ABSTRACT

Aims: Vocal cord paralysis due to iatrogenic injury of the recurrent laryngeal nerve (RLN) is one of the main problems in thyroid surgery. Although many procedures have been introduced to prevent the nerve injury, still the incidence of recurrent laryngeal nerve palsy (RLNP) varies between 1.5-14%. The aim of the present study is to assess the risk factors of recurrent laryngeal nerve injury (RLNI) during thyroid surgery.

Patients and Methods: Patients who had thyroid surgery between October 2010-october 2011 and were admitted to the department of surgery in Mosul Al-Jamhoori Teaching Hospital were enrolled for this case series review. Factors predisposing to recurrent laryngeal nerve injury were evaluated such as pathology of the lesions, the type of operations and identification of recurrent laryngeal nerve intra-operatively. Preoperative and postoperative indirect laryngoscopic examinations were performed for all patients.

Results: Four cases of temporary recurrent laryngeal nerve injury were noticed out of the (100) patients, which developed on the 2nd and 3rd postoperative day with symptoms of mild hoarseness of voice. All the cases underwent extensive dissection around the nerve during operation. One was being operated for carcinoma of thyroid with total thyroidectomy, and the other three were operated for Graves disease, where a near total thyroidectomy was done. Integrity of the (RLN) was confirmed during surgery. All the patients were kept under observation with regular indirect laryngoscopic examination of the vocal cords. They started improving their symptoms at the end of the 6th weeks and were asymptomatic at the end of 4-6 months. Three cases of non recurrent laryngeal nerve (NRLN) were found in this study. All were on the right side of the gland. Due to systematic dissection all of the nerves could be saved during surgery. Two case of permanent (RLNI) were found in this study.

Conclusions: The present study showed that thyroid carcinoma, reoperation for recurrent goiter, non-identification of (RLN) and total thyroidectomy were associated with a significantly increased risk of operative recurrent laryngeal nerve injury.

Keywords: NRLN, RLN, thyrodectomy, laryngoscopic examinations

INTRODUCTION

Recurrent laryngeal nerve is a branch of vagus which hooks around ligamentum arteriosum with arch of aorta on the left and right subclavian artery on the right side, it runs in the trache-oesophageal groove near the posteromedial surface close to thyroid gland, the nerve lies in between branches of inferior thyroid artery, so inferior thyroid artery should be ligated away from the gland. The thyroid gland is innervated by the sympathetic system from the superior, middle, and inferior ganglia of the cervical chain, but in thyroid surgery the recurrent and superior laryngeal nerves of the parasympathetic (vagus) system (which play no role in the innervations of the gland) are of utmost importance, so they are considered here. The surgeon must be prepared for any configuration of artery and nerve. According to Procacciatte and colleagues, after the recurrent laryngeal nerve is made taut by upward and medial traction...
of the thyroid, it may be palpated caudally to the inferior pole of the gland. This maneuver aided safe dissection in the region of the inferior thyroid artery.\(^\text{(2,6-10)}\) The recurrent laryngeal nerve is one of the major complications of thyroid surgery, injury to this nerve may be unilateral or bilateral, temporary or permanent and partial or complete. The most common cause of recurrent laryngeal nerve injury is thyroid surgery.\(^\text{(3,4)}\) About 7% of thyroid surgeries result in some sort of nerve injury and up to 3% of the patients are left with paralysis of both vocal cords, a condition that leads to difficulty of breathing which often requires tracheostomy, the loss of function of the recurrent laryngeal nerve during thyroid surgery results from traction or handling of the nerve during its dissection or inclusion of the nerve in a ligature or inadvertent section of the nerve, other uncommon causes are damage to the vagus nerve in the neck and damage due to pressure from the cuff of the endotracheal tube.\(^\text{(5)}\) Complications such as bleeding, hypoparathyroidism and Recurrent Laryngeal Nerve Injury (RLNI) represent nearly half of all the complications of thyroid surgery, the latter complication after thyroidectomy, although infrequently encountered, can jeopardize the quality of life. In addition to the hoarseness that occurs with unilateral RLNI, bilateral RLNI leads to dyspnea and often life-threatening glottal obstruction, the incidence of RLNI has been found to be higher during re-explorations, Graves disease and thyroid carcinoma procedures. RLNI is a major concern in thyroid and parathyroid surgery. Therefore, methods that can reduce the incidence of this complication are of great interest, an almost certain way to ensure the integrity of the RLN is to always identify the nerve during all surgical procedures on thyroid and parathyroid glands, the aim of the present study is to assess the factors influencing the risk of RLN injury during thyroid surgery, the routine identification of recurrent laryngeal nerve during thyroid surgery reduces the incidence of nerve injury markedly.\(^\text{(6,7,8)}\) The surgeon experience and use of nerve monitoring during surgery including the use of electrophysiological nerve stimulation are the primary factors contributing to the removal of thyroid tissue without injury to the nerve.\(^\text{(4,9)}\) In this study, the incidence of recurrent laryngeal nerve after thyroid surgery has been investigated, it was correlated to the age of the patients, different diseases of thyroid gland and the extent of operative procedures (lobectomy, subtotal or total thyroidectomy), unilateral and total injury of the recurrent laryngeal nerve will produce paralysis of all ipsilateral intrinsic laryngeal muscles (Functional Changes with Nerve Injury) fig. (1), the only exception is the cricothyroid, which is supplied by the superior laryngeal nerve (external branch), Paralysis of one recurrent nerve will usually result in significant hoarseness, which may diminish over time as the contralateral vocal cord is compensated by crossing the midline, the cricothyroid muscle, having an intact innervation and being unopposed, will tense the vocal cord, this moves the vocal cord toward a median or paramedian position and results in a hoarse voice, a bilateral recurrent nerve injury will usually result in airway obstruction and significant respiratory distress, especially if both vocal cords remain in the paramedian position, tracheotomy is usually required, arytenoidectomy or some type of vocal cord lateralization procedure is required to restore a normal airway, but the voice may become quite breathy.\(^\text{(2)}\) After unilateral injury of the external branch of the superior laryngeal nerve, the cricothyroid on the affected side is paralyzed. This results in partial paresis of the posterior segment of the true vocal cord and transient weakness of voice and hoarseness as shown in table 1 and fig. 1.\(^\text{(11,12)}\)

