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Clinical and Stroboscopic evaluation of vocal cord function before and after thyroid surgery.

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ABSTRACT

Introduction: Voice change due to injury to the Recurrent Laryngeal nerve and the external branch of the superior laryngeal nerve is an important complication of Thyroid Surgery

Objectives: Video Laryngeal Stroboscopy comes in handy for the detection of vocal cord palsies postoperatively that may be missed on routine examination, to know the extent of the pathology.

Methods: 100 patients with thyroid swelling who have been evaluated and planned for thyroidectomy in a tertiary care centre between June 2016 to June 2018 were taken as subjects for this prospective observational study. Clinical examination and Video Laryngeal Stroboscopy were done pre operatively and compared to the same on third post-operative day and 1month following surgery.

Results: Preoperative Video Laryngeal Stroboscopy was normal in all subjects. 26 out of 100 subjects had subjective postoperative voice change of various degrees. Out of 26 patients, 22 were diagnosed to have Recurrent Laryngeal Nerve palsy and 4 with Superior Laryngeal Nerve palsy .Most common symptoms post-surgery were Voice fatigue in 26% followed by decreased pitch range in 13% and hoarseness in 6% cases. Bowing of vocal cords was seen in 4 subjects (4%), Asymmetry of travelling mucosal wave (slight to severe) in 8 subjects (8%), incomplete glottis closure in 6 subjects (6%).

Conclusion: Video Laryngeal Stroboscopy is a useful tool in evaluation of patients with suspected laryngeal paralysis. Paralysis of Superior Laryngeal Nerve, Recurrent Laryngeal Nerve or both results in asymmetric laryngeal vibration that is easily identified by even inexperienced observers using Stroboscopy in an otherwise normal rigid telescopy of larynx.

Keywords: Recurrent laryngeal nerve palsy, Stroboscopy, Thyroidectomy

MAIN TEXT

INTRODUCTION

One of the common squeal we encounter after thyroidectomy is voice change due to various degrees of injury to the recurrent laryngeal nerve and the external branch of the superior laryngeal nerve. When performing thyroid surgeries, the effect on the voice is of great concern. Video Laryngeal stroboscopy is arguably the most important clinical tool for the evaluation of voice disorders but it is not routinely done as a part of pre-operative evaluation of Thyroid patients. Video Laryngeal Stroboscopy is essential for the detection of vocal cord palsies postoperatively as symptomatic assessment and radiographic evaluation are insufficient. As the incidence of invasive thyroid disease is increasing, preoperative stroboscopic evaluation of vocal cords is valuable tool to not only know the extent of the pathology but also to predict the outcome of the surgery.

AIMS AND OBJECTIVES:

To outline the importance of Video Laryngeal Stroboscopy in assessing the status of Vocal cords in thyroid disease before undertaking surgery. To outline the importance of Video Laryngeal Stroboscopy in early and prompt diagnosis of Recurrent Laryngeal Nerve palsy.

MATERIALS AND METHODS

All patients presenting to ENT outpatient department with a thyroid swelling and who were evaluated and planned for surgery between June 2016 to June 2018 were taken as subjects for this prospective observational study. Institutional Ethics Committee (IEC) clearance obtained before undertaking the study.

Parameters assessed during examination[2] were Fundamental frequency is measured by using the strobe unit and is used to set the frequency of the light flashes, periodicity,

amplitude (amplitude refers to the lateral excursion of the vocal folds during their displacement away from the midline during oscillation.), symmetry, glottic closure, mucosal wave, estimated speed of glottic wave.

Inclusion criteria were patients of all ages with thyroid disease and are treated by hemithyroidectomy, Completion/ total thyroidectomy. Exclusion criteria were pre-existing laryngeal or vocal cord pathology. Co-morbidities that may affect stroboscopy instrumentation usage like inadequate mouth opening, cervical spine problems

A Video Laryngeal Stroboscopy unit consists of a Stroboscopic light source, Microphone, Video camera, Endoscope and Video recorder. Recent research has suggested that the application of the Mallampati classification system is useful for predicting the adequacy of transoral rigid laryngoscopic exposure for stroboscopy[3].

