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Effect of Medialisation Procedures in Patients with Phonatory Gap

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Abstract
Background: Glottic insufficiency is the inability of true vocal folds to approximate completely in midline during phonation [1]. Glottic insufficiency occurs mainly due to vocal fold motion impairment (eg palsy, paresis), soft tissue loss, vocal fold atrophy and scarring. [4] Glottic insufficiency is amenable to treatment and various therapy regimens have been reported with variable effectiveness for treatment of glottic insufficiency with main goal to make the deviated vocal fold closer to midline to facilitate glottal closure during phonation and swallowing [3]. However, the main stay of management remains surgical - medialization procedures including Type 1 Thyroplasty and Fat Injection Laryngoplasty [2]. This study gives opportunity to assess the effect of these medialisation procedures on voice related outcomes and improvement on glottal closure. **Methods:** A Prospective study was carried out on 12 subjects who underwent Fat Injection Laryngoplasty or type 1 Thyroplasty. Outcomes were assessed based on post operative improvement in symptoms assessed by VHI-10 score, glottal closure on laryngoscopy and Maximum Phonation Time (MPT) immediately after surgery and on follow up at 1st month and 6th month after procedure. **Results:** Total of 12 patients were studied whose MPT showed improvement from 5.33±0.88 secs preoperatively to 10.16 ± 1.02 secs immediately after surgery, 10.67± 0.98 secs 1 month after surgery and 10.08± 1.31 secs 6 months after surgery. VHI also showed significant improvement from 26.08 ± 1.39 preoperative value to 21.91 ± 1.24 immediately after surgery, 11.91 ± 2.10 after 1 month and 11.5 ± 2.81 after 6 months of procedure. **Conclusions**: Medialisation procedures (Fat injection Laryngoplasty and Type 1 Thyroplasty) are found to yield significant improvement in voice related outcomes and closure of phonatory gap from immediate post op period when followed up to 6 months post procedure.

Keywords: Glottic insufficiency, glottal closure, Fat injection Laryngoplasty, Type 1 Thyroplasty

1. Introduction

During phonation vocal folds approximate in midline completely. Glottic insufficiency is the inability of true vocal folds to approximate completely in midline during phonation [1]. Glottic insufficiency occurs mainly due to vocal fold motion impairment (eg palsy, paresis), soft tissue loss, vocal fold atrophy and scarring. [4] Vocal fold palsy is the commonest cause of glottic insufficiency and occurs mostly following injury to the laryngeal nerves and unilateral vocal fold paralysis is a frequent cause of dysphonia and dysphagia. Patients with glottic insufficiency mainly present with vocal fatigue, decreased voice projection, shortness of breath and in some cases with aspiration and cough. [1] Mainstay of treatment of glottic insufficiency remains surgical by medialisation procedures including Fat Injection Laryngoplasty and Type 1 Thyroplasty.

In recent years, injection laryngoplasty for managing glottic insufficiency has regained popularity. It corrects glottic incompetence by injection of filler material (eg. autologous fat, hyaluronic acid-based products, human collagen-based products, calcium hydroxyappetite) into the paraglottic space. Injection laryngoplasty has the advantages that it avoids an open surgical procedure, requires no waiting period. Lower procedural cost and morbidity as can be done in outpatient clinical setting with minimal anaesthetic requirements [5]. Moreover it can act as a temporary procedure for clinical situations in which immobile vocal fold has a good prognosis for full functional recovery while waiting for thyroplasty. [6] Advantages of

autologous fat injections include easy availability, no immune reactions, however resorption rates remain highly unpredictable and procedure requires GA. [7]

Type 1 Thyroplasty with or without arytenoid adduction has been an effective and reliable method for long term rehabilitation for glottic insufficiency. Type 1 thyroplasty is the most preferred treatment for unilateral vocal fold palsy and involves medialization of paralysed vocal fold towards the midline by an implant inserted into the paraglottic space via the thyroid cartilage window. [8] However disadvantages include neck scar, placement of a foreign body into the paraglottic space.

