CLINICAL STUDY

The surgical anatomy of the nervus laryngeus recurrens

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Abstract

In this study, the authors remind the readers the problem traditionally discussed in the thyroid gland surgery – protection of the nervus laryngeus recurrens (NLR) from iatrogenic damage. The aim of this study is to point out some anatomical details on the course of the recurrent nerve *(Ref. 4)*. Full Text (Free, PDF) *www.bmj.sk*.
Key words: thyroid gland, surgery, nervus laryngeus recurrens, iatrogenic damage.

An adequate knowledge of regional neurovascular anatomy variations together with a fine operative technique is an essential part of any uncomplicated thyroid gland surgery. It is known that the most frequent serious complication in the thyroid surgery is damage of the **nervus laryngeus recurrens (NLR).** It's exact identification and protection during the entire thyroidectomy or total lobectomy is basis for the successful surgery. Surgeons, who don't look for the NLR, don't prepare and identify it, take 3 to 4 time greater risk of the nerve injury. That means a 3 % to 4 % frequency of NLR lesion compared to 0.9 % in the case of nerve preparation.

The first scholar to describe the nervus laryngeus recurrens was *Galen*. He described it as a branch of the cranial nerve. *Vesalio and Willis* described anatomical relations of larynx and NLR. In 1923, *Lahey* was the first to recognize the importance of NLR during thyroid gland surgeries. *Lahey* developed a standard technique of its preoperative identification. In 1956, Riddel published a higher incidence of NLR lesions in case of non-preparing surgeons (1).

The nervus laryngeus recurrens contains both motor, sensory fiber, and parasympathetic fiber. The nerve splits into inner branch which supplies the vocal cords and the subglottical region with sensory fiber and outer branch which supplies the motor functions of the laryngeal muscles (*m. cricoarytaenoideus posterior as the only one opening the glottis, m. cricoarytaenoideus lateralis, m. vocalis, m. thyroaryteoideus, m. aryteoideus obliquus, m. arytenoideus transversus/except for the cricothyroid muscle/m. cricothyroideus),* whose motor innervation secures the *superior nervus laryngeus*. Before entering larynx, the nerve supplies branches for m. constrictor pharyngis inferior. The course of the nerve differs on the right and left side. The nerve turns back as the nervus vagus branch in the upper part of the thorax. The right nerve turns along the right arteria subclavia and rises; quite obliquely it leads into the right tracheoesophageal rima.

It can pass through, above or under lower thyroid artery or between the branches. The left NLR winds itself around the arch of the aorta and rises up much more steeply and dorsally in the tracheoesophageal rima on the left. It can have the same relationship to the lower thyroidal artery as the right NLR. Both branches enter the larynx in about 2 mm in front and under the articulatio cricothyroidea (in front of cornu inferior of the thyroid cartilage) over the muscular fibers of the muscle constrictor pharyngis inferior. Following the course of the nerve from the thorax to larynx, some anatomical variety can appear. Many studies concluded that the nerve usually splits into 2 or more branches before its actual entry to the larynx. Approximately in 40 % of cases the nerve bifurcates before entry in between muscular fibers. This happens most often in the distance from 0.6 to 4 cm. However, it can bifurcate anywhere after detaching from the nervus vagus. Nevertheless, before reaching the lower thyroidal artery, this kind of bifurcating is very rare. The anterior branch can enter the laryngeal muscles before and even after the cricothy-

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roid articulation. When the nerve come the place of entry without splitting, it can split even after this articulation.

