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Retrograde Thyroidectomy: A Technique for Visualization and Preservation of the External Branch of Superior Laryngeal Nerve[☆]



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ABSTRACT

INTRODUCTION: The external branch of the superior laryngeal nerve (EBSLN) should be identified during thyroidectomy to prevent injury and post-operative voice change. Identification is rendered difficult during a standard thyroidectomy where there is a large gland with upper pole enlargement. We describe the retrograde thyroidectomy technique to facilitate nerve preservation.

PRESENTATION OF CASE: A retrograde thyroidectomy was performed in a 53-year old woman with a difficult goiter. Operative steps are described.

DISCUSSION: This technique allows the upper pole to be completely mobilized caudally providing unparalleled visualization of the upper pole vascular pedicle, thereby preserving the EBSLN.

CONCLUSION: There is better visualization of the superior thyroid pedicle and the EBSLN with retrograde thyroidectomy, potentially reducing the incidence of EBSLN injury during a difficult thyroidectomy.

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1. Introduction

Ever since Billroth reported 36% incidence of injury to the recurrent laryngeal nerve (RLN) during thyroidectomy in 1877, surgeons have attempted to preserve the RLN with focus on its anatomic variations, differences between right and left sides, varying relationships with the ligament of Berry and anatomic relations to the inferior thyroid artery.¹

The external branch of the superior laryngeal nerve (EBSLN) is also involved in phonation. It provides the sole motor supply to the cricothyroid muscle and may also produce voice alteration when injured. However the EBSLN has received minimal attention, prompting Delbridge to declare it the “neglected nerve in thyroid surgery”.² Although several intra-operative techniques have been described to minimize injury, current advanced diagnostic techniques still demonstrate EBSLN injury in 5%³ to 30%⁴ of patients post thyroidectomy.

We report a thyroidectomy technique that greatly enhances exposure of the superior thyroid pedicle in order to preserve the EBSLN especially with grossly enlarged glands.

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2. Presentation of a case

A 53 year old female with a 10 year history of a large goiter decided to have surgery for cosmetic reasons. Examination revealed a large, non-toxic multi-nodular goiter. She had a markedly enlarged left lobe and isthmus and a smaller right lobe (Fig. 1). Investigations revealed that she was biochemically euthyroid.

At surgery, using a standard collar incision at the lower neck, the strap muscles were separated to expose the goiter. The middle thyroid vein was divided. As the gland was fixed to the trachea by the ligament of Berry, the enlarged upper pole was pushed cranially well beyond its normal anatomic position. This made it impossible to safely dissect the upper pole using the standard operative technique to pull the upper pole caudally. Neither could we expose the superior thyroid vessels and EBSLN by retracting the upper pole laterally as commonly described.

Therefore, the inferior thyroid pole was delivered into the neck wound after ligating and dividing the inferior thyroid veins (Fig. 2). With the lower pole delivered, the plane between the trachea and the medial aspect of the lobe was easily developed using finger and bipolar dissection close to the gland. The dissection was taken cranially to identify and divide the isthmus. This exposed the medial border of the ligament of Berry (Fig. 3).

At this point, the lateral aspect of the lobe was mobilized by dividing the areolar tissue and terminal branches of the inferior thyroid artery using “capsular dissection” as practiced by Theodore Kocher⁵ and refined by Bliss⁶ and Delbridge.¹

When the medial aspect of the ligament of Berry was divided, the entire lobe was lifted to allow clear visualization to dissect the lateral edge of the ligament of Berry, completely freeing the thyroid



Fig. 1. A non-toxic multi-nodular goiter with marked enlargement of the left lobe and isthmus. Note the proximal extent of the upper pole of the left lobe of thyroid.

off the trachea and allowing clear visualization of the recurrent laryngeal nerve at the lateral edge of the ligament of Berry in order to preserve it (Fig. 4).

With the ligament of Berry completely divided, the thyroid lobe was lifted off the trachea and larynx and drawn caudally by peeling the avascular plane between the anteromedial border of the upper pole and cricothyroid muscle by digital dissection. This avascular plane was easily opened by downward and lateral traction on the freed thyroid lobe. The thyroid lobe was then completely free, attached only by the superior thyroid vessels. Thus, one could see the upper pole from all sides, including its posterior surface and it could be drawn caudally, well below the cricothyroid muscle and

EBSLN. The cricothyroid muscle and the EBSLN were then easily seen and preserved before ligation of the superior vascular pedicle (Figs. 5 and 6).

