

Original article:

Study of Delayed Recurrent Laryngeal Nerve palsy following total thyroidectomy

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ABSTRACT

Introduction: The exact incidence of recurrent laryngeal nerve injury is unknown. Different studies have reported varying prevalence (0-14%).^[2-4] This difference in complication rates may reflect variation in surgical experience or number of surgeries performed at a particular center. Routine visual identification of the RLN has been shown to result in a lower incidence of RLN injury in multiple studies.

Methodology: This prospective, observational study was carried out in the Department of ENT, Armed Forces Medical College, Pune, Maharashtra, a tertiary care centre. All patients were admitted and thorough clinical, biochemical and histopathological evaluations were done. Indirect laryngoscopy was done in each patient to assess the status of vocal cords. Patients were prepared for operation and all necessary routine investigations for thyroid surgery were carried out.

Results & Conclusion: RLN injury is an annoying complication of thyroid surgery. This can be avoided, if surgery is performed by experienced surgeons and more care should be taken while doing surgery on huge sized goiter and during extensive surgery like total thyroidectomy. Majority of nerve lesions are transient which shows recovery within six months of surgery. Definitive procedures for corrective treatment of RLN injury should not be considered for at least six months after surgery.

INTRODUCTION

Theodor Kocher was the first surgeon who performed total thyroidectomy in 1909 with minimal risk to recurrent laryngeal nerve and parathyroid glands. His accomplishment led to a reduction in surgical mortality from 50% to less than 4.5%.^[1] Additional improvements in techniques have reduced the mortality rate near to zero. Morbidity, however, always remains a concern. Complications of any surgical procedure are a sensitive measure of the quality. Reported complications following thyroid surgery are rare but their consequences can often be life threatening as compared to the some other surgeries being performed routinely. Complication rate after thyroid surgery varies widely from surgeon to surgeon and from center to center, as reported in the literature. The location of the thyroid gland in relation to the airway and the gland's abundant vascularity are primary reasons to be alert to early changes seen in the post operative thyroidectomy patient. An understanding of both the anatomy and physiology of the thyroid gland, as well as the surgical approach itself, can help to detect potential complications postoperatively. The patient can then receive early intervention to minimize the chance of lifethreatening consequences. Vascular insult,

viruses, bacterial infections, neurotoxic drugs, tumors and trauma have all been implicated in nerve injury. Recurrent laryngeal nerve is invariably at risk in surgery on the neck, thorax and skull base and damage to the nerve may be the cause of litigation.^[2] Surgery on thyroid gland is one of the causes of recurrent laryngeal nerve paralysis. Injury to recurrent laryngeal nerve anywhere along its course usually results in paralysis of the vocal cord.

Surgically induced recurrent laryngeal nerve paralyses are frequently not recognized at the time of thyroid surgery.

The exact incidence of recurrent laryngeal nerve injury is unknown. Different studies have reported varying prevalence (0-14%).^[2-4] This difference in complication rates may reflect variation in surgical experience or number of surgeries performed at a particular center. Routine visual identification of the RLN has been shown to result in a lower incidence of RLN injury in multiple studies.^[1-3] But this operative standard still results in a 4% to 8% incidence of initial postoperative RLN paralysis; with continued follow up, the RLN frequently recovers function, resulting in a permanent paralysis rate of 1% to 2%.^[4-7] The most common laryngoscopic findings in unilateral vocal fold paralysis beyond vocal fold motion impairment include bowing, incomplete glottal closure, and phase asymmetry on videostroboscopy.^[35] The position of the vocal fold (eg, paramedian vs lateral) does not necessarily clarify the location of the lesion along the neurologic pathway from brain to motion of vocal fold.^[36]

MATERIALS AND METHODS:

This prospective, observational study was carried out in the Department of ENT, Armed Forces Medical College, Pune, Maharashtra, a tertiary care centre. All patients were admitted and thorough clinical, biochemical and histopathological evaluations were done. Indirect laryngoscopy was done in each patient to assess the status of vocal cords. Patients were prepared for operation and all necessary routine investigations for thyroid surgery were carried out. All surgeries were done by consultant or senior fellow surgeon having same competency level of our team. Vocal cords mobility was checked by the operating surgeon at the time of extubation. Postoperatively, indirect laryngoscopy was done. All preoperative, operative and post-operative findings were recorded in detail. The patients who developed vocal cord paralysis were planned to be followed up on fortnightly basis in the first three months and then at monthly intervals for at least six months. Clinical evaluation of these patients was done regarding any improvement in voice quality and vocal cord function.