### Patients and Methods

A case series study of 100 patients, who underwent different thyroid surgeries for different diseases of thyroid during 1\(^\text{st}\) of October 2010-1\(^\text{st}\) of October 2011 were analysed for injury of recurrent laryngeal nerve (RLN) when routine identification and exposure of RLN throughout its course up to its entry into the larynx was ensured before ligation of the inferior thyroid artery. The other known complications of thyroid surgery like injury of the parathyroid gland and superior laryngeal nerve were not included in this study.\(^\text{(13-16)}\) The age range is in 25-65 years and the operative technique regarding identification of the recurrent laryngeal nerve before ligation of the inferior thyroid artery. Recurrent laryngeal nerve related to the inferior thyroid artery was examined and then was followed up to the inferior corner of the thyroid till the artery is divided into its terminal branches and the nerve enters the larynx below the cricothyroid muscle, ligation of the artery was done after the nerve identified. If the nerve was not found in its normal course, a thorough search for non recurrent laryngeal nerve (NRLN) was done.\(^\text{(7,9)}\) Special attention was given to the entry point of (RLN) into larynx where it is closely related to suspensory
ligament of berry, this is another frequent site of RLN injury, after confirming the integrity of the nerve further steps of the operation, an immediate postoperative examination by direct laryngoscopic examination was done to confirm the presence of bilateral vocal cord movement, one of the common sites of injury to the nerve is at the entry point in the larynx just lateral to the ligament of Berry.\(^\text{(7,8)}\) Patient’s charts were evaluated for history, physical examination, thyroid function tests and operative reports for the type of operation (total, near total or subtotal thyroidectomy) and also to check if RLN was identified or not.\(^\text{(9,11)}\) Attempts were made to identify the RLN in all cases, in case of failure to identify the RLN, careful dissection of the gland and ligation of the related vessels close to their distal branches was carried out to avoid injury. The cases were analyzed for RLNI in relation to gender, category and type of surgical operation, as well as histopathological diagnosis, dysphonia or vocal cord paralysis detected on indirect laryngoscopy was considered as transient paralysis if recovered within 6 months and as permanent paralysis if it continued beyond 6 months.\(^\text{(6)}\) Conventional RLN monitoring consists of a needle electrode placement into the cricoarytenoid muscle (direct needle placement, endoscopic hook, or special endotracheal tube) and a stimulator electrode contact with the nerve. An alternative or adjunct to electromyography is open palpation of the arytenoids during RLN stimulation, which can be done during thyroid dissection for identification and/or at the conclusion of the resection to insure nerve integrity.\(^\text{(5,17-20)}\)