3. Discussion

In almost all descriptions of thyroidectomy, the upper pole pedicle is ligated and divided before the RLN is completely freed and before ligament of Berry is divided.^{1,7,8} In this “classic” thyroidectomy, several techniques to preserve the EBSLN have been described:

(A) ‘With gentle downward traction on the thyroid, the vessels come clearly into view.’⁸

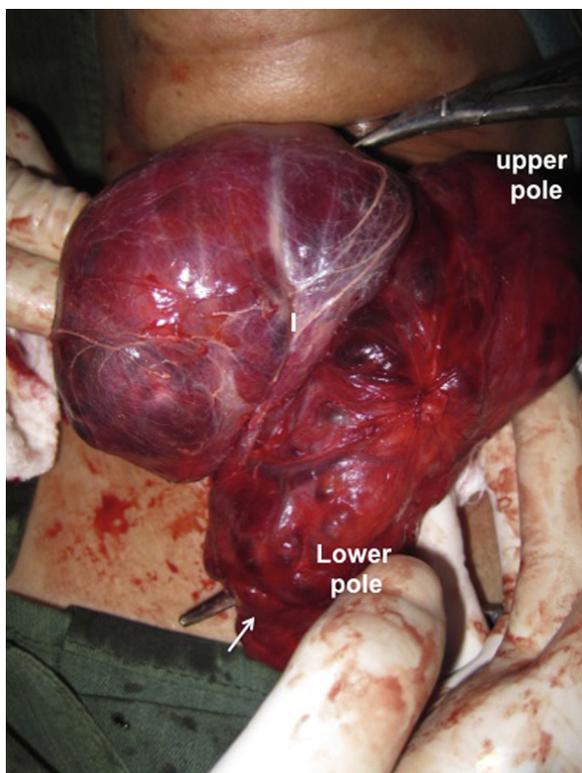


Fig. 2. The lower pole of thyroid has been delivered into the wound after ligation and division of the inferior thyroid pedicle (white arrow). This allows dissection supero-medially to divide the isthmus (enlarged in this patient).

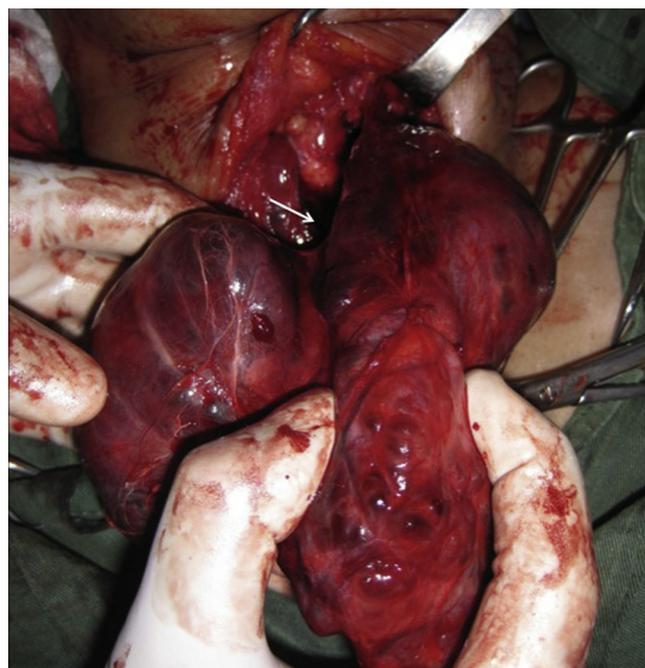


Fig. 3. Capsular dissection at the lateral aspect of the lobe is complete, inferior pedicle has been ligated and the medial aspect of the ligament of Berry is divided (white arrow) to mobilize the gland.

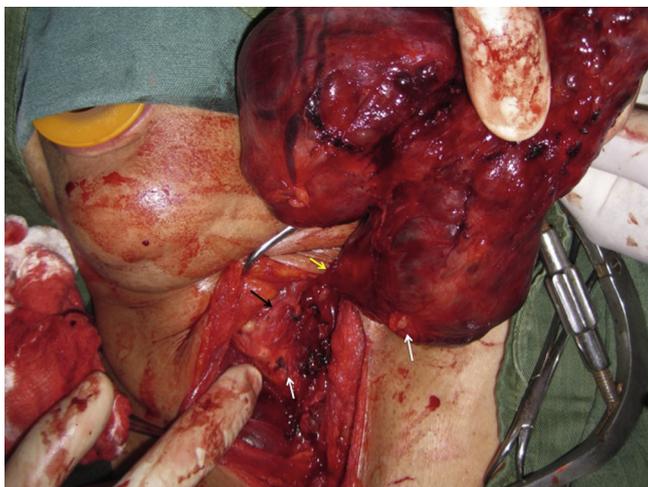


Fig. 4. Complete division of the medial aspect of the ligament of Berry (cut ends marked by white arrows) frees the entire thyroid lobe allowing it to be lifted off the trachea, affording clear visualization of the EBSLN (black arrow) and the superior thyroid artery (yellow arrow).

