

## VISUALIZATION AND PRESERVATION OF RECURRENT LARYNGEAL NERVE BY HYDRODISSECTION

## REKÜRREN LARİNGEAL SİNİRİN HİDRODİSEKSİYON İLE GÖRÜLMESİ VE KORUNMASI

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## ABSTRACT

**AIM:** Recurrent laryngeal nerve (RLN) injury is the most feared complication of thyroid surgery. Hydrodissection; separation of tissues by fluids is described in laparoscopic cholecystectomy, cataract surgery, carpal tunnel syndrome treatment where meticulous dissection must be carried out. In this study, we aimed to assess the incidence of RLN damage observed in our series by hydrodissection of RLN during thyroid surgery.

**MATERIAL AND METHOD:** Thirty four consecutive patients underwent thyroidectomy for various thyroid diseases in 18 months were included in the study. All the patients' demographic variables (age, sex), operation type (bilateral total thyroidectomy, hemithyroidectomy (total lobectomy and isthmectomy), completion total thyroidectomy, whether central neck compartment dissection was performed), pathology reports, nerves at risk were noted retrospectively.

**RESULTS:** Only in one case, temporary unilateral RLN paralysis causing hoarseness was observed, after total thyroidectomy performed for voluminous toxic multinodular goitre.

**CONCLUSION:** Hydrodissection is an easily applicable, non time-consuming and cheap technique. This preliminary study may be followed by further researches with larger sample sizes.

**Keywords:** hydrodissection, recurrent laryngeal nerve, thyroidectomy, paralysis, hoarseness

## ÖZET

**AMAÇ:** Rekürren Laringeal Sinir (RLS) hasarı tiroid cerrahisinin en korkulan komplikasyonudur. Laparoskopik kolesistektomi, katarakt cerrahisi, karpal tünel sendromu tedavisi gibi titiz diseksiyon yapılan durumlarda da tarif edildiđi gibi hidrodiseksiyon dokuların sıvıların kullanımı ile diseke edilip, ayrıştırılmasıdır. Bu çalışmada, tiroid cerrahisi sırasında hidrodiseksiyon ile RLS' nin görülmesi ve hasarlanma oranlarının saptanması amaçlanmıştır.

**GEREÇ VE YÖNTEM:** Bu çalışmaya 18 ay içinde çeşitli tiroid hastalıkları nedeni ile art arda opere edilen 34 hasta dahil edilmiştir. Olguların yaş, cinsiyet gibi demografik verileri, yapılan operasyon tipleri (bilateral total tiroidektomi, hemitiroidektomi (total lobektomi ve istmektomi), tamamlayıcı tiroidektomi, santral boyun diseksiyonu yapıp yapılmadığı), patoloji raporları, risk altındaki sinirler retrospektif olarak kayıt altına alınmıştır.

**BULGULAR:** Sadece dev toksik multinodüler guatr için total tiroidektomi yapılan bir olguda ses kısıklığına neden olan tek taraflı geçici RLS hasarı gözlemlendi.

**SONUÇ:** Hidrodiseksiyon kolay uygulanabilir, zaman almayan, ucuz bir tekniktir. Bu öncü çalışma daha geniş örneklemelerde yapılan çalışmalarla takip edilebilir.

**Anahtar Kelimeler:** hidrodiseksiyon, rekürren laringeal sinir, tiroidektomi, paraliz, ses kısıklığı

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## INTRODUCTION

Thyroid surgery is one of the most frequently performed surgical procedures. Recurrent laryngeal nerve (RLN) injury is the most feared complication of thyroid surgery. According to literature 0.5-5% and 1-30% of patients is reported to have permanent or temporary RLN injury after the surgery, respectively (1, 2).

RLN innervates all intrinsic muscles of larynx with the exception of cricothyroid muscle (3). Injury of RLN causes vocal cord paralysis. Unilateral RLN injury causes hoarseness, but when RLNs are bilaterally damaged aspiration during swallowing or life threatening dyspnea can occur according to severity of glottal narrowing. In severe dyspnea due to bilateral vocal cord palsy, urgent tracheotomy or glottal widening surgery should be performed (4, 5).