The choice for type of procedure depends upon etiology, severity and duration of glottic insufficiency and other factors like patient's preference, availability of material, anaesthetic issues and also surgeon's preference,training and facilities available. [9]

This study gives an opportunity to study clinical manifestations and management options for patients with dysphonia having phonatory gap and to study the outcomes of medialisation procedures in the study population.

2.Material and Methods

A total of 12 patients of glottic insufficiency were selected on the basis of diagnosis of vocal fold atrophy, paresis or palsy causing phonatory gap on videostroboscopic findings. Patients with functional disorders, neoplasms, infections or inflammatory disorders of larynx, patients with significant posterior 1/3rd glottic gap and previous laryngeal surgeries were excluded. A detailed history was taken, clinical examination and Rigid endoscopic examination was done to assess the size (mild to moderate), shape (spindle) and location (mid membranous) of phonatory gap. Objective voice analysis (MPT) and subjective voice analysis (VHI-10) was done.

Maximum phonation Time (MPT): It is the time duration in seconds for which an individual can maximally prolong the vowel |a| at a comfortable pitch in one single breath [10]. Patients MPT was recorded using a stop watch after demonstration and longest duration amongst 3 readings was taken.

Voice Handicap Index -10 / VHI-10 Questionairre: It is a tool for subjective voice analysis of patients with glottic insufficiency, a shortened version of the original 30 item score. For each question patient is required to rate each answer using a 5- point scale [11]. Total score indicates severity of the voice disorders for the patient (Maximum score -40, Minimum score -0) [12]

Routine blood investigation was done and detailed informed consent regarding the procedure and participation for study was taken. Type of medialisation procedure was decided on the basis of etiology, duration, patient preference and severity of glottic insufficiency. Either Fat injection laryngoplasty or type 1 Thyroplasty was done under required anesthesia

For Fat injection Laryngoplasty under GA, Autologous fat was harvested from the patient's right lower quadrant of abdomen through liposuction by a 50cc leurlock syringe and 15-20cc of subcutaneous fat with soft tissue was obtained. Harvested tissue was rinsed with normal saline to remove blood clots and fibrous bands discarded. Obatined fat globules were loaded into a 2 cc syringe and approximately 0.5 – 1ml of purified fat was injected lateral to vocal process in mid membranous part of vocal fold into thyroarytenoid muscle, lateral to arcuate line in a step ladder manner.

Type 1 Thyroplasty was performed under local anaesthesia and IV sedation. A presterilised silicon block was handcarved and inserted via the thyroid cartilage window designed and measured using vernier calliper into the paraglottic space after appropriate measurements. The approximate size of carved window was -10-16 mm wide x 3-5 mm tall. Drill (MARATHON DRILL) was kept standby in required cases for calcified cartilages. Inner perichondial layer elevation was done with microelevator on all sides without injuring it. Depth gauge was used to assess the depth of silicone block required, anteriorly and posteriorly, by assessing patients voice intraoperatively. Then the implant was carved and inserted into the window and checked for snugly fit by voice assessment and fibreoptic laryngoscopy if required. Patients voice and glottal closure was assessed by MPT, VHI -10 and rigid laryngoscopy on table and Day one, on follow up at 1 and 6 months after procedure.

Statistical Analysis: p-value <0.05 was considered as statistical significance. Statistical software STATA version 14.0 was used for data analysis.