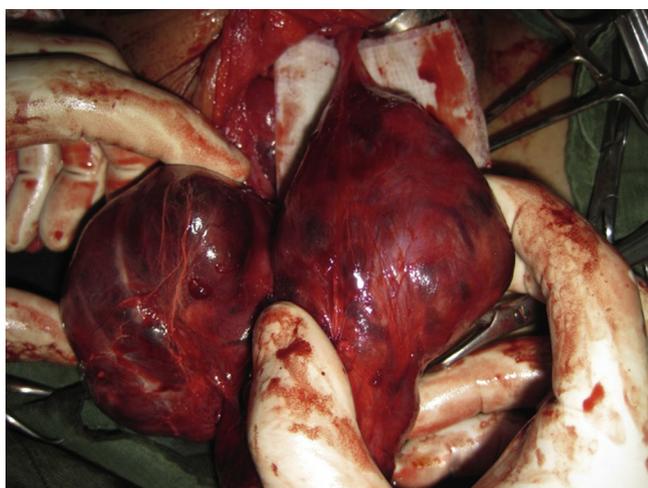


Fig. 5. Complete division of the ligament of Berry allows the thyroid lobe to be drawn caudally by peeling the avascular plane between the anteromedial border of the upper pole and the cricothyroid muscle. This affords an unparalleled view of the superior pole, superior thyroid artery, EBSLN and related structures.

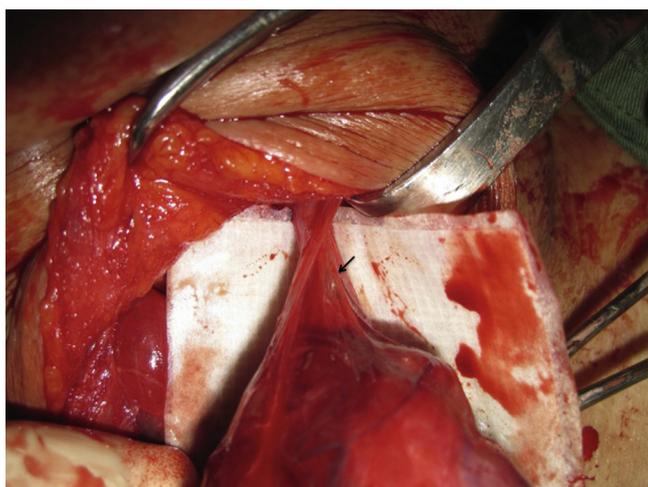


Fig. 6. Retrograde thyroidectomy affords an unparalleled view of the superior pole, superior thyroid artery (arrow) and related structures.

- (B) 'Lateral retraction of the upper pole of the thyroid lobe opens up the avascular space between the lobe and the cricothyroid muscle, thus exposing the EBSLN'.¹
- (C) 'The superior thyroid vessels are ligated close to the thyroid capsule of the superior pole to avoid inadvertent injury to the EBSLN'.⁹

Although these techniques may be beneficial for small goiters, they prove challenging with a grossly enlarged gland. This is because the ligament of Berry firmly fixes the lobe to the cricoid cartilage and supero-lateral trachea.^{10,11} Because of this fixity an enlarged upper pole will push the superior thyroid vessels cranially, well above its normal anatomical position. The EBSLN, however, does not ascend with the upper lobe. It maintains the normal anatomic course descending on the surface of the inferior constrictor to the cricothyroid muscle.^{12,13} In this new relationship the EBSLN becomes caudal to the enlarged and ascended upper pole, rendering it at high risk for iatrogenic injury.

In addition to distorting the relationship between EBSLN and the upper pole structures, the ligament of Berry poses an additional problem intra-operatively that limits the performance of a "classic" thyroidectomy for large glands. The lobe is firmly fixed by the ligament of Berry and this limits downward traction of an enlarged upper pole, severely limiting exposure of the superior thyroid vessels and the EBSLN. Moreover, it is difficult to achieve 'lateral retraction' of an enlarged, bulky upper pole to enter the avascular space between the superior thyroid vessels and cricothyroid in order to expose and preserve the EBSLN.

This technique of retrograde thyroidectomy overcomes all of these challenges that will exist with a large, difficult goiter. We have demonstrated the unparalleled exposure that easily allows the surgeon to identify the superior thyroid vessels and the relationship with the EBSLN. Abnormalities in the course of the EBSLN would also be easy to identify with this technique. Because it eliminates "cephalic localization" of the upper pole, it allows the surgeon to easily identify type 2b variations in which the nerve is at very high risk of iatrogenic injury.^{13,14} In our view, the surgeon's control over voice complications is the meticulous dissection of the ligament of Berry since the RLN enters the larynx at its lateral border and the EBSLN lies immediately superior to it.^{10,11,13,14} Complete division of the ligament of Berry will free the entire lobe, leaving it attached only by the superior pedicle and allowing clear visualization of these structures. Theoretically, adoption of this technique should result in a decrease in the incidence of EBSLN injury.

4. Conclusion

The technique of retrograde thyroidectomy affords excellent exposure and better visualization of the superior thyroid artery and the EBSLN. This should reduce the incidence of EBSLN injury during thyroidectomy. We recommend retrograde thyroidectomy when fixation by the ligament of Berry causes the enlarged superior pole and its vessels to extend well above the cricothyroid muscle and EBSLN (placing the latter at increased risk).

Consent

Written informed consent was obtained from the patient for publication of this case report and case series and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Conflict of interest

None declared.

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Ethical approval

Ethical approval was granted by the University of the West Indies' Institutional Review Board.

Authors' contributions

VN conceptualized and edited the manuscript. SOC prepare the manuscript. RM and DD revised the manuscript and all authors agreed with the intellectual content.

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