al improvement in VAS was from 8.9 to 1.8 after 1 month follow up postoperatively.¹³

Vocal outcome

Comparing the pre and post operative mean value for each parameter at 1 month follow up we found that G of the GRB scale reduced from 2.3 to 0.36 and the roughness and breathiness scale reduced from 2.27 to 0.33 and 1.67 to 0.27 respectively which is similar to study conducted by Zhang et al where they found a reduction from 2.3 to 1.3 for the Global parameter and

reduction of 2.4 to 1.6 and 2.3 to 0.9 for roughness and breathiness parameter of GRBAS scale. As per the study by Ragab et al the improvement was from 2.33 to 0.5 for Global parameter and an improvement from 2.16 to 0.22 and 2.61 to 0.94 for parameters roughness and breathiness respectively showing similar improvements as our study. The improvement is found to be significant for all parameter of the GRB scale.

CONCLUSION

Cold knife endoscopic laryngeal surgery is possibly a better option for addressing BVFL. The system using telescope with a high-definition video system for performing endoscopic laryngeal surgery is economic, and allows optimal vision and improved surgeon comfort and ease. The system enables the surgeon to acquire both static images and video sequences and can store data. The best phonomicrosurgical outcome depends on accurate diagnosis with comprehensive voice evaluation, good selection of patient with counseling, adequate pre and post-operative care and application of best surgical technique. Endoscopic laryngeal surgery has proved its superiority over the conventional microlaryngeal techniques with its minimal tissue damage, minimal scarring in dysphonic patients.

Limitation

The main limitation of this study was the sample size was a small number, hence the inference was limited. Also this study utilized only cold steel techniques for the excision of vocal fold lesions lasers were not used hence there was no comparison between the two methods.

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Conflict of interest: None declared

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

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