Hydrodissection is separating tissues with fluids to dissect and preserve surrounding tissues at operation zone (6) described in laparoscopic cholecystectomy, cataract surgery, carpal tunnel syndrome treatment where meticulous dissection must be carried out. This technique helps exploring anatomical landmarks by gentle dissection without giving harm to tissues (7-11). In thyroid surgery hydrodissection is performed to dissect foamy planes and increase visualization of RLN by high velocity stream of warm saline. This technique is used by most of the surgeons in Turkey but not published before. Despite being used extensively in routine clinical practice to our best knowledge no report evaluating hydrodissection in thyroid surgery exists in the literature up to date.

In this study, we aimed to assess the incidence of RLN damage observed in our series by hydrodissection of RLN during thyroid surgery.

## MATERIAL AND METHOD

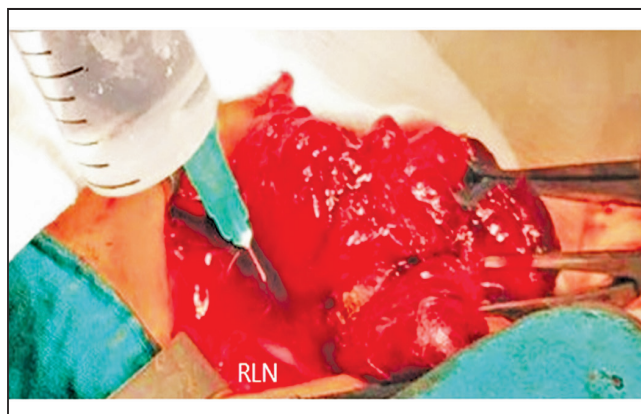
### *Patient Selection and Data Collection*

Thirty four consecutive patients underwent thyroidectomy for various thyroid diseases in 18 months were included in the study. All the patients' demographic variables (age, sex), operation type (bilateral total thyroidectomy, hemithyroidectomy (total lobectomy and isthmectomy), completion total thyroidectomy, whether central neck compartment dissection was performed), pathology reports, nerves at risk were noted retrospectively.

### *Surgical Technique*

RLN exploration was routinely done to avoid nerve damage on the resected lobe side. During RLN dissection if only it was necessary, bipolar cautery was used. Hydrodissection technique was performed while exploring RLNs. For hydrodissection a 10 ml syringe containing normal warm saline was used with a needle of 1 cm length (**Figure 1**). After ligation of middle thyroid vein and superior thyroid vessels, the thyroid lobe gently retracted medially and carotid artery laterally by retractors, hydrodissection was performed

by high velocity stream of warm-normal saline to the foamy dissection area of RLN and berry ligament. This technique helps exploring anatomical landmarks by gentle dissection without giving harm to tissues. In thyroid surgery, hydrodissection is performed to dissect foamy planes and increase visualization of RLN by high velocity stream of warm saline.



**FIGURE 1: Hydrodissection and visualization of RLN.**

Intraoperative nerve monitoring (IONM) could not be routinely used during thyroid operations, because it's paid only in cancer patients and recurrent surgeries by social health insurance policies in our country.

## RLN EVALUATION

Preoperative and postoperative evaluation of vocal cords by indirect laryngoscopy were performed 3 days before and after the operation routinely.

During extubation and awakening from anesthesia both vocal cords were evaluated by direct vision for mobility on the operating table (gold standart for evaluation of RLN injury).

This study has been reported in line with the PROCESS criteria (12).

### *Statistical Analysis*

Demographic and clinical data were summarized and classified by percentage distribution. Statistical analyses were performed using SPSS version 22 (IBM Corp., Armonk, NY, USA).

## RESULTS

A total 34 consecutive cases of thyroid surgery with 58 nerves at risk were performed. Most of the patients were female (88% of the total). Most common age group was 51-60 years as shown in **Table 1**. There were 19 total thyroidectomies, 6 total thyroidectomies and central neck dissections (CND) for papillary thyroid cancer, 6 hemithyroidectomies and 3 completion thyroidectomies (**Table 2**). Indication for thyroidectomy was malignant nodule in more than 20% of the patients (**Table 3**). In one case; in which completion thyroidectomy performed for papillary thyroid carcinoma (RLN was injured ipsilaterally

after hemithyroidectomy at another center) and RLN was intact on side ipsilateral to planned resection, intraoperative nerve monitoring (IONM) was used.

