



## Review

# Unintentional recurrent laryngeal nerve injuries following thyroidectomy: Is it the surgeon who pays the bill?



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## HIGHLIGHTS

- Injury of Recurrent Laryngeal Nerve has become one of the most frequent cause of medicolegal lawsuit.
- The incidence of unintentional RLN injury is 1–2% in tertiary referral centers, testifying that, also in experienced hands, it is a predictable but not preventable event at all.
- What is the value and meaning of an informed consent?

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## ABSTRACT

**Background:** Thyroidectomy is one of the most common intervention in general surgery and, after the turn of the century, its rate has sharply increased, along with a worldwide increased incidence of differentiated thyroid cancers. Therefore, injuries of the recurrent laryngeal nerve have become one of the most frequent cause of surgical malpractice claims, mostly following surgery for benign pathology.

**Main body:** Even if the incidence of definitive paralysis is generally lower than 3%, during the last 20 years in Italy, the number of claims for damages has sharply raised. As a consequence, a lot of defensive medicine has been caused by this issue, and a witch-hunt has been accordingly triggered, so determining mostly a painful and lasting frustration for the surgeons, who sometimes are compelled to pay a lot of money for increasing insurance premiums and lawyers fees. Recurrent laryngeal nerve injury should be considered as a potentially catastrophic predictable but not preventable event, rather than the result of a surgical mistake.

**Conclusion:** Purposes of the Authors are analyzing incidence, conditions of risk, and mechanisms of recurrent laryngeal nerve injuries, underlining notes of surgical technique and defining medical practice recommendations useful to reduce the risk of malpractice lawsuits and judgments against surgeons.

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## 1. Introduction

Thyroidectomy is one of the most commonly performed intervention in general surgery and, since the turn of the century, its rate has sharply increased, along with a worldwide increased incidence of differentiated thyroid cancer [1]. The number of thyroidectomies in United States has risen from 48.000 in 1997 up to 58.000 in 2007 and also in Germany, from 2001 to 2006, surgical procedures for thyroid and parathyroid glands have risen from 117.000 up to

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160,000 [2]. As a consequence, recurrent laryngeal nerve (RLN) injuries, mostly during surgery for benign pathology, have become the most frequent cause of surgical malpractice claim [3–6]. SS Abadin has reported 143 medical malpractice suits following thyroid surgery throughout 20 years, identifying a RLN injury in about 10% of cases, with a bilateral damage in about 3% [3]. A literature review of closed malpractice claims has showed that in about 50% of cases a RLN damage has been reported [2] and a median of 974,625 \$ has been the jury award granted in the United States, calculated during the years 1989–2009 [3]. Even if the incidence of a definitive paralysis is generally lower than 3%, during the last 20 years in Italy the number of claims for damages has sharply risen. According to the parameters established by the legislative decree n.38 of 2000 by the Italian Ministry of Health (i.e. Balduzzi Decree), a definitive biological damage of 25% has been acknowledged to patient in case of bilateral vocal cord palsy, while the rate of damage is variable from 6% to 25% for unilateral injury. So judges, lawyers, specialists in forensic medicine and insurance agents have spent a lot of time with the aim of better fulfilling the compensation expectations of the patients. A witch-hunt has been triggered, mostly determining a painful and lasting frustration for the surgeons that sometimes are compelled to pay a lot of money for increasing insurance premiums and lawyers fees. Moreover, this issue has raised defensive medicine. As a matter of fact, often the bill is very expensive and surgeons are considered responsible for undue insurance compensations. Nevertheless, injury of the RLN is a potentially catastrophic complication leading to the paralysis of the abductor muscle of the vocal cords, the posterior cricoarytenoid muscle. Symptoms range from a mild hoarseness, in case of unilateral lesion, to stridor and acute airway obstruction in the bilateral damage, with serious and sometimes catastrophic effects on patient social interaction and occupational status [7,8].

Capsular dissection, visual identification and intraoperative nerve monitoring allow to reduce the definitive RLN injury rate to 0.3–3% and, in transient forms, to 6–8% [4,9,10], but unfortunately, they do not prevent vocal cord paralysis to the patient [9]. Most of RLN injuries are not recognized intraoperatively and transection (rarely), clamping, stretching, electrocoagulation, ligature entrapment or ischemia are the main causes. Therefore, especially in patients where a visual nerve integrity has been accurately intraoperatively obtained, it is supposed that sometimes the real cause cannot be identified.