For rigid strobolaryngoscopy (used in our study), topical anesthesia (10% xylocaine spray) to the posterior tongue as well as the oropharynx was applied. The patient leaned forward with the neck flexed and the head extended at the atlanto-occipital joint (Kirstein position). We ensured that the microphone is calibrated properly. With mouth open and tongue protruded, tongue was retracted anteriorly and rigid telescope was carefully inserted. Proper focus demonstrated clear visualization of the subepithelial vasculature of the vocal fold. To avoid fogging, the tip of the telescope was dipped in antifog solution (savlon or hot water). With the vocal folds in clear focus, we took the patient through a number of vocal tasks using the ?ee sound. This should be done at low, mid-range, and high frequency pitches as well as different volumes. Movement of arytenoid and vocal fold mobility, glottis closure pattern, mucosal wave and pliability were noted.

DATA acquisition: Detailed history and clinical examination were done as per the proforma designed for the study. History of previous neck explorations, symptoms suggestive of an impairment of VF mobility, the suspected pathology of the thyroid disease (benign or malignant) was verified.

Preoperative Rigid telescopy of larynx and Video Laryngeal Stroboscopy were performed and findings recorded. Postoperative rigid telescopy and Video Laryngeal Stroboscopy were performed on the postoperative day 03 and later at one month following the surgery in all subjects in sitting position with a rigid 70 degree scope Subjects were asked to phonate ?eee using various pitches and the images were recorded and various paramateres mentioned above were documented as follows.

Mobility: Normal-Bilateral Vocal folds mobile, Unilateral vocal fold palsy (UVFP), Bilateral vocal fold palsy (BVFP).

Stroboscopic Parameters used for assessment: 1.Symmetry- Normal, Mild, Moderate and Severe asymmetry 2. Amplitude- Normal, Mild, Moderate, Severe 3.Periodicity- Normal, aperiodic 4.Nonvibratory segments- None, Anterior one third, Middle one third, Posterior one third 5.Duration of closure – Predominantly closed, Predominantly open, Half open and Half closed 6.Closure pattern- Hour glass, Spindle, Posterior glottic chink, Anterior glottis chink, Complete closure, Complete non closure

Findings indicating External Branch of Superior Laryngeal Nerve Palsy: Bowing and Inferior displacement of vocal cord, Rotation of posterior glottis towards paralysed side[4].

Findings indicating Recurrent Laryngeal Nerve Palsy: Asymmetry of travelling wave motion(slight to severe), Incomplete Glottic closure(mild to severe), Extent of the wave excursion along the vocal fold mucosa, Lateral displacement of vocal fold on vibration, Estimated speed of glottis wave(Absent wave on paralysed side)[5].

Thyroid Surgery was performed according to standards based on the recommendations of the American society of surgeons.[6,7,8] Identification of the Recurrent Laryngeal Nerve was mandatory and was attempted in all patients. Intraoperative neuromonitoring was not performed.

Statistical Methods: Demographic data was charted using diagrammatic representation. Data was analysed SPSS, version 16.0.

RESULTS

Overall 26 out of 100 subjects had subjective postoperative voice change of various degrees. Most common symptoms complained were Easy Voice fatigue seen in 26% of the subjects. Decreased pitch range was seen in 13%, Hoarseness was noticed in 6 (6%), Preoperative Videostroboscopy was NORMAL in all subjects. Postoperative Videostroboscopy was done on Post operative day 3 and at 1 month following surgery. On Postoperative Video Laryngeal Stroboscopy Bowing of vocal cords- 4 cases (4%), Asymmetry of travelling mucosal wave (slight to severe) in 8 subjects (8%) Incomplete glottis closure in 6 subjects (6%).

PATIENTS WITH RECURRENT LARYNGEAL NERVE PARALYSIS:

Glottic closure: Mild to moderate incomplete-4 cases, severely incomplete 2 cases. Glottic wave : Extent excursion along vocal fold mucosa was Symmetric in none, Mild to moderate asymmetry in 4 cases, Marked asymmetry in 6 cases and was absent on paralysis side 4 cases.

Estimated speed of glottic wave was Symmetric in none. Absent velocity on paralysed side in 4 cases. Preoperative Video Laryngeal Stroboscopy and rigid telescopy were normal in all patients hence the effect of invasive thyroid malignancy (causing vocal cord paresis/palsy) on the vibratory pattern of the vocal cord could not be studied.

