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Original Research Article

A novel way of identification of recurrent laryngeal nerve during thyroid surgeries

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ABSTRACT

Background: This was a report of a movement of the recurrent laryngeal nerve which can be demonstrated during thyroid surgeries which can be used for locating the nerve, or identifying it if already exposed and causing confusion with other nearby structures or when alone too.
Methods: The nerve is located by observing for a superior-inferior movement of the recurrent laryngeal nerve transmitted by the loose areolar tissue over it and dissecting over this site to locate the nerve right underneath it. This was by direct observation of the movement which will be there so long as the thyroid is held retracted to the opposite side and is not separated from the thyroid at the tissues that constitute the condensation of pre-tracheal fascia called the Berry's ligament.
Results: The recurrent laryngeal nerve originates from the vagus and loops posteriorly and then upwards around the arch of aorta on the left side and the subclavian artery on the right side. When the thyroid gland is retracted away and thus the nerve put on slight stretch, a superior-inferior to and fro- movement of the nerve can be seen. This movement can be used for identification and dissection of the nerve along its course.
Conclusions: A review of literature has been done and it is clear that this movement has not been hitherto identified or published.

Keywords: Recurrent laryngeal nerve, Identification, Dissection, Location, A new method

INTRODUCTION

This study started following the consistent observation of a here to fore undescribed movement of the recurrent laryngeal nerve on the left side following its dissection. This led to the natural use of this movement in confirming the identity of the nerve on the left side when there was confusion about its identity, particularly when it runs parallel with the superior branch of inferior thyroid artery. It's relation to this artery is very close. It becomes imperative to identify the nerve before the ligature of the branches of the artery lateral to the Berry's ligament. The course of the recurrent laryngeal nerve in the region lateral to the thyroid is varied enough to cause difficulty in locating it and prevent injuries. There is a certain superior-inferior movement of this nerve induced by virtue of its being looped around the arch of aorta on the left side, and the subclavian artery on the right side.

When the strap muscles have been dissected away from the thyroid tissue and the middle thyroid vein ligated to displace the internal jugular vein laterally, allowing the carotid to be pulled laterally, the superior thyroid artery at the superior pole ligated, the thyroid can be displaced medially with the hand of the assistant or the surgeon, the loose areolar tissue bearing the recurrent nerve, inferior thyroid artery and its branches, veins and the parathyroid glands are exposed. The movement of the underlying recurrent laryngeal nerve can be seen as a movement in the loose areolar tissue that is located over it. This can be dissected to identify the nerve.

Aims and objectives

The aims and objectives of the study were- (a) to present the identification of the movement of recurrent laryngeal nerve, before the surgical community; (b) to use this identified movement for easier identification and dissection of the nerve; and (c) to use this movement for earlier location of nerve

METHODS

Study design

The study design was observational study/retrospective.

Study place

The study place was Pushpagiri Medical college, Tiruvalla, Kerala, India.

Study population

All the thyroid cases which have been operated by the author since the year 2003 till presently in the year 2021 June, has been used. There has been an average of about 30 cases per year, a bit more in some years. A total of 400 cases have been observed and used in this study. Identification of the right recurrent laryngeal nerve using this method has been practiced only in the last 2 years. Using this for locating the left recurrent laryngeal nerve was being done in the last 3 years.

Inclusion criteria

All the cases which have been operated by the author as the as the surgeon. Those surgeries where the author assisted as a teacher too were included.

Exclusion criteria

All the cases done in the institution which were not operated by the author as the main surgeon.

Method for identification of nerve

Retract the thyroid gland medially after mobilisation of superior pole and ligation of middle thyroid vein, if present. If the middle thyroid vein is present, when the strap muscles are dissected from thyroid and retracted laterally, the internal jugular vein will be visible. If the middle thyroid vein has been ligated and divided, or if it is absent, the common carotid artery will be exposed easily in retraction and the jugular will not be in the way. This is because the middle thyroid vein tethers the internal jugular to the carotid. Once the common carotid is retracted laterally from the thyroid, observe for a movement in the lose areolar tissue, lateral to the trachea which should be identified by palpation. It is important to hold oneself quite still, because if you keep moving, you will not be able to appreciate the movement of the nerve, which is a transmitted movement of the pulsation of the arch of aorta on the left side and the right subclavian artery pulsation on the right side.

On the right side, one additional method should be used, because often the jugular venous pulse is transmitted to the tissues on the right side, so this movement should be obliterated by holding this movement away by the tip of a forceps which is what I use, for the purpose.

Ethical consideration

This was an observational study, done in the natural process of execution of surgeries by the author, not with the intent of publication of results or as part of conduct of a study, but purely done as part of execution of surgery to which the patient has given a written consent each time. It was being published in retrospect.