Important anatomical abnormalities are connected with congenital vessel abnormalities. Rarely and specifically with approximately 0.6 % incidence of aberrant right subclavia exiting directly from the arch of the aorta behind the left subclavia, we find the right NLR exiting directly from nervus vagus – *non-recurrens*. It is possible – but very rare – to find a similar variant on the left side connected with the right-hand sided aortal arch and retroesophageal left subclavia. By reaching the lower pole of the thyroid gland, the nerve crosses over the lower thyroidal artery, where most of the time (61.5 % of cases) runs behind the branching. With lower frequency (32.5 % of the cases) it occurs in front of the branching and between the branches it occurs in 6.5 % of the cases (2). The relation towards the tracheoesophageal crevice is not constant. It is located in 65 % of cases on the right; otherwise it is on the left in 77 %. In the lateral position of the trachea, it was found on the right in 33 % of the cases and on the left in 22 % of the cases. Rare anterolateral course of the nerve always carry a high risk of NLR injury. The course of the NLR is not constant even in the relationship towards thyroid gland is. It is not a typically described pathway when the nerve enters the gland, with the exception of a so-called tunnel course, when it is encircled around by the thyroid gland tissue (for example: the Zuckerkandl projection).

The nerve never penetrates the pretracheal fascia. In many cases is the nerve pulled out by the surgical preparation together with the thyroid gland lobe and Berry's ligament, where in 50 % of the cases it can lead in its back portion, and it can be damaged there. In this place, it is damaged mostly by excessive thyroid gland traction. In its course the damage is frequently done by creating a knot or by incautiously-made haemostatic stitches or even by a "blind ligament interruption." Thyroidectomy carried out strictly extra capsular has a better haemostasia and therefore offers a greater visibility of the operating field. Without great difficulty it is possible to identify the nervus laryngeus recurrens in the area of *Wang's point* which is before the entry into larynx. Another critical location with a possibility to damage NLR is the area of the lower thyroid artery, where there are critical massive ligations. The final specific issue is that bleeding during the surgery always presents a risk for damaging the recurrent nerve.

Several ways how to identify the NLR have been described and it is important to know how to use some of them, eventually to combine them during surgery. For the NLR identification, besides Wang's point, is important the area of the nerve's crossing with the low thyroid artery, the tracheoesophageal crevice. Furthermore, according to Beahrse, Loré and Sadwicka, identification is possible in the Simons triangle or by the so-called medial approach (3).

During thyroid gland surgery we must adhere to the following: a preoperative ORL examination, adequately safe operative access, perfect haemostasia, the change of operating place in risky locations, separate interruption of the preserved vascular structures, no holding of the identified NLR by instruments, no lifting of NLR from its bedding, no electrocoagulation or aspirator in its surroundings. Even in a case of a tunnel course it is possible to release the nerve (with the exception of infiltration NLR by carcinoma). Of course, the thorough knowledge of anatomical neck structures is essential.

Besides NLR identification, the steps leading to a more secure thyroid gland surgery may be summarized in a few points. At first, the position of the patient during the surgery: the patient's head should be in hyperextension and above the patient's body in order to minimize blood pressure. Secondly, a well chosen approach. Most of the time we choose the operating lesion 2 cm above the jugular, at a slightly arched approach, in a way that it would be easily enlarged by pulling the uncus. For significant cosmetic reasons, the incision should be made in the natural skins bending and it should be symmetrical, even in a case that we will be performing just a one-sided performance. The next step is creating an adequate skin lobe and in the case of a large struma, we should not hesitate to employ a transverse intersection of the sternohyoid muscles. Good mobilization of the thyroid gland, the ligature of the upper thyroidal vessels in tight proximity to the thyroid gland and maintaining the outer branch of the nervus laryngeus superior (NLS) lead to better results. The outer branch of the NLS innervates m. cricothyroideus, which causes the tone of vocal cords (4). Thus, good results in the thyroid gland surgery occur when it is performed by a surgeon who is able to combine good anatomical knowledge, precise operative techniques and experience in thyroid gland surgeries.

References

1. Ardito G, Revelli L, Dalatri L, Lerro V, Guidi ML, Ardito F. Revised anatomy of the recurrent laryngeal nerves. Amer J Surg 2004; 187: 249—253.

2. Buhr HJ, Mann B. Thyroidektomie und Lymfadenektomie. Chirurg 1999; 70: 987—998.

3. Dvorak J. Rakovina štítné žlázy. Libri 1997.

4. Vidal JM, Moran AM. Manoeuvres for finding laryngeal nerves and parathyroid glands during surgery International Congress Series, 1240, 2003: 883—886.

Received May 10, 2007.
Accepted June 9, 2007.