

Aberrant Course of the Middle Thyroid Vein and Unusual Peripolar Branching of the Inferior Thyroid Artery Associated with a Quadrifurcation of the Recurrent Laryngeal Nerve: A Complex Anatomical Variant during Thyroidectomy

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Abstract

Introduction: The safety of thyroidectomy relies on a thorough knowledge of the anatomy of the thyroid bed. We report an exceptional case combining an aberrant course of the middle thyroid vein (MTV), peripolar branching of the inferior thyroid artery (ITA), and an early extralaryngeal quadrifurcation of the recurrent laryngeal nerve (RLN). **Case Report:** A 35-year-old female patient underwent total thyroidectomy for a compressive multinodular goiter evolving over 8 years. Intraoperative exploration revealed a complex, high-risk anatomical arrangement across three planes: 1) An aberrant ascending MTV creating a venous mask over the ITA; 2) An ITA with peripolar branches bypassing the lower pole; 3) An early extralaryngeal quadrifurcation of the RLN in a strictly retrovascular position. **Results:** Step-by-step ultraglandular capsular dissection enabled safe ligation of the aberrant MTV, preservation of the parathyroid vascular arcade, and individual visualization and tracking of all four RLN branches until their muscular entry. The postoperative course was uneventful, with complete resolution of compressive symptoms, no voice impairment, and no clinical signs of hypocalcemia. **Conclusion:** The concomitant presence of these three anatomical variants represents a significant surgical challenge. Early identification and meticulous capsular dissection are essential to prevent vascular, neurological,

and parathyroid complications.

Keywords

Thyroidectomy, Recurrent Laryngeal Nerve, Quadrifurcation, Middle Thyroid Vein, Inferior Thyroid Artery, Anatomical Variation

1. Introduction

Thyroidectomy is a highly codified procedure whose safety relies on a thorough knowledge of the anatomy of the thyroid bed [1] [2]. Exposure of the Simon/Kocher triangle requires meticulous identification of the vascular structures and the recurrent laryngeal nerve to prevent hemostatic, parathyroid, and neurological complications [1] [2]. While the classic relationships between the recurrent laryngeal nerve and the inferior thyroid artery are well documented, the simultaneous presence of venous and arterial vascular variants associated with multiple recurrent laryngeal artery branches creates a high-risk intraoperative hazard [1] [2]. The aim of this study is to report an exceptional case involving an aberrant course of the middle thyroid vein, an unusual peripolar branching of the inferior thyroid artery, and a quadruple recurrent laryngeal nerve.

2. Observation

A 35-year-old female patient consulted for an ante-cervical swelling that had been developing for more than 8 years. Her medical history showed no history of travel to an area where goiter is endemic, no family history of goiter, no history of medication use, and no history of previous cervical irradiation.

Clinical examination revealed a painless anterior cervical mass that moved with swallowing. The patient reported signs of local compression, such as respiratory distress and pharyngeal discomfort, which prompted the surgical indication. There were no clinical signs of hyperthyroidism or hypothyroidism. Laboratory tests confirmed a euthyroid state (TSH, T3, and T4 within normal limits). Cervical ultrasound showed bilateral nodular goiters without any signs of malignancy. A cervical CT scan was not performed.

The procedure was performed under general anesthesia. During the approach to the posterior and lateral vascular junction of the right thyroid lobe, intraoperative exploration revealed a particularly sinuous anatomical arrangement in three planes (**Figure 1**):

- Superficial plane (Middle thyroid vein): The right middle thyroid vein exhibited an aberrant ascending course, directly superimposed on the course of the inferior thyroid artery and forming a venous mask spread over the underlying arterial axis.
- Intermediate plane (Inferior thyroid artery): The inferior thyroid artery exhibited an unusual, peripolar branching, giving off arterial branches that bypassed

the lower pole of the thyroid gland before providing parenchymal and parathyroid vascularization.

- Deep plane (Recurrent laryngeal nerve): The right recurrent laryngeal nerve was in a strictly retrovascular and perpendicular position. Ascending dissection of the nerve revealed a quadrifurcation. early extralaryngeal, the recurrent trunk dividing into four distinct branches before its entry under the crico-thyroid/crico-pharyngeal muscle.

