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Proper handling of the pyramidal lobe in minimal access thyroid procedures

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Abstract

The thyroid gland is a butterfly-shaped gland located in the lower part of the anterior surface of the neck between the fifth cervical and the first thoracic vertebra. Usually, it consists of two lateral, almost symmetrical lobes, the connective isthmus and the pyramidal lobe. The pyramidal lobe is a conical or cylindrical projection of the gland's parenchyma that extends superiorly to the thyroid cartilage or the hyoid bone. Most often, it originates from the isthmus and it is located to the left of the middle line. It can be absent in up to 50% of the cases. From the time of Theodor Kocher who performed the first classic thyroidectomies, we are now entering the era of minimal access thyroid surgery where new techniques are devised in order to provide a better cosmetic result. The presence of the pyramidal lobe is a classic example of an anatomic variation of the thyroid gland that plays an important role in the completeness of a total thyroidectomy, especially when the procedure is carried out for an autoimmune or malignant disease. The pyramidal lobe can also increase the complexity of minimal access procedures that are nowadays applied for the removal of the thyroid gland. The purpose of this article is to outline the importance of the pyramidal lobe in minimal access thyroid surgery.

Keywords Anatomic variation · Endoscopy · Minimally invasive surgical procedures · Thyroid gland · Thyroidectomy

Introduction

The thyroid gland is a butterfly-shaped, extremely vascular, endocrine gland that typically consists of two lateral, almost symmetrical lobes, the connecting isthmus and the pyramidal lobe [1–3]. The pyramidal lobe is a conical or cylindrical projection of the gland's parenchyma that extends superiorly to the thyroid cartilage or the hyoid bone. It usually originates from the lower crest or the anterior surface of the isthmus, but sometimes it originates from one of the lateral lobes (more commonly the left) [1]. In rare cases it is detached from the rest of the thyroid gland or it consists of two or more parts [2, 3]. The pyramidal lobe is an embryological remnant of the thyroglossal duct and it is attached to the hyoid bone with connective tissue [1, 3].

Since 1909, when Theodor Kocher was awarded a Nobel Prize for rendering thyroidectomy a safe surgical procedure [4, 5], minimal access techniques have mostly replaced the classic procedure with the aim of minimizing tissue damage and postoperative pain, as well as improving the cosmetic result, minimizing the cost and length of hospital stay, while having an acceptable percentage of complications [6].

The aim of the present review is to highlight the importance of the pyramidal lobe in the era of minimal access and endoscopic surgery, possible technical problems generated by its existence and possible solutions.

Minimal access thyroid surgery

Minimal access thyroid procedures are divided into three main categories: non-endoscopic thyroidectomies, partly endoscopic, and completely endoscopic [7, 8]. Non-endoscopic minimal access thyroidectomy is performed in a similar way to conventional thyroidectomy but through a smaller incision, while endoscopic procedures are performed with or without gas insufflation through different

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routes, such as the axilla, the breast or the anterior chest. In the first category, the only procedure that is actually included is mini-incision thyroidectomy, which bares the closest similarity to conventional thyroidectomy. It is conducted through a smaller incision that is placed higher in the neck. The use of accessory tools such as headlights and magnifying glasses can be quite helpful to the surgeon. In the category of partly endoscopic procedures, minimally invasive video-assisted thyroidectomy (MIVAT), transaxillary gasless robotic thyroidectomy, and robotic facelift thyroidectomy (RFT) are included. These procedures have two parts, one open and one endoscopic or robotic. The last category includes axillo-bilateral breast approach (ABBA) and bilateral axillo-breast approach (BABA) as well as transoral thyroidectomy. These procedures are performed purely by the use of endoscopic tools that are inserted through small holes eliminating the need for larger incisions.

Mini-incision thyroidectomy

Mini incision thyroidectomy without the use of an endoscope is the most closely related minimal access method to conventional thyroidectomy [6, 7]. It is performed through a 3 cm or less incision [6]. The surgeon usually uses a headlight and magnifying glasses-loupes (loupes assisted thyroidectomy-LATE). This technique can be performed with loco-regional anesthesia through superficial and deep cervical block, which reduces postoperative pain [6, 9]. Concerning pyramidal lobe, the difficulty in this technique lies in its complete removal through the small incision. The key-point in this operation is performing the incision high enough in the neck, above the isthmus of the thyroid gland —especially when echographic evidence or high suspicion exists of a pyramidal lobe. The creation of a skin flap up to the point of the notch of the thyroid cartilage, as well as the removal of a part of the subcutaneous tissue allows the creation of a long enough canal directed to the hyoid bone. This allows the recognition and complete excision of the pyramidal lobe along with small thyroid-tissue islets that are included in the fibrous cord that is the remnant of the thyroglossall duct.

Minimally invasive video-assisted thyroidectomy—MIVAT

MIVAT is one of the most popular and widely used minimal access techniques due to its simplicity and its steep learning curve [7, 9, 10]. Only thirty cases seem to be enough to achieve an efficient level of performance and safety [11]. Although the procedure was initially used for the treatment of benign thyroid diseases, it can now be applied to all categories of thyroid pathologies. There are only few absolute contradictions, which include previous neck surgery, high risk differentiated thyroid cancer, an estimated thyroid volume over 25 ml and a size of a malignant nodule over 2 cm [11].