Review of relevant literature

The recurrent laryngeal nerves are the nerves of the sixth pharyngeal arch.

The recurrent laryngeal nerve supplies four intrinsic muscles of the larynx; lateral cricoarytenoid, posterior cricoarytenoid, thyroarytenoid and transverse and oblique inter-arytenoid, cricothyroid is supplied by external laryngeal nerve. Inter-arytenoid is supplied by both recurrent nerves and is unpaired. Recurrent nerves also supply the inferior constrictor muscle and cricopharyngeus muscle. It gives sensory supply to the mucosa of the vocal cord and the sub-glottis. It gives cardiac branches to the deep cardiac plexus and branches to the trachea, oesophagus and the inferior constrictor muscles of pharynx. Branching of the recurrent nerve can occur outside the larynx at any point, but is uncommon inferior to the level of the inferior thyroid artery.[1] The extra-laryngeal branches are described as being separated into anterior fibres solely innervating adductor muscles, thyroarytenoid, inter-arytenoid and lateral cricoarytenoid and posterior branches that innervate the abductor muscle, posterior cricoarytenoid. Other studies have described no such consistency.[2]

The routine identification and dissection of recurrent laryngeal nerve during surgery is advocated by most surgeons to reduce the risk of injury. Several surgical landmarks are used to identify the nerve during surgery, relation of the nerve to inferior thyroid artery, relation to the tracheoesophageal groove, relation to berry's ligament and relation to Zuckerkandl's tubercle.[1]

The recurrent laryngeal ascends in the neck between the branches of the inferior thyroid artery in 6.5%, posterior to it in 61.5% and anterior to it in 32.5%. On the right side, the nerve is in any of the three locations in relation to the artery, on the left it is more likely to lie posterior to the artery.[3,4] The recurrent nerve is often in close proximity to Berry's ligament, most of them found within 3 mm of the

ligament.[5] The tubercle of Zuckerkandl represents a thickening where the ultimobranchial body fuses into the median thyroid process and can be enlarged into a nodular process. When enlarged, it is a consistent landmark for the recurrent nerve because the nerve always courses medial and deep to it. The right recurrent nerve leaves the right vagus nerve as it crosses the right subclavian artery and loops posteriorly under the artery. It traverses at an angle towards the tracheoesophageal groove and then runs parallel to it.

The left recurrent nerve arises from the left vagus as it crosses the aortic arch. It then passes posteriorly under the arch and the ligamentum arteriosum. The left recurrent nerve travels in a course that is parallel and close to the tracheoesophageal groove. Both the nerves are accompanied by the inferior thyroid artery's superiorly directed branch. Both the nerves on either side pass deep to the lower border of the inferior constrictor muscle and enter the larynx posterior to the cricothyroid articulation.