3.Results

Out of total 12 selected patients in this study, age of the patients varied from 18 to 54 yrs with mean of 37.2 yrs and majority of the patients in the 21-30 yr age grp. Mean age for males was 31.88 yrs and 36.5 yrs for females in the study. Amongst the selected patients, 9 (74.97 %) were males and 3 (24.99 %) were females. All the 12 subjects (100%) included in the study had finding of phonatory gap on rigid laryngoscopy preoperatively and immediately after surgery complete glottal closure was seen in all 12 subjects (100%). After 1 month 9 subjects (75%) had complete closure and 3 subjects (25%) continued to have slit like opening on rigid laryngoscopic examination. At the end of 6 months 9 subjects (75%) had complete glottal closure, 3 subjects (25%) had slit like opening (p -value- < 0.001,highly significant). Assessment of voice using MPT and VHI-10 in the preop and post op (immediately , on 1st month and 6th month of follow up) showed significant improvement in the post operative Day one. Mean MPT showed significant improvement from 5.33 ± 0.88 sec to 10.16 ± 1.25 secs immediately after surgery, 10.67 ± 0.98 secs after 1st month follow up. At the end of 6th month mean MPT was 10.08 ± 1.31 secs (p value <0.001,highly significant).VHI showed mild improvement from 26.08 ± 21.91 to 21.27 ±1.24 immediately after surgery on post op day one. However, at the end of 1st month and 6th month follow up, the mean VHI showed significant improvement to 11.91 $\pm$ 2.10 and 11.5 ± 2.81 respectively (p value -<0.001, highly significant).

4.Discussion

This study in which the mean age group of subjects was 37.32 years with minimum of 18 years and maximum of 54 years was comparable to 3 other studies conducted by Tuan-Jen Fang et al [13] (mean age of 45.9 years, ranging from 15-78 yrs), Ehsan Khadivi et al [14] study with mean age of 43.3 yrs, ranging from 20 – 57 yrs and Enrique Salmeron Gonzalez et al [15] study with mean age 57.2 yrs, ranging from 18 -80 yrs. In this study, out of 12 patients, 9 (74.99%) patients were males and 3 (24.97%) patients were females which was comparable to 3 other studies conducted by Ming Shao Tsai [16] et al in which out of 22 patients 13 (59.1%) were males and 9 (40.9%) were females,Tuan – Jen fang et

al [13] study in which out of 33 subjects the female subjects were 24 (72.7%) and 9 (27.3%) were males and Ehsan khadivi et al [14] study in which out of 20 subjects females were 13 (65%) and males were 7 (35%)).In the this study, mean MPT was below normal before surgery (5.33 ±0.88) and got significantly improved after surgery upto 6 months (10.16 ±1.02 sec immediately after surgery ,10.67±0.98sec at 1st month, 10.08 ±1.31sec at 6th month follow up with p value <0.001) and was comparable to 2 other studies by Tuan –Jen Fang et al [13] study in which 33 patients showed mean MPT of 5.9 ± 4.8 seconds before surgery, 8.6 ± 4.7secs at 1st month, 9.8 ± 4.3 secs at 3rd month and 10.1 ± 5.2 secs at 6th month follow up with p-value <0.001) and Ehsan Khadivi et al [14] study with mean MPT of 2.7 ±1.3 seconds, 6.4 ± 2.4 secs at 1st month and 7.6 ± 1.8 secs at 6th month follow up with p-value < 0.05).In our study the VHI-10 also showed improvement from preop value of 26.08 ± 1.39 to 21.91 ± 1.24 immediately after surgery, 11.91 ± 2.10 after 1 month and 11.50 ± 2.81 after 6 months with p-value <0.001 and was comparable to 2 other studies by Enrique Salmeron Gonzalez [15] et al study with preop mean VHI-10 of 21.92 ± 6.95 to 16.33 ± 7.06 after 8 months with p-value <0.003 and Guen-Hyo kim [17] et al with preop mean VHI-10 of 30.00 ± 6.38 to 19.06 ± 9.53 after 6 months with p-value <0.001

5.Conclusion

Medialisation procedures (Fat injection laryngoplasty and Type 1 thyroplasty) are found to yield significant improvement in voice related outcomes and the closure of phonatory gap when followed upto 6 months. Therefore, these procedures prove to be safe and effective methods that can be carried out in patients with dysphonia having phonatory gap.

6.Declaration

Funding: None

Conflict of Interest: None declared

Ethical Approval: All procedures involving human participants were in accordance with the ethical standards of the institution.

Informed Consent: Informed consent was from all the participants included in this study.

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