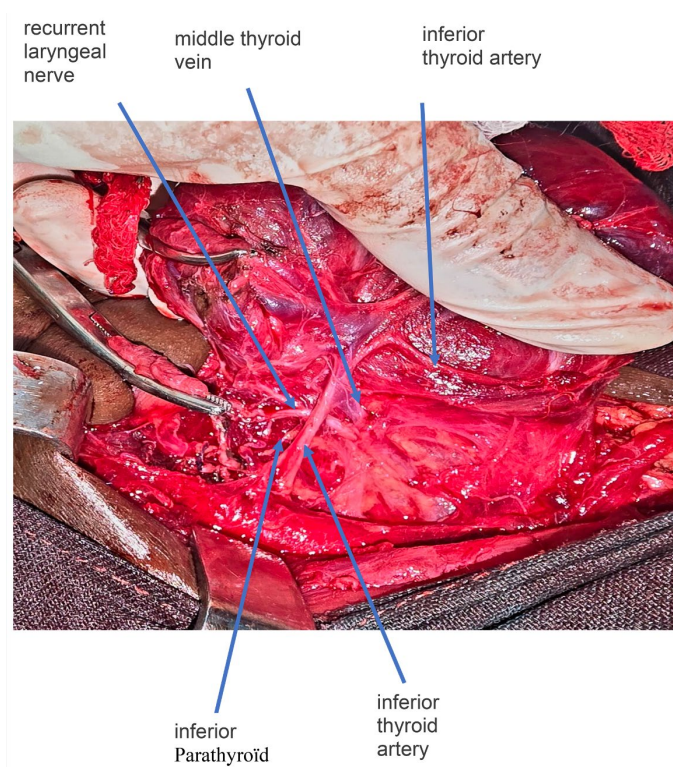


Figure 1. Intraoperative exploration.

3. Results

The step-by-step ultra-glandular dissection strategy allowed for the safe completion of the total thyroidectomy (**Figure 1, Figure 2**):

- Hemostatic control: The initial section of the middle thyroid vein with an aberrant course between two ligatures freed the underlying arterial axis and allowed direct visualization of the lower pole.
- Parathyroid and arterial preservation: Careful dissection of the unusual and peripolar branches of the inferior thyroid artery allowed preservation of the parathyroid vascularization while freeing the glandular parenchyma.
- Neurological safety: Complete isolation of the recurrent trunk and individual monitoring under direct vision of the four branches of the quadrifurcation until their muscular penetration prevented any risk of section or untimely stretching (**Figure 3**).

The postoperative course was uneventful. The patient experienced complete

resolution of preoperative compressive symptoms, without dysphonia or signs of hypocalcemia. An evaluation including serum calcium was normal at 2.4 mmol/L, while TSH was elevated at 4 mIU/L. The patient was started on levothyroxine at an initial dose of 100 µg/day. Postoperative nasofibroscope revealed normal mobility of both vocal cords. Histological examination of the surgical specimen confirmed a thyroid adenoma. Follow-up clinical, biological, and ultrasound monitoring was normal. This included nasofibroscope, serum calcium measurement on postoperative day 2, TSH measurement at 6 weeks, and then an annual ultrasound.

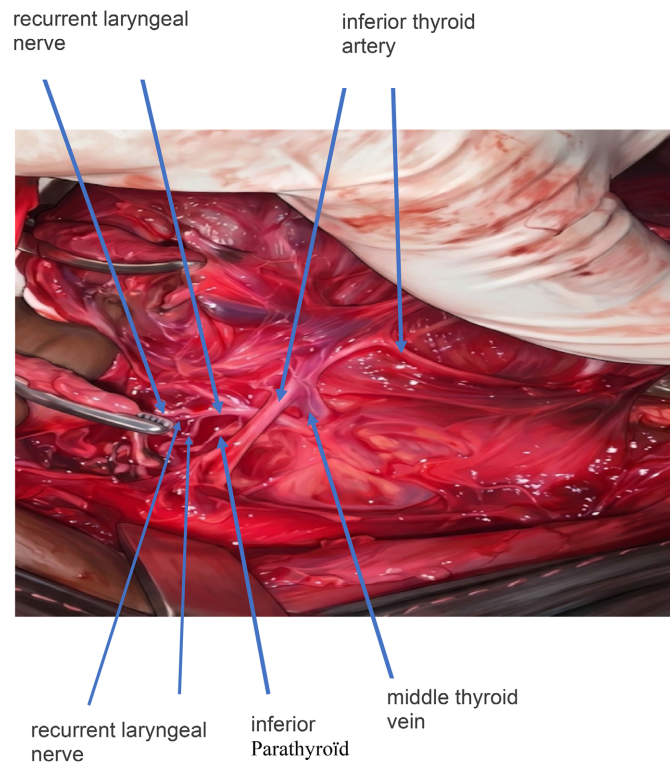


Figure 2. Ultra-glandular dissection strategy.