**Preoperative Assessment and Preparation:**

- A detailed clinical assessment and investigation was performed for each patient including history, clinical examination, and usual pre-operative investigation (Hemoglobin, ESR, Blood sugar, Blood urea) as well as ECG.\(^\text{(1,9)}\)
- Chest X-Ray was part of routine preoperative assessment and to see if there was retrosternal goiter especially when symptoms and signs suggest retrosternal goiter.\(^\text{(9)}\)
- Ultrasound examination was carried out for all patients to assess the nature of thyroid swelling (solid, cystic, complex) and to look for other nodules of thyroid gland which were not detected clinically.\(^\text{(7,9)}\)
- Fine needle aspiration cytology was limited to some patients with clinical solitary nodule and for other suspicious cases and according to surgeon preference (few patients in this study were submitted to this examination).\(^\text{(1,19)}\)

*All our patients underwent pre-operative indirect laryngoscopy by otorhinolaryngologist to examine vocal cords function.*

**Operation:** The indication for thyroidectomy in this study can be categorized as follows:

1. To remove solitary thyroid nodule & multinodular goiter.\(^\text{(14)}\)
2. As definitive therapy for some patient with thyrotoxicosis (when antithyroid drug failed to control signs & symptoms for 6 months or longer).\(^\text{(11,12)}\)
3. To alleviate pressure symptoms or respiratory obstruction attributed to thyroid gland enlargement.\(^\text{(11,20)}\)
4. Occasionally to remove an unsightly goiter.\(^\text{(11)}\)

**During surgery the following points were studied:**

(a) **Magnitude of surgery:**

In spite of all kinds of thyroid surgery were performed during this study, lobectomy & subtotal thyroidectomy were the most common procedures, total thyroidectomy was for malignant disease and when biopsy result of first operation showed malignant changes (completion thyroidectomy).\(^\text{(21,22)}\)

(b) **Types of thyroid pathology:**\(^\text{(1)}\)

- Assessment of:
  1. Lesion size.
  2. Number of nodules.
  3. Consistency of the lesion whether solid, cystic was also made.
  4. Fixation of the goiter.

(c) **The experience of the surgeon:**
The surgeon was either a resident or consultant and the incidence of the nerve was studied in relation to the degree of experience of the surgeon who did the operation. (11)

(d) Recurrent laryngeal nerve identification:
The percentage of nerve identification during surgery is also encountered, and its effect on the incidence of nerve injury is also recorded; although this attitude was not practiced with all patients, some surgeons were insisting on exposing this nerve to avoid its injury. The incidence of nerve injury in those two group was recorded and analyzed. (12)

(e) Re-operation:
The rate of reoperation (completion thyroidectomy) was also recorded and the causes of these operations were also studied. (12)

(f) Post operative follow up and evaluation:
The (RLN) was examined at the end of each operation by direct laryngoscopy after extubation of the endotracheal tube by anesthetist and the surgeon who did the operation to check the vocal cords functions. (12)

A possible complication of thyroid surgery is injury of the recurrent laryngeal nerve (RLN) resulting in postoperative vocal cord dysfunction, typically manifesting as hoarseness. In the setting of total thyroidectomy, bilateral RLN paralysis is possible, this could be manifested as acute postoperative stridor and presented as an airway emergency, the use of a nerve stimulator and/or electromyography monitoring may help to prevent (RLN) damage by both identifying the (RLN) intra-operatively and confirming that the nerve was not damaged at the conclusion of the case prior to closing the surgical wound. (9-19) The nerve stimulator stimulates the (RLN) and results in adduction of the vocal cord, a potential problem with this technique is assessing adequate cord function, alternative ways of assessing the response to (RLN) stimulation include palpating the larynx, monitored vocal cord contraction by an indwelling electrode (i.e. on an endotracheal tube), or direct visualization of the vocal cord response to (RLN) stimulation. (4,17) The laryngeal mask airway (LMA) has been used extensively in thyroid surgery in some centers and offers a number of advantages to the patient, such as the avoidance of muscle relaxants and relaxant reversal, decreased hemodynamic response to intubation and extubation, and possibly a decreased incidence of postoperative odynophagia, its use may increase because there is greater pressure to perform these procedures as outpatient surgery, direct visualization of the cords, using a fiberoptic bronchoscope via an LMA, provides a method of laryngeal assessment during and following thyroid dissection. (8, 21-24)