**TABLE 1: AGE DISTRIBUTION**

Age distribution	n (%)
<20 years	2 (5.9)
21-30	1 (2.9)
31-40	7 (20.6)
41-50	8 (23.5)
51-60	12 (35.3)
> 60 years	4 (11.8)
Total	34 (100)

**TABLE 2: Surgery performed**

Surgery performed	n (%)
Total thyroidectomy	19 (56)
Total thyroidectomy + CND	6 (17.5)
Hemithyroidectomy	6 (17.5)
Completion thyroidectomy:	3 (9)
Total	34 (100)

**TABLE 3 Pathology results**

Pathology result	n (%)
Nodular hyperplasia	23 (67.5)
Papillary carcinoma	7 (20.5)
Hurthle cell adenoma	2 (6)
Follicular adenoma	2 (6)
Total	34 (100)

Only in one case, temporary unilateral RLN paralysis causing hoarseness was observed, after total thyroidectomy performed for voluminous toxic multinodular goitre, although, preoperative fine needle aspiration biopsy of nodules were benign, final pathology was micropapillary carcinoma. It lasted for 1 month, and then RLN recovered completely.

## DISCUSSION

Traction, contusion, crush, thermal damage, complete or partial cut and impaired blood supply are the main causes of RLN injury in thyroid surgery (13). To prevent RLN damage, a good knowledge of anatomy and surgeon's experience are crucial. Routine visualization of RLN along tracheoesophageal sulcus, following the course of RLN near suspensory ligament of berry ligament until entering the larynx is recommended to avoid RLN injury (14, 15). But still some surgeons declare that visualization of RLN is not possible in all operations. Therefore staying close to thyroid capsule during thyroidectomy is considered to be a good surgical practice to preserve the nerve(16, 17).

Accurate knowledge of RLN anatomical variations,

RLN landmarks such as relation of the nerve with inferior thyroid artery branches, berry ligament, inferior horn of thyroid cartilage during thyroidectomy, is essential as mentioned in the literature. Also inflammatory processes of thyroid (thyroiditis), large nodules, previous operations can change the course of nerve. Hence meticulous dissection of RLN should be performed (15, 18). In simple thyroidectomies lateral or inferior dissection of RLN is the most common approach but in challenging cases such as large nodules, plunging thyroid gland, neck extension limitations, superior approach, craniocaudal dissection of RLN is accepted to be more appropriate (19). In our study, both lateral and superior approach were used, hydrodissection of foamy tissue and visualization of the nerve by removing blood and debris via high velocity stream of saline was the main point.

Today, various methods of nerve monitoring and stimulation techniques are in use. Intraoperative nerve monitoring (IONM) significantly reduces iatrogenic RLN injury, helps identification of nerve especially in cases with anatomical variations and points early warning of nerve injury (20-22). But disadvantages of IONM like improper electrode position leading to nerve damage must be kept in mind (23). In our study we used IONM in only one case which had a story of RLN injury at the previously operated site. Hydrodissection of RLN is also helpful in use of IONM by allowing dissection of the planes gently just like the insufflation of gas does in laparoscopy. In our country, since government does not pay for it, we cannot use IONM routinely. However hydrodissection is an easily applicable, non time-consuming and cheap technique.

Although the approaches to thyroid diseases changes among surgeons (24), in conventional thyroidectomies with the help of energy devices and/or right-angled clamps, sharp and blunt dissections are performed during RLN dissection. But in reoperations, malignancy and, inflammatory conditions, the anatomical planes are not always clear. Hydrodissection mostly helps in these adverse conditions by dissecting the planes without any harm to surrounding tissue. Hydrodissection cannot identify the nerve like IONM but removing the tissues around the nerve and opening the planes, helps identification and identification. Limitation of the current study is the lack of control group and small sample size.

## CONCLUSION

Hydrodissection is an easily applicable, non time-consuming and cheap technique. This preliminary study may be followed by further researches with larger sample sizes.

## ETHICAL APPROVAL

Institutional Board Approval and clinical trial registration was obtained for this article. (Ankara University Ethical Committee 06-480-19; NCT03907761 clinical trials.gov)

**DECLARATION OF INTEREST**

None.

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