We involved 3 cases of delayed onset recurrent laryngeal nerve palsy following Total thyroidectomy and its transient recovery.

RESULTS:

In our first case A 45 year old female patient who presented to us with a gradually increasing swelling in the midline of neck for one year. The swelling was small to start and gradually increased to its current size. There were no clinical or biochemical signs of hypo or hyperthyroidism. On examination, there was a thyroid swelling measuring 4x4 cms in diameter, not moving with tongue protrusion. There were no palpable lymph nodes in the neck.

An ultrasound examination was carried out, which revealed Right lobe measuring 4x1.6x1.5cms in its superoinferior, transverse & antero-posterior dimensions respectively. Left lobe measuring 4.4x1.5x1.8cms in its superoinferior, transverse & antero-posterior dimensions respectively & show few hyperechoic nodules, largest being 1.3x1cms. The isthmus show mildly hyperechoic nodule measuring 2.5x1.2cms. The patient then underwent a fine needle aspiration cytology which was reported as features suggestive of follicular neoplasm.

An indirect laryngoscopy was performed and there was no abnormality reported. After counselling the patient about the significant finding of follicular neoplasm, we planned for a total thyroidectomy. Informed consent was obtained from the patient after explaining the risk of recurrent laryngeal nerve injury.

Intra operatively, both the lobes were meticulously dissected with release of adhesions posteriorly. During surgery, both the recurrent laryngeal nerves could be identified. We then proceeded to a completion total thyroidectomy by dissecting the remaining thyroid gland. Post operative serum calcium and albumin was done for the patient which was within normal limits.

During extubation, normal position of both vocal cords was confirmed with laryngoscopy. Post operatively the patient had normal voice for the first three days. On fourth post-operative day, patient complained of hoarse voice. There were no significant respiratory complaints. An indirect laryngoscopy confirmed Rightl vocal cord palsy with loss of movement. Patient was referred for voice therapy. This included abdominal breathing and humming/resonant voice to encourage closure of glottis. After five months of voice therapy patient reported improvement in voice quality and an indirect laryngoscopy has confirmed normal movements in both vocal cords. The final histopathology of the specimen was that of a colloid goiter with features suggestive of follicular adenoma.

In our second cases , A 33 year old female patient who presented to our OPD with a gradually increasing swelling in the midline of neck for two years. The patient had no pressure symptoms . There were no clinical or biochemical signs of hypo or hyperthyroidism. On examination, there was a thyroid swelling measuring 5x6 cms in diameter, not moving with tongue protrusion. There were no palpable lymph nodes in the neck.

An ultrasound examination was carried out, which revealed Right lobe measuring 5x1.6x1.9cms in its superoinferior,transverse & antero-posterior dimensions respectively. Left lobe measuring 3.9x1.5x1.6cms in its superoinferior,transverse & antero-posterior dimensions respectively.The isthmus showed a nodule measuring 2.5x1.2cms.The patient then underwent a fine needle aspiration cytology which was reported as features suggestive of Hurthle cell neoplasm.

An indirect laryngoscopy was performed which was within normal limits. After counselling the patient about the significant finding of Hurthle cell neoplasm, we worked up the patient for a total thyroidectomy. Informed consent was obtained from the patient after explaining the risk of recurrent laryngeal nerve injury.

Intra operatively, both the lobes were meticulously dissected with release of adhesions posteriorly. During surgery,the left recurrent laryngeal nerve could not be identified. We then proceeded to a completion total thyroidectomy by dissecting the remaining thyroid gland. Post operative serum calcium and albumin was done for the patient which was within normal limits. During extubation, normal position of both vocal cords was confirmed with laryngoscopy. Post operatively the patient had normal voice for the first two days. On third post-operative day, patient complained of hoarse voice. There was no respiratory complaint. An indirect laryngoscopy and a Hopkin rod examination confirmed Left vocal cord palsy with loss of movement. Patient was referred for voice therapy. This included abdominal breathing and humming/resonant voice to encourage closure of glottis. After four months of voice therapy patient reported improvement in voice quality and an Hopkins rod examination has confirmed normal movements in both vocal cords. The final histopathology of the specimen was that of a Hurthle cell adenoma

In our third case , A 63 year old female patient who presented to us with a gradually increasing swelling in the midline of neck for three years. The swelling was small to start and gradually increased to its current size. There were no clinical or biochemical signs suggestive of hypo or hyperthyroidism. On examination, there was a thyroid swelling measuring 4x3 cms in diameter, not moving with tongue protrusion. There were no palpable lymph nodes in the neck.

