Management of Surgical Complications of Thyroidectomy Related to the Superior and Inferior Laryngeal Nerves

Review Article

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Abstract

Thyroidectomy is a frequently performed operation nowadays and is generally considered to be a safe procedure. Though infrequent, the occurrence of complications may become life threatening or result in serious functional impairment. Due to the close anatomical relationship between the thyroid gland and superior and inferior laryngeal nerves, injury to these nerves could cause sensory-motor impairment of the laryngeal function and represent a major and feared complication of thyroidectomy.

Damage to the external branch of the superior laryngeal nerve (SLN) may supervene during superior thyroid vessels ligation. Incidence varies from 0% to 20% with most studies reporting 5% - 10% temporal and 0% - 10% permanent injury. Because symptoms of nerve damage are subtle and given that electromyography (EMG) of the cricothyroid muscle is not routinely performed postoperatively, the real incidence of nerve damage is likely to be much higher. The main treatment for SLN damage is speech therapy. In selected cases, surgical management could be attempted.

Damage to the recurrent laryngeal nerves (RLN) is possible, due to their close relation to both the thyroid lobe and the inferior thyroid artery. The reported incidence of this complication varies from 1% to 5% for temporary injuries and 0.1% to 1.8% for permanent injuries. These figures are reliable if pre- and post-operative laryngeal function assessment is carried out in every case. Unilateral injury produces light or severe dysphonia and aspiration, whereas the main symptom of bilateral damage is inspiratory dyspnoea.

In the management of RLN paralysis, the choice of treatment is guided by the importance and type of functional deficit and the prognosis for recovery. In unilateral RLN paralysis, the main target of therapy is the improvement of voice and swallowing; this is accomplished initially by speech therapy and by injection laryngoplasty, medialization thyroplasty or arytenoid abduction surgery in cases of severe or prolonged functional impairment.

Bilateral RLN injury may be a real emergency because of acute respiratory distress caused by adduction of the vocal cords. The first step to take may be the establishment of the airway by re-intubation, tracheotomy or unilateral vocal cord abduction and fixation by suture. For cases in which paralysis of RLN is presumed permanent (9 – 12 months post-operatively), there are various options:

- Maintenance of tracheostomy and use of speaking tracheostomy tube.
- Procedures aiming at reinnervation of abductor muscles.
- Procedures for permanent glottic enlargement. The latter can be accomplished by external arytenoidectomy and vocal cord laterization, medial thyrotomy and chordectomy, as well as by endoscopic laser-assisted procedures in step-wise mode (posterior transverse chordotomy, medial or total arytenoidectomy). The main advantage to laser-assisted procedures is that they are minimally invasive procedures and tracheotomy may not be essential. Despite the favourable results of laryngeal nerves paralysis surgical treatment, prevention of nerve injuries cannot be overemphasized. To accomplish this demands a sound knowledge of anatomy and adherence to the meticulous surgical technique.

Key words:
Thyroid gland surgery, Superior & inferior laryngeal nerve damage, Management of laryngeal nerve injuries

Introduction

Thyroidectomy is an operation that is routinely performed nowadays and is generally considered to be safe in expert hands that show careful adherence.
to the meticulous surgical technique, introduced by Theodore Kocher at the beginning of the 20th century. Since that time, other surgeons have contributed many additional refinements to the technique that have resulted in further reductions in the complication rate. These days, complications of thyroidectomy are infrequent. However, those that occur may become life-threatening or cause serious functional impairment. The risk of complications varies depending on the extent of the operation, surgeon’s experience, thyroid pathology and, in particular, reoperative surgery.

Because of the close anatomical relationship between the thyroid gland and laryngeal nerves (Superior (SLN) and Inferior or Recurrent (RLN)), sensory-motor impairment of the laryngeal function is a well-known possible complication of thyroid surgery. Injury to these nerves, especially to the recurrent laryngeal nerves, represents a major and feared complication of thyroidectomy.

The present review focuses on the description of thyroidectomy-related laryngeal nerve damage and methods of management of such complications.

**Damage to the superior laryngeal nerve**

The SLN arises from the vagus nerve immediately after its exit from the jugular foramen (nodose ganglion). During its descent in the neck, it finds itself in close proximity to the carotid sheath. As the nerve progresses on the middle pharyngeal constrictor, it divides into two branches, the larger internal and the external, approximately at the level of the greater cornu of the hyoid bone. The internal branch enters the larynx through the thyrohyoid membrane and provides sensory innervation to the hyperglottic portion of the larynx as well as to the mucous membrane of the piriform recess. The external branch of the SLN is in close proximity to the superior thyroid artery as these two structures descend to the upper pole of the thyroid gland and the cricothyroid muscle. The nerve provides motor innervation to the inferior pharyngeal constrictor as well as to the cricothyroid muscle. The external branch accompanies the superior thyroid artery and lies medial to the artery; their paths usually diverge above the level of the upper border of the thyroid lobe where the nerve terminates at the cricthyroid muscle. The action of the cricothyroid muscle induces lengthening and tensing of the vocal cords. Unilateral injury to the nerve results in loss of innervation to the cricothyroid muscle, loss of high tones and pitch, and easy vocal fatigue. However, a normal speaking voice is often present.

The nerve is most likely to be damaged at the time of ligation and division of the superior thyroid vessels. To avoid this complication, the arterial branches should be individually ligated close to the upper pole of the thyroid gland.

The incidence of damage to the lateral branch of the superior laryngeal nerve during thyroidectomy varies from 0% to 20%, with most studies reporting an incidence of 5% - 10% and permanent paralysis reported from 0% - 10% [1]. Because the findings of nerve damage are subtle and given that electromyography (EMG) of the cricothyroid muscle is not routinely performed postoperatively, the true prevalence of nerve damage is likely to be much higher.

Despite the fact that the damage is adequately overcome in most patients, it can be devastating in individuals that use their voices professionally such as singers or teachers, because of the resulting handicap that significantly affects their vocal quality, with serious consequences to their profession.

In most cases, the diagnosis of nerve damage is not possible by usual laryngoscopy; videostroboscopy of the larynx may help the diagnosis. If nerve damage is suspected, diagnosis is confirmed by cricothyroid muscle electromyography (EMG), as mentioned above.

The main treatment of the SLN paralysis consists of speech therapy. Selective cricothyroid muscle reinnervation with a muscle-nerve-muscle neurotization technique using an autologous nerve graft between the innervated cricothyroid muscle and the non-functional contralateral cricothyroid muscle has been reported to result in EMG evidence of the reinnervation of the cricothyroid muscle [2]. However, this method does not appear to have wide acceptance. The limited voice registration and lack of voice power can also be improved by a surgical cricothyroid approximation procedure. It can consist of a cricothyroid sublaxation, like that proposed by Zeitels [3], or a cricothyroid approximation [4].

**Damage to the inferior laryngeal nerve**

The inferior or recurrent laryngeal nerve (RLN) is a mixed nerve which provides sensory and motor innervation to the trachea, oesophagus, pharynx and larynx. The RLN arises from the vagus nerve in the upper chest and loops under the aortic arch in the left, or subclavian artery in the right, and then ascends back into the neck, travelling along the tracheoesophageal groove. This difference in the level of looping between the left and right side results in a different course of the inferior laryngeal nerve after its branching from the vagus nerve on each side. The consequence of this different course is that the right nerve is found more lateral and superficial in