Exposure: Exposure of the recurrent nerve during any procedure on the thyroid is a sound surgical principle and should be done wherever possible. If the nerve cannot be found readily, the surgeon must avoid the areas in which it may be hidden, fibrosis increased bleeding, and lack of clear anatomic relationships are responsible for most nerve injuries, postoperative exploration for hemorrhage also is associated with a higher risk of nerve injury. (22-26) At one time, the recurrent nerve was considered so delicate that if a recurrent laryngeal nerve is seen during thyroidectomy, it is injured. (27-29) At the other extreme are those who would require demonstration of the nerve by direct stimulation during laryngoscopic observation of the vocal cords, we believe that visual identification, with avoidance of traction, compression, or stripping the connective tissue is all that is necessary. Complete anatomic dissection is not required, but simple exposure will not destroy it. (30-33, 34) The recurrent laryngeal nerve forms the medial border of a triangle bounded superiorly by the inferior thyroid artery and laterally by the common carotid artery. The nerve can be identified where it enters the larynx just posterior to the inferior commu of the thyroid cartilage, if the nerve is not found, a non recurrent nerve should be suspected, especially on the right. (19,34-38) The tubercle of Zuckerkandl is the most posterior extension of the lateral lobes of the thyroid gland at the level of the ligament of Berry. There are connective tissues between the nerve and the trachea on the right more than on the left. (2,19,33)

Results

We found most of thyroid disease occurred in females in the age group (17-35 years). Among male, the higher occurrence of thyroid disease was in the age group of (35-54 years). Sex ratio was (8:1) and the mean age (42 years) with a range of (17-70 years). This is similar to that reported by both Al-Fakhri et al. and Vokurka et al. which was (45 years) ranging from (20-70 years). The overall incidence of recurrent laryngeal nerve injury was (6%). This figure is not far from that reported by Baker & Al-Jarrah
In the last 25 years, near total thyroidectomy has replaced bilateral subtotal thyroidectomy as the preferred option for the management of all patients with bilateral benign multinodular goiter, Graves’ disease, and all but very low-risk thyroid cancer patients. The principal change in operative technique has been the move from ‘lateral dissection’ to ‘capsular dissection.’\(^{(15,39)}\) The incidence of injuries to the recurrent laryngeal nerve has been reported 1% to 2% from different thyroid surgery centers when performed by experienced neck surgeons. This incidence is higher when thyroidectomy is performed by a less experienced surgeon, or when thyrotoxicosis is done for a malignant disease. Sometimes the nerve is deliberately sacrificed if it runs into an aggressive thyroid cancer.\(^{(3,12,40)}\) This complication is generally unilateral and transient, but occasionally it can be bilateral and permanent and it may be either deliberate or accidental. The permanent lesion of damaged RLN is often manifested as an irreversible dysfunction of phonation and is the most common complication following thyroid surgery. Permanent injuries to the recurrent laryngeal nerve are best avoided by identifying and carefully tracing the path of the recurrent nerve. Surgeon’s experience, histopathologic diagnosis, previous thyroid surgery, surgical technique and anatomic variations are important factors affecting this complication.\(^{(7,8)}\) Mechanisms of injury to the nerve include complete or partial transection, traction, or handling of the nerve, contusion, crush, burn, clamping, misplaced ligature, and compromised blood supply. In unilateral RLNI, the voice becomes husky because the vocal cords do not approximate with one another. Dysphonia starting on the 2nd – 5th post-operative days is commonly due to edema, whereas traction injury of the nerve and damage of axons may result in dysphonia lasting up to 6 months. Dysphonia continuing after 6 months is commonly permanent caused by cutting, ligating or cauterization of the nerve. Bilateral (RLNI) is much more serious, because both vocal cords may assume a median or paramedian position and cause airway obstruction, and tracheostomy may be required.
Accidental transection commonly occurs at the level of upper two tracheal rings, where the nerve closely approximates the thyroid lobe in the area of Berry’s ligament. (5,9) Despite many excellent studies, recurrent nerve dissection has repeatedly been questioned because there was either no change or an increased risk of vocal cord paralysis. Several of these studies concluded that recurrent nerve dissection is not mandatory in subtotal resection but still advocate the procedure for the sake of practice, that it will be useful in complicated cases (e.g., thyroid cancer). In this study, the incidence of (RLNI) increased to (8.7%) in cases where the nerve was not identified. Dissection beginning from the avascular cricothyroid space was reported as a safe method of (RLN) preservation. (33,40) In recent years, many surgeons have sought to try to further reduce the low incidence of (RLNI) by use of nerve monitoring devices during surgery. Although several devices have been utilized, all have in common some means of detecting vocal cord movement when the recurrent laryngeal nerve is stimulated. Many small series have been reported in the literature assessing the potential benefits of monitoring to decrease the incidence of nerve injury. Given the low incidence of (RLNI), it is not surprising that none of the studies have shown any statistically significant decrease in (RLNI) by using a nerve monitor. The use of a nerve stimulator did not aid in anatomical dissection of the (RLN) and was useful in identifying only superior laryngeal nerve. Discontinuous nerve monitoring by stimulation during total thyroidectomy confers no obvious benefit for the experienced surgeon in nerve identification, functional testing or injury prevention. (22,32) Deliberate identification of the (RLN) minimizes the risk of injury. When the nerve is identified and dissected, the reported (RLNI) rate during thyroidectomy is (2.3%). This is reportedly higher in the re-operative setting (2-12%) or if the nerve is not clearly identified (4 - 6.6%). (3,9,36) Intra operative hemostasis and a thorough understanding of the anatomy are essential for nerve identification and preservation. The (RLNI) is more common in operations for thyroid carcinoma, hyperthyroid (toxic) goiter and recurrent goiter cases. In recurrent goiter, injuries are due to adhesions and anatomical displacement whereas in hyperthyroid cases, it is due to increased vascularization of the gland. (4,17) In the present study, the rate of (RLNI) was (28.5%) in thyroid carcinoma and in benign goiter cases the (RLNI) rate was (4.3%). The rate was the highest (25%) in recurrent goiter cases. The type of surgical procedure is another factor influencing the rate of (RLNI). In subtotal thyroidectomy cases, (RLNI) rate was low, while it is higher in total thyroidectomy cases. In the present study, (RLNI) rate was (4.4%) in subtotal compared to (20%) in total/near total thyroidectomy. (6,9,15)