Mild to moderate asymmetry in Vocal fold lateral displacement on vibration in 6 cases

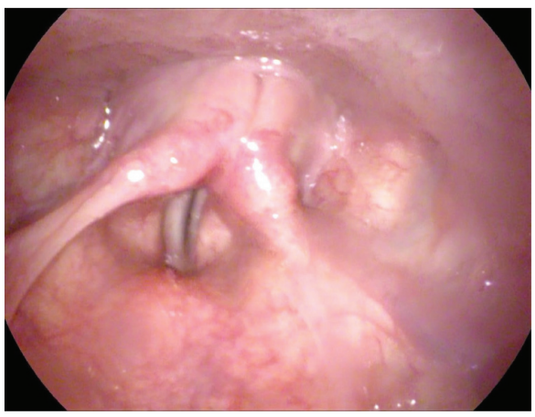
In total of 100 patients, 76 patients were females and 24 were males

Among the 100 patients, Histopathological examination revealed benign lesions in 82 cases (82%), the commonest being the nodular colloid goiter.76 subjects among these underwent hemithyroidectomy. 6 underwent total thyroidectomy. Malignancy was found in 18 of the cases (18 %), Papillary carcinoma was the commonest malignancy. 10 cases underwent total thyroidectomy. 8 cases underwent hemithyroidectomy followed by completion thyroidectomy, Intra operatively Recurrent Laryngeal Nerve was identified without doubt in 89 cases. 11 cases the entire course of Recurrent Laryngeal Nerve could not be traced 5 cases among these 11 have developed post-operative Recurrent Laryngeal Nerve palsy.

Out of 18 patients with malignancy 12 cases were papillary carcinoma thyroid, 4 cases were follicular variant of papillary carcinoma thyroid, and 2 cases was follicular carcinoma.

Pic 1

Normal looking picture of Rigid laryngoscopy picture of subject with voice change on post op day 3.



Pic 2 :

Stroboscopic picture of Early Left Vocal cord palsy of the same subject who was normal onRigid Laryngoscopy.

Pic 3 : Gottic closure pattern in various phases as seen on Video Laryngeal Stroboscopy

DISCUSSION:

The normal human eye can see only five images per second. However, stroboscopy allows the eye to see the high frequency vibration of the vocal folds by intermittent flash synchronized with the phonation frequency (Talbot's law). It is therefore an optical phenomenon that captures the fragments of complete movement[9]. Reported rates for Recurrent Laryngeal Nerve Palsy with identification of the nerve are 0.9%-4.7% for temporary, and 0- 1.7% for permanent palsy. Rates of paralysis do not increase with the type of operation, being similar to total and less than total thyroidectomy.[8.10, 11]

Recurrent Laryngeal Nerve Palsy can be complete or incomplete. A complete paralysis is that in which all the motor units of the nerve, as in the case of the surgical section, are affected. In incomplete paralysis, some of the motor units in the nerve are affected, as in mechanical pressure, straining of the nerve, or heat damage from thermocauterisation during thyroidectomy.

In complete paralysis the vocal fold is immobile and has no muscle tone. The glottis does not close completely. The movements of the vocal folds are asymmetrical. The mucosal wave is absent or reduced in the paralytic vocal fold.

In incomplete paralysis, the vocal fold is slightly mobile and has some muscular tone. Glottic closure is better. The mucosal wave is reduced in the affected fold and the bilateral waves are asymmetrical. Abnormalities in the vibratory pattern become more apparent as the number of affected neurons increases.