An ultrasound examination was carried out, which revealed Right lobe measuring 3x1.6x0.5cms in its superoinferior,transverse & antero-posterior dimensions respectively. Left lobe measuring 4.8x1.5x1.9cms in its superoinferior,transverse & antero-posterior dimensions respectively & show few hypoechoic nodules,largest being 1.1x1.1cms. Both the lobes showed increased vascularity.There were no lymph nodes.The patient then underwent a fine needle aspiration cytology which was reported as features suggestive of Papillary Carcinoma.

An indirect laryngoscopy was performed and there was no abnormality seen. After counselling the patient about the significant finding of papillary carcinoma, we planned for a total thyroidectomy. Informed consent was obtained from the patient after explaining the risk of recurrent laryngeal nerve injury and other complications.

Intra operatively, both the lobes were meticulously dissected with release of adhesions posteriorly. During surgery, both the recurrent laryngeal nerves could be identified. We then did a completion total thyroidectomy by dissecting the thyroid gland.The parathyroids were saved. Post operative serum calcium and albumin was done for the patient which was within normal limits.

During extubation, normal position of both vocal cords was confirmed with laryngoscopy by the anaesthetist. Post operatively the patient had normal voice for the first five days. On sixth post-operative day, patient complained of hoarse voice. There were no significant respiratory complaints. An Hopkins rod examination confirmed Right vocal cord palsy with loss of movement. Patient was referred for voice therapy. This included abdominal breathing and humming/resonant voice to encourage closure of glottis. After four months of voice therapy patient reported improvement in voice quality and an indirect laryngoscopy has confirmed normal movements in both vocal cords. The final histopathology of the specimen was that of a papillary carcinoma thyroid.The patient was followed up with a thyroid scan after one month followed up with radioiodine ablation.She has been following up in the Opd.

Case number	Age	Sex	Diagnosis	Surgery	Day of onset of hoarseness	Months of voice therapy
1	45yrs	Female	Follicular Neoplasm	Total Thyroidectomy	4	5
2	33yrs	Female	Hurthle cell Neoplasm	Total Thyroidectomy	3	4
3	63yrs	Female	Papillary Ca Thyroid	Total Thyroidectomy	6	4

DISCUSSION:

Surgical management of the thyroid disease has changed significantly over the course of the twentieth century. Advances in the investigations to diagnose thyroid disease have provided for adequate treatment and control of functional problems. RLN innervates all the intrinsic muscles of the larynx with exception of the Cricothyroid muscle, which is supplied by the superior laryngeal nerve.^[2] Mechanism of injury to the nerve includes complete or partial transection, traction, contusion, crushing injury, thermal damage, misplaced ligature or compromised blood supply. Any thing that increases local scar formation e.g. thyroiditis, previous surgery and radiation, increases the chances of RLN injury.^[2,5]

The consequence of RLN injury is the true vocal fold paresis or paralysis with varying degrees of symptoms and signs depending upon the severity and side of involvement. Unilateral RLN injury causes the ipsilateral vocal cord to remain in the median or paramedian position. The voice may be hoarse and breathy. The patient's cough is weak, and aspiration may occur. Presentation is often subacute. Definite voice changes may not manifest for days or weeks. The paralyzed vocal fold undergoes atrophy, causing voice to worsen. Dysphagia and aspiration are other potential sequelae of unilateral vocal fold paralysis.^[6]

Bilateral RLN paralysis may manifest immediately after extubation and patient exhibit signs of airway obstruction in the immediate postoperative period. Bilateral RLN injury is a severe, life threatening complication that results in airway obstruction and requires immediate attention. In this condition, both vocal cords remain in a median or paramedian position. As a result, the patient exhibits inspiratory stridor, dyspnoea, tachypnoea, and nasal flaring, although the voice is near normal.^[6,7]

RLN injury is an annoying but avoidable complication which results from severing, clamping or stretching of the nerve during surgery and may result in severe untoward sequelae for the patient.^[2]