Conclusions

1. The incidence of recurrent laryngeal nerve injury in the present study is within the range reported elsewhere.
2. The study confirmed that the recurrent nerve injury is significantly related to the type of thyroid pathology and extent of surgery.
3. It is also noted that the incidence of recurrent laryngeal nerve injury can be reduced to the minimum when the nerve is identified during surgery.

- We advise routine (RLN) identification in any operation of thyroid gland. However, absolutely necessary is the identification of the nerve in the following situations:
  1. Hemithyroidectomy specially on the right side to avoid injury of (NRLN).
  2. Re-operations.
  3. Carcinoma of thyroid.

- If the (RLN) is not easily identified in normal course, a possibility of (NRLN) especially on the right side should always be considered.

- Special attentions to the entry point of the (RLN) into the larynx near the ligament of berry are required, where risk of injury of the nerve is high.

Recommendations:

1. During thyroid surgery, surgeons should have a thorough knowledge and awareness about the anatomical variations of recurrent laryngeal nerve.
2. All surgeons should try to identify the recurrent laryngeal nerve in any operation of the thyroid to reduce the incidence of the nerve injury to the minimum.
3. For a large goiter with a suspicion of malignant changes, total thyroidectomy followed by
hormonal replacement should be considered, in order to reduce the reoperations.

4. A single dose of intra operative corticosteroids did not produce any benefit in terms of reducing the postoperative temporary / permanent (RLNP) rate, but it did shorten the recovery time for patients suffering from temporary (RLNP).

The most effective method for protection of (RLN) from injury is still controversial. Some surgeons claim that omitting the identification of (RLN) may cause little trauma. However, other studies have proved that this is not true. Opposing to this idea, identification of (RLN) during operation requires the surgeon to have the knowledge of the anatomic course of the nerve and its variations leading to decreased (RLNI) incidence. Intra-parenchymal dissection or subtotal excision would be recommended if failure to identify (RLN) occurs.