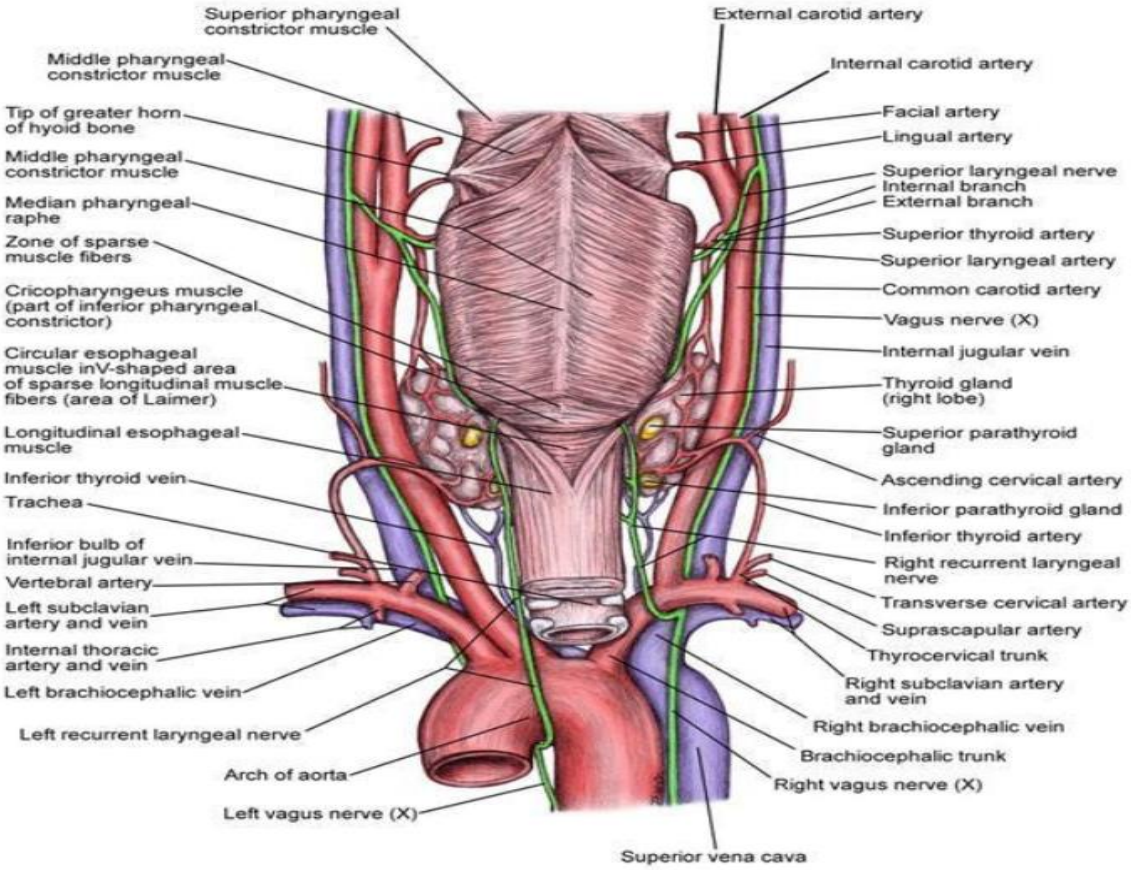

Figure 1: Course of right and left recurrent laryngeal nerve.

Source: Medscape.

RESULTS

A total of 408 cases were operated over an 18 years period. Using this movement for identification of the nerve was a natural result, on the left side, where this movement was observed initially. But this was done after exposing the nerve. The movement was used for easier location of the nerve and thus speeding the process of dissection only in the last 3 years, where the movement of the overlying loose areolar tissue was looked for and dissected to locate the nerve beneath. This was done for 45 cases on the left side and 30 cases on the right side. The jugular venous pulse obliterated all other movements often on the right side and this movement was minused or stopped from showing by using a narrow instrument to hold the pulsation away. A narrow instrument like an Adson's forceps was used, so that the field does not get covered or shadowed by anything.

Use of this method was found to be extremely useful in definite and confident identification of the nerve and once identified thus, the nerve was exposed through all the course superiorly, without touching the nerve or dissection in a plane beneath it. Multiple vessels entering the thyroid near the berry's ligament were all identified thus confidently, ligated and divided to free the thyroid from the nerve. In the event that a vessel breaks, we know which is the inferior thyroid and which the recurrent nerve so confidently that we can apply pressure over the vessel

alone, identify the bleeder and ligate it, without any harm to the nerve.

Out of all the cases 44 were male all of which were operated for multinodular large goitres with short necks. 24 of them were operated for secondary thyrotoxicosis and 16 for pressure symptoms, 2 for primary thyrotoxicosis, and 2 for solitary nodules, which turned out to be follicular adenoma and colloid nodule.

364 cases were female, 197 operated for large multinodular goitres for pressure symptoms, secondary thyrotoxicosis, primary and for cosmetic reasons due to patient's demand and insistence, 102 multinodular goitres operated for ultrasound or FNAC reports suggestive or suspicious for malignancy, in nodules in multinodular goitre,

49 for solitary nodule of thyroid, 21 of which were colloid nodules, two follicular carcinomas, the rest were papillary carcinomas with recurrent cysts in 12 cases and follicular adenomas. Among the multinodular goitres, two were anaplastic carcinomas, one medullary carcinoma, 33 papillary carcinomas and 30 micropapillary carcinomas.

16 cases were operated for primary thyrotoxicosis.

This movement is always identifiable on the left side except where 2 extremely large thyroids were operated, where the strap muscles were cut on both sides, and the nerve was easily identifiable, one was a recurrent thyroid after previous subtotal thyroidectomy, the other came in dyspnoea, was intubated in emergency, and operated two days later, both the cases had relatively larger size nerves too. On the right side, it could not be identified in two out of 50 cases. It has helped in easier and faster identification of the nerve and in the prevention of damage in all the cases where it was used, so far.

DISCUSSION

Methods of identification of the nerve described

The tubercle of Zuckerkandl identifies the posterolateral aspect of thyroid lobe and is mostly found lateral to the recurrent laryngeal nerve. The tubercle can be found in 80% of thyroids and when found can lead directly to the recurrent laryngeal nerve as 93% 0f nerves are found medial to this tubercle.[6,7] Most often, the nerve is found in a groove between the tubercle and the lobe of the thyroid gland.[8]

Both the left and right recurrent laryngeal closely follows the inferior thyroid artery.[9] The entire course of the nerve from superior to inferior or inferior to superior as it travels alongside the thyroid, is traced according to the author of this reference. This is what is required in my opinion too, and I usually do it from the region of identification by tunnelling superiorly over the nerve. The relation to the inferior thyroid artery is far more useful for this than use of Zuckerkandl's tubercle. It is in this process that the movement of the nerve which I described becomes particularly useful and handy, if there is confusion as to whether we are looking at the artery or the nerve. The branch of the artery that travels superiorly, or the main artery itself which turns superiorly can confuse with the nerve, whether together or alone.