The relationship of RLN to the inferior thyroid artery is highly variable and surgeon must have a thorough knowledge of all types of relationships during surgery.^[8] Basic principle of surgery to avoid damage to any vital structure dictates that the structure must be clearly identified. RLN is no exception, and routine exposure of RLN through out its course has been shown to reduce the rate of nerve injury.^[9] By adopting this principle, nerve injury rate of zero has been reported in the literature even after total thyroidectomy for thyroid cancer.^[9,10] Conversely, when nerve is not clearly identified, the reported injury rate is three to four times higher.^[2] The use of electrophysiological monitoring of RLN during thyroid surgery has been mentioned in the literature. Electromyography (EMG) has not been recommended during routine thyroid surgery because of low prevalence of nerve injury in such surgery.^[11] It may be beneficial during revision thyroid surgery or previously irradiated neck or with very large masses when the nerve is at a greater risk.^[1,11] Some surgeons are of the opinion that it is too dangerous practice to dissect the nerve.^[8] It is reported that prevalence of RLN injury increases with the size of the diseased gland and extent of thyroid resection.^[3,10,12] Some surgeons are of the opinion that it is not possible to identify the recurrent laryngeal nerve in every case. In these circumstances, technique of staying close to the thyroid capsule and division of terminal branches at capsular level is recommended.^[9] Careful identification and meticulous thyroid dissection is essential to prevent RLN injury. The potential for recovery is generally proportional to the degree of injury, although clinical factors such as unrecognized severity of injury and delay in the diagnosis have

precluded establishing an exact relation. This principle underlies the policy of watchful waiting in certain surgical etiologies, where nerve is known or even suspected to be intact.^[2]

Any corrective procedure is not recommended for unilateral vocal cord paralysis until at least six months because a reversible injury may improve by that time.^[12,18] Different treatment options are recommended; medialization of the vocal cord,^[19] neuroorrhaphy of RLN^[12] and reinnervation of vocal cord^[20] Medialization by injection laryngoplasty (Gel foam injection, Sialastic or Gore -Tex implant) or by laryngeal frame work surgery (Type-I thyroplasty) is commonly performed.^[19] Neuroorrhaphy of RLN with good results has been reported at some specialized centers.^[12] Reinnervation is another recommended procedure for permanent RLN injury. Phrenic nerve, Ansa cervicalis, Hypoglossal nerve or preganglionic sympathetic neurons have been used with limited success.^[21,22] The principal goals for surgery in case of bilateral vocal cord paralysis are to improve air way patency. Cordotomy and arytenoidectomy are the most common procedures. However, the patient must be counseled about worsening of voice quality postoperatively. Neuromuscular pedicle transfer has been reported to improve air way in case of bilateral vocal fold paralysis but reports are limited and results are not widely accepted.^[19,21]

The risk of injury to recurrent laryngeal nerve is increased with thyroidectomy for cancer, sub sternal goiter, chronic thyroiditis, Graves' disease, and re-operative neck surgeries.^[25] These disease processes make the RLN identification more difficult. Injury to the RLN can result from sharp trauma (transection), clamping, ligation, compression, traction, thermal injury, or ischemia.^[29] The anterior motor branch of a recurrent laryngeal nerve bifurcating near the ligament of Berry is particularly at risk of traction injury during surgery.^[30] Laryngoscopy is an essential part of the evaluation of UVFP. Our case is unique in that there was delayed presentation of recurrent laryngeal nerve palsy on the fourth post-operative day, which has recovered completely in three months' time. We believe vascular spasm as a possible cause for this delayed presentation of vocal cord palsy. Voice therapy in UVFP is typically directed at abdominal breathing and humming/ resonant voice to improve closure of the glottis, encourage abdominal breath support, and improve vocal fold function while avoiding the supraglottic hyper function.^[31] Significant numbers of patients with UVFP who opted for voice therapy reported vocal improvement subjectively or as measured by glottal closure, acoustic measurements, pitch range, and/or patient-reported voice handicap.^[22, 23] Interpretation of the impact of voice therapy in UVFP may be obscured by returning neurologic function^[34] and it is unknown whether there is a relationship between voice therapy and neurologic recovery.^[31]

CONCLUSION

RLN injury is an annoying complication of thyroid surgery. This can be avoided, if surgery is performed by experienced surgeons and more care should be taken while doing surgery on huge sized goiter and during extensive surgery like total thyroidectomy. Majority of nerve lesions are transient which shows recovery within six months of surgery. Definitive procedures for corrective treatment of RLN injury should not be considered for at least six months after surgery.

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