Authors, analyzing incidence, conditions at risk, and mechanisms of RLN injuries, underline notes of surgical technique and medical practice recommendations useful to reduce the risk of malpractice lawsuits and judgments, as well, against surgeons.

## 2. RLN anatomy

The RLN is a mixed nerve with sensory and motor fibers, originating from the thoracic portion of the vagus nerve. The right RLN lies in a more superficial plane, along the lateral esophageal edge and is traditionally considered at higher risk of injury. On the contrary, the left nerve, surrounding the aortic arch, is located in the tracheoesophageal groove, more deeply. As a unique segment, or divided in several branches (up to five), it penetrates the cricopharyngeal membrane and innervates the laryngeal muscles. Typically, anastomoses with the superior laryngeal nerve, committed to the innervation of the posterior cricoarytenoid muscle, are described.

The Zuckerkandl tubercle, a bulge of thyroid tissue from the lateral thyroid lobe, the inferior thyroid artery with its branches, and Berry's ligament, a posteromedial thickening of perithyroid fascia, adherent to thyroid capsule and very hard to dissect, are the main important anatomical neural landmarks [11–13].

In addition, their anatomical variants contribute to precisely define RLNs at risk. Precocious division of RLN extralaryngeal branches is a common anatomical variation [14]. Generally, the anterior extralaryngeal branches are motor fibers that sometimes may be stretched during Berry's ligament dissection. Distortion and elongation of the nerve, caused by large goiter with retrosternal extension, should be considered as another important risk condition favoring RLN palsy [15]. The knowledge of highly variable relationships between the RLN and inferior thyroid artery (ITA) is critical to a better neural identification. Moreover, intertwining between RLN and ITA ramifications may complicate dissection and hemostasis [16].

Non-recurrent laryngeal nerve is a rare variant (incidence 0.3–1.6%) observed more frequently on the right side, still representing a surgical challenge. Two types of anomalies are recognized, in type I, the non-recurrent laryngeal nerve originates from vagus nerve above the laryngotracheal junction and descends into larynx, mimicking a branch of the vessels of the superior thyroid pedicle. In type II, it arises from vagus nerve below the laryngotracheal junction and runs parallel to the path of the inferior thyroid artery mimicking an arterial branch [17].

## 3. Nerves at risk

"Nerves at risk" (NAR) should be considered as additional conditions – patient, thyroid pathology or surgery related - increasing the chances of a neural damage [18]. Re-intervention is one of the most important predisposing factor for NAR. Surgical adhesences, due to former surgery, and distorted anatomical planes lead to a hard identification of RLN, increasing nerve traction. A risk for permanent RLN palsy up to 30% has risen reported following re-operative procedures [19,20]. Thyroid cancer, infiltrating surrounding soft tissue and in some cases the nerve itself, increases the risk of intra-operative damage from 3 to 8 times, if compared to benign disease [4,21–24]. For many years, Graves' disease and retrosternal goiter have been considered NAR conditions but recent studies based on large series showed no increased risk of RLN palsy in such diseases [7,21]. Furthermore, despite the different anatomical routes between left and right RLN, no statistically significant difference in terms of damage rates has been reported in the international literature [25]. Surgeon experience and, of course, the extent of surgery might significantly determine surgical outcomes. Few studies, analyzing surgeon's experience as a risk factor for RLN, showed an increased incidence among surgeons with less than 45 NAR patients per year [21,26–28].

## 4. Mechanism of RLN injury

RLN injury during thyroidectomy or parathyroid surgery occurs significantly more often "to a visually intact RLN than to a transected nerve" [23]. According to the Evidence data, several mechanisms are advocated as responsible for an unapparent neural lesion.

First of all, during ligation and dissection of the ITA, an unintentional neural clamping might occur, especially in case of neural bifurcation close to Berry's ligament. Actually, during the stretching of the ligament along with the anterior motor branch, the posterior sensory one can be mistaken for the entire RLN, leading to an injury of the anterior fibers [29]. Moreover, a knot too close to the nerve might determine a band of connective tissue constricting the nerve itself.

During thyroidectomy, the gland is dissected and medially rotated from its cervical attachment; this maneuver may cause a stretch injury to the distal segment of RLN, adherent to Berry's ligament [30]. These overstretching injuries are divided into two different subtypes: type 1, caused by the direct distress on the

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