In Superior Laryngeal Nerve Palsy, Anterior glottis moves to the affected side because of the tone of the unaffected cricothyroid muscle. The mucosal wave is asymmetrical as the wave is late in the affected fold.[12] in our series, Preoperative Video Laryngeal Stroboscopy and rigid telescopies were normal in all patients. There were no false positive abnormalities. 4 subjects with incomplete Recurrent Laryngeal Nerve Palsy and 3 with Superior Laryngeal Nerve palsy had no symptoms. 4 cases of Superior Laryngeal Nerve palsy and 6 with incomplete Recurrent Laryngeal Nerve palsy were not diagnosed by rigid telescopy of larynx. These were subsequently diagnosed on Video Laryngeal Stroboscopy post operatively. In the evaluation on the third postoperative day, rigid telescopy showed abnormalities of movement in the vocal cords resembling vocal cord palsy in 16 out of 26 patients .Video Laryngeal Stroboscopy on the second postoperative day diagnosed the 4 Superior Laryngeal Nerve palsy (which looked normal on rigid telescopy of larynx), 8 incomplete inferior laryngeal nerve palsies , and three complete inferior laryngeal nerve palsy (patients with the injured recurrent nerve),in those 26 patients with vocal disturbances. Thus incomplete Recurrent Laryngeal Nerve palsies and two laryngeal injuries were found only by Video Laryngeal Stroboscopy and they were all asymptomtic. The present study highlights the efficiency of Video Laryngeal Stroboscopy in the early diagnosis of nerve palsies. At the end of first month, only patients with a cut nerve still had a weak voice. Video Laryngeal Stroboscopy and laryngoscopy showed that the right vocal cord was adducted medially and the left cord also hyper adducted to compensate for the right. The other 16 patients with symptoms had complete relief of their vocal disturbances. The Video Laryngeal Stroboscopy and laryngoscopy of those patients at one month were within normal limits. Incomplete paralysis of the Recurrent Laryngeal Nerve with a small number of affected neurons causes little abnormality in the movement of the vocal fold, which can be asymptomatic, and can easily be missed rigid laryngoscopy. Asymmetrical mucosal waves seen on Video Laryngeal Stroboscopy provide the diagnosis. Nevertheless, 6 of our patients who had incomplete paralysis on Video Laryngeal Stroboscopy had insignificant findings on rigid telescopy. The displacement of the anterior glottis occurs in severe cases of Superior Laryngeal Nerve paralysis. Asymmetry in the mucosal wave is the only finding in mild cases. Rigid telescopy of larynx was normal in 4 patients who had incomplete Superior Laryngeal Nerve paralysis on Video Laryngeal Stroboscopy. However, it is not possible to differentiate between complete and incomplete paralysis, so as to assess the prognosis. Recurrent Laryngeal Nerve Palsy was temporary in those with incomplete palsy on Video Laryngeal Stroboscopy, but was permanent in the one with complete palsy on Video Laryngeal Stroboscopy. Video Laryngeal Stroboscopy was successful not only in the diagnosis of vocal disturbance after thyroidectomy, but also in assessing the outcome of the injury to the Recurrent Laryngeal Nerve Palsy.

Incomplete paralysis of the Recurrent Laryngeal Nerve on Video Laryngeal Stroboscopy means neuropraxia that is, a temporary and reversible block of nerve conduction. Complete paralysis of the Recurrent Laryngeal Nerve means neurotmesis or axonotmesis, in which some regeneration may occur, but complete recovery cannot be expected. Rigid telescopy of larynx and Video Laryngeal Stroboscopy are useful in routine postoperative use for diagnosis of nerve palsies and, cases of neuropraxic injury may be misdiagnosed or undiagnosed with rigid telescopy of larynx .Video Laryngeal Stroboscopy has certain obvious advantages when compared with a rigid telescopic examination of larynx, both in differential diagnosis of the vocal disturbances and in the prediction of the outcome of the paralysis. Hence routine usage of Video Laryngeal Stroboscopy, especially postoperative should be done in thyroidectomies and in cases with abnormalities of the voice, or damage seen on indirect laryngoscopy, rigid telescopy or both.

CONCLUSION

Laryngeal stroboscopy is a useful tool in evaluation of patients with suspected laryngeal paralysis. Paralysis of Superior Laryngeal Nerve, Recurrent Laryngeal Nerve or both results in asymmetric vocal cord vibration that is easily identified by even inexperienced observers. The mucosal wave has a greater velocity and further travels along the mucosa on the normal vocal fold. The probable cause for these vibratory findings is the reduced stiffness in the paralyzed cord, which reduces the velocity and extent of the travelling mucosal wave. Stroboscopy can reliably identify the abnormal vibratory

pattern in an otherwise normal indirect laryngoscopy and rigid telescopy of larynx. Our experience suggests stroboscopy cannot reliably distinguish Recurrent Laryngeal Nerve paralysis from vagal paralysis. Studies are being planned in canine model to better quantify the travelling wave findings in laryngeal paralysis.

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