REFERENCES
Table (1) *Functional Changes with Nerve Injury*

<table>
<thead>
<tr>
<th>Functional Changes with Nerve Injury</th>
<th>Voice</th>
<th>Glottic Close</th>
<th>Airway</th>
</tr>
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<tbody>
<tr>
<td>Recurrent laryngeal nerve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>Weak</td>
<td>Weak</td>
<td>Good</td>
</tr>
<tr>
<td>Bilateral</td>
<td>Normal</td>
<td>Adequate</td>
<td>Poor</td>
</tr>
<tr>
<td>External branch, superior</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>Lowered</td>
<td>Weakened</td>
<td>Good</td>
</tr>
<tr>
<td>Bilateral</td>
<td>Lowered</td>
<td>Loss of reflex</td>
<td>Good</td>
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<tr>
<td>Combined injury</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>Weak</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Bilateral</td>
<td>Weak</td>
<td>Weak</td>
<td>Adequate</td>
</tr>
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*Before compensatory cord changes occur.*

Table (2) *The relation of recurrent laryngeal nerve injury and the sex of the patients:*

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Unilateral Nerve Injury</th>
<th>Bilateral Nerve Injury</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>89</td>
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<td>6</td>
<td>6</td>
<td>6.7</td>
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<tr>
<td>Male</td>
<td>11</td>
<td>0</td>
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<tr>
<td>Total</td>
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<td>2</td>
<td>6</td>
<td>6</td>
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Table (3) *The effect of thyroid status on the incidence of recurrent laryngeal nerve injury.*

<table>
<thead>
<tr>
<th>Thyroid status</th>
<th>No.</th>
<th>Unilateral Nerve Injury</th>
<th>Bilateral Nerve Injury</th>
<th>Total</th>
<th>%</th>
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<tr>
<td>Euthyroid</td>
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<td>5</td>
<td>5</td>
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<td>Thyrotoxicosis</td>
<td>12</td>
<td>4</td>
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<td>1</td>
<td>8.3</td>
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<tr>
<td>Total</td>
<td>100</td>
<td>4</td>
<td>6</td>
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</table>
### Table (4) The distribution of thyroid pathology between both sexes:

<table>
<thead>
<tr>
<th>Sex</th>
<th>Solitary Nodule</th>
<th>Unilateral M.N.G</th>
<th>Bilateral M.N.G</th>
<th>Diffuse</th>
<th>Total</th>
<th>%</th>
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<tbody>
<tr>
<td>Female</td>
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<td>3</td>
<td>54</td>
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<tr>
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<td>2</td>
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<td>7</td>
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<tr>
<td>Total</td>
<td>12</td>
<td>4</td>
<td>61</td>
<td>100</td>
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</tr>
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</table>

### Table (5) The distribution of thyroidectomies between both sexes

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Lobectomy</th>
<th>Subtotal thyroidectomy</th>
<th>Total thyroidectomy</th>
<th>Completion Thyroidectomy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>89</td>
<td>23</td>
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<td>4</td>
<td>3</td>
<td>93</td>
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<td>2</td>
<td></td>
<td>1</td>
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<td>12</td>
</tr>
<tr>
<td>Total</td>
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<td>25</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>105</td>
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</tbody>
</table>

### Table (6) The incidence of recurrent laryngeal nerve injury in relation to the type of surgery performed:

<table>
<thead>
<tr>
<th>Operation</th>
<th>No.</th>
<th>Temporary Injury</th>
<th>Permanent Nerve Injury</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtotal Thyroidectomy</td>
<td>8</td>
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<td>1</td>
<td>3</td>
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<tr>
<td>Lobectomy</td>
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<td>0</td>
<td>1</td>
<td>4.3</td>
</tr>
<tr>
<td>Total Thyroidectomy</td>
<td>11</td>
<td></td>
<td>1</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Reoperation</td>
<td>4</td>
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<td>1</td>
<td>1</td>
<td>25</td>
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<tr>
<td>Total</td>
<td>30</td>
<td></td>
<td>3</td>
<td>5</td>
<td>6</td>
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</table>

### Table (7) The incidence of recurrent laryngeal nerve injury (unilateral and bilateral, temporary and permanent)
### Functional Changes with Nerve Injury

<table>
<thead>
<tr>
<th>Nerve Injury</th>
<th>Temporary Nerve Injury</th>
<th>Permanent Nerve Injury</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Unilateral Nerve Injury</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral Nerve Injury</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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![Functional Changes with Nerve Injury](image)

**Fig. (1) Functional Changes with Nerve Injury**

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