One of the most serious complications of thyroid surgery is injury to the recurrent laryngeal nerve, which varies from 0.5% to 14% depending on the type of disease, the type of surgery, the extent of resection and the surgical technique.[10-12] Currently there are three approaches used to identify the nerve: the superior, lateral and inferior approaches.[13]

The common component of all three approaches is that the recurrent nerve is identified from the lateral side of the thyroid. Yet in some special cases when the lateral side of the thyroid is difficult to divide, it is not possible to use any of these techniques to identify the recurrent nerve. Here a medial approach was used after dividing the isthmus. This was used where revision with the presence of a fibrous scar due to previous surgery; multifocal thyroid cancer with local invasion of recurrent nerve, oesophagus, carotid sheath and lymph node metastasis and other cases in which it was difficult to find the nerve using he standard approaches.[14]

As seen in the review of literature, the branches and supply of recurrent nerves are to trachea, muscle of oesophagus, inferior constrictor muscle, subglottic area, in addition to the muscles of pharynx. So, picking up the nerve or manipulating it might harm these branches, and often lead to symptoms of reflux and cough following surgery if it is done.

So, identification as well as dissection of the nerve with little manipulation is very important. The natural movement of the nerve by virtue of its looping around the aortic arch on the left and the subclavian artery on the right comes to great use once your eyes are trained to identify it, in identification as well as dissection of the nerve once the thyroid lobe is retracted medially.

A moving eye or head cannot identify another movement, which is of lesser magnitude. So, it is imperative to look steadily at the site for identification of the nerve by virtue of its movement. On the left, it is enough to concentrate on the tracheoesophageal groove. On the right it is best to identify the inferior thyroid artery and look for its superior branch. The movement of the jugular venous pulse can interfere with identification of the movement of the nerve, but this can simply be obliterated by the use of a forceps to just push laterally and downwards very lightly on that pulse. If the nerve is already exposed in any part, the movement can be seen directly and further dissection can be done by tunnelling over the nerve without touching it using a small right-angled artery forceps.

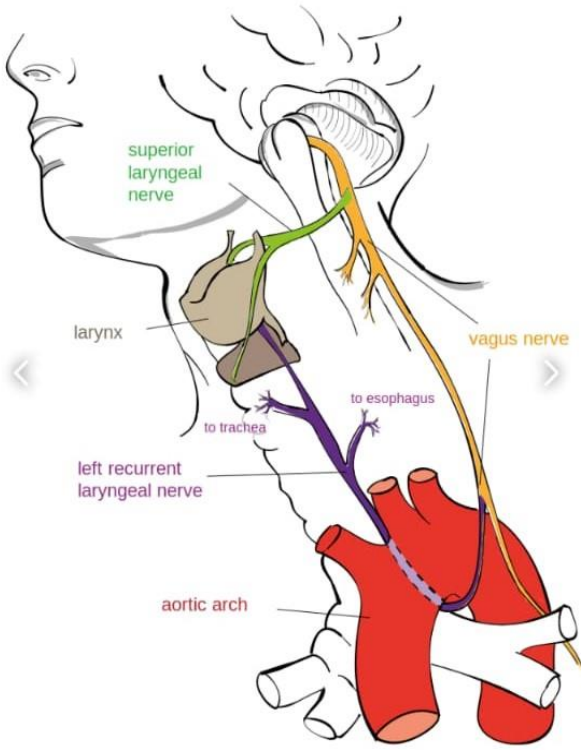

Figure 2: Course of left recurrent laryngeal nerve demonstrating branches to esophagus and trachea.
Source: Wikipedia, dated 5th Febraury 2014, based on drawing by truth seeker author: Jkwchui.

Limitations

When the movement cannot be identified, as it occurred rarely on the right side, it cannot be used. It cannot be used in case of non-recurrent course of the nerve on the right side, the incidence of which is 1 out of 100.

CONCLUSION

This was a completely new finding, the movement of the nerve, that has been identified. It is useful in identification of the nerve and in locating the nerve in cases of difficulty. It has been put to practical use in more than hundred cases. It has been demonstrated to and observed by all my colleagues who have been working with me in my unit, and also my post graduate students. It is easily demonstrable and usable.

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Ethical approval: Not required

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