Figure 3. Intraoperative view of the thyroid bed.

4. Discussion

Thyroid surgery relies on a rigorous understanding of the anatomy of the thyroid bed, as the prevention of major complications (suffocating hematoma, recurrent laryngeal dysphonia, and hypoparathyroidism) requires systematic and ultraglandular dissection. The originality of our observation lies in the concomitant association of three major anatomical anomalies within the same surgical space: a middle thyroid vein (MTV) with an aberrant course, an inferior thyroid artery (ITA) with peripolar branching, and a quadrifurcation. Early extralaryngeal involvement of the inferior laryngeal/recurrent nerve (NLR).

The thyroid vein (TV) is typically the shortest and most taut vascular element connecting the mid-pole of the gland to the internal jugular vein (IJV) [1]. Literature reviews highlight that while the TV generally exhibits less variation in its junction than the inferior thyroid veins, its course and presence can fluctuate significantly [2]. In our case, the TV presented an aberrant ascending course directly superimposed on the axis of the inferior thyroid artery (ITA), creating a true superficial “venous mask”. As reviews on thyroid venous drainage remind us, a lack of awareness of these atypical courses exposes the patient to a major risk of venous laceration or avulsion at the level of the IJV’s flank during traction maneuvers of the goiter mass [2]. Ligation and initial sectioning of this aberrant TV represented the key step in hemostatic control, freeing access to the posterior junction.

The ITA exhibits numerous variations in origin, course, and termination. While aberrant origins directly from the common carotid artery have been reported as rare variants [3], alterations in its terminal branching pose a direct challenge to preserving parathyroid vascularization. In this case, the ITA gave off branches arranged peripolarly around the inferior pole. This arrangement necessitated strict subcapsular dissection to avoid devascularizing the inferior parathyroid gland. Preserving the parathyroid vascular arcade as close as possible to the parenchyma prevented any signs of postoperative hypocalcemia.

Extralaryngeal division of the recurrent laryngeal nerve (RLN) is a variant frequently described in anatomical and surgical series [4] [5]. The anatomical study by Sidibé *et al.*, involving 796 cases, highlights the frequency of variations in the course and branching of the recurrent laryngeal nerve, emphasizing the need for methodical visual identification [6]. Similarly, studies of thyroidectomy series confirm that the nerve most often divides into 2 or 3 terminal branches before entering under the cricothyroid/cricopharyngeal muscle [4] [5].

However, a quadrifurcation Early extralaryngeal involvement, as observed in our patient, represents an extremely vulnerable branching pattern. Each branch can have a specific motor or sensory function. Mistaking one of these thin nerve filaments for fibrous bands or parathyroid vascular pedicles is a classic pitfall leading to partial vocal cord paresis or paralysis. Only complete exposure of the main trunk and individual monitoring under direct vision of each of the four branches up to their muscular penetration ensured the integrity of phonatory function.

5. Conclusion

This rare anatomical combination—an aberrant course of the middle thyroid vein, an unusual and peripolar branching of the inferior thyroid artery, and a quadri-furcation of the recurrent laryngeal nerve—presents a major technical challenge during thyroidectomy. In this patient, who underwent surgery for a compressive goiter, early recognition of these anomalies and an ultraglandular capsular dissection ensured safe surgical resection, preserving voice function and serum calcium levels.

Ethical Approval Statement

It was a purely scientific work aimed at improving the grip of the in charge in the field of otology. The ethical standards were strictly followed for each study participant with their informed consent, and respect for anonymity.

Author Contributions

Concept—N’faly Konate; Design—N’faly Konate; Kassim Diarra; Souleymane Siriman Magassouba; Supervision—Kassim Diarra; Souleymane Siriman Magassouba, Tiemoko Diakité, Djibo Mahamane Diango, Mohamed Keita; Resources—N’faly Konate; Kassim Diarra; Sidibé Mamadou; Materials—N’faly Konate; Sidibé Mamadou; Mohamed Keita; Data Collection and/or Processing—N’faly Konate; Kassim Diarra; Moussa Bourama Keita; Analysis and/or Interpretation—N’faly Konate; Literature Search—N’faly Konate; Kassim Diarra; Writing Manuscript—N’faly Konate; Critical Review—N’faly Konate; Kassim Diarra; Souleymane Siriman Magassouba; Tiemoko Diakité, Warsama Isman Aden; Idriss Arab, Moussa Konate, Yaya Dembele, Ibrahim Bouare, Djibo Mahamane Diango, Mohamed Keita.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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