The procedure is carried out through a 1.5 cm incision 2 cm above the sternal notch and has two parts; one endoscopic and one open. At first, the thyroid gland is exposed after incising the cervical linea Alba and then it is bluntly dissected from the strap muscles. Afterwards, the thyroid lobe is retracted medially in order to facilitate enough working space for the placement of the endoscope. The endoscopic part of the procedure begins by introducing a 5 mm 30° camera. The first step is the ligation of the middle thyroid vein, which allows the mobilization of the lobe. The next target is the superior thyroid pedicle, which is divided using ultrasonic shears. Afterwards, the lobe is retracted medially and the recurrent laryngeal nerve and the parathyroid gland are identified. This marks the end of the endoscopic part of the operation. During the first step of the open part the thyroid gland is gradually removed from the wound by pulling out its free superior pole. The isthmus is divided next in order to allow further mobilization of the thyroid lobe [11]. At this point of the procedure, if a pyramidal lobe exists, special care should be taken in order to avoid incising it along with the isthmus. Moreover, the creation of a subplatysmal elevated flap may be inevitable so as to dissect the pyramidal lobe from the trachea completely and remove it along with one of the lateral lobes. However, this maneuver can be avoided if the surgeon incorporates this step in the endoscopic part of the procedure.

Transaxillary gasless robotic thyroidectomy

Transaxillary robotic thyroidectomy is one of the most commonly used minimal access techniques in Asia [7]. It is performed by a 5–6 cm long incision across the lateral border of the pectoralis major muscle and a 0.8 cm incision in the internal side of the anterior thoracic wall used for the insertion of the fourth trocar [12]. The thoracic incision is placed in the side where the largest thyroid nodule exists [13]. When total thyroidectomy is required, first an isthmectomy is performed and then proceeds to a contralateral lobectomy applying a median to lateral approach. If the pyramidal lobe originates from the same side as the incision, it must be recognized and dissected before incising the isthmus in order to be removed along with the first specimen. If it originates contralaterally to the incision, it must be recognized, dissected, and detached from the pretracheal fascia for the remaining thyroid lobe to be mobilized. The identification and resection of the pyramidal lobe during Robot-Assisted Transaxillary Thyroid Surgery (RATS) can be performed with a relative ease, since all the advantages of performing a surgical procedure using a robot are applied

[14]. These advantages include the use of instruments with increased precision that allow wrist-like movements and the creation of adequate working space with magnification of the operative field and three-dimensional vision.

Axillo-bilateral breast approach (ABBA) and bilateral axillo-breast approach (BABA)

ABBA is performed through one 5 mm port on the rim of each areola and another 5 mm port in the right axilla. The thyroid isthmus is incised and then, the upper pole of the lobe is mobilized and the superior thyroid vessels are ligated [15]. BABA can be performed either robotically or endoscopically using four ports. Two of them are placed in each axilla and the rest in each areola [16]. In these two techniques recognizing the pyramidal lobe in the early stages of the operation is essential. The isthmus is divided parallel to the pyramidal lobe and following the lateral lobe's dissection, mobilization, and detachment from the pretracheal fascia the pyramidal lobe is dissected up to the hyoid bone and removed alongside the rest of the specimen.

Robotic facelift thyroidectomy—RFT

This technique is performed through a retroauricular incision that begins from the retroauricular groove and ends 1 cm inside the occipital hairline. The strap muscles are identified and are retracted ventrally in order to reveal the upper pole of the lateral lobe. Afterwards, the robotic part of the procedure begins [17, 18]. Initially, the superior thyroid vessels are ligated using ultrasonic scissors. The upper pole is retracted downwards to identify the superior laryngeal nerve and the upper parathyroid gland. Then, the recurrent laryngeal nerve is identified and the ligament of Berry is incised. Afterwards, the isthmus is divided and the middle thyroid vein ligated. In the end, the inferior parathyroid gland is identified and the inferior thyroid vessels ligated. The pyramidal lobe plays an important role in cases where this technique is applied for total thyroidectomy. The difficulty lies in the recognition of the pyramidal lobe during the stage of excision of the lobe lying contralaterally to the incision. In this stage, careful maneuvering of the already dissected lobe is required. This can be achieved using long drainage tubes [19]. This aims to create the optimal surgical field in order to identify the pyramidal lobe and excise it along with the rest of the specimen.

Transoral endoscopic thyroidectomy vestibular approach—TOETVA

Transoral thyroidectomy is the most recent minimal access technique in thyroid surgery and is advancing rapidly due to its excellent cosmetic result [20]. It is performed with a vestibular approach (TOETVA). Mainly, it has two advantages over other remote access thyroid procedures. At first, it has the shortest route to its target, thus creating the smallest possible wound. Secondly, it provides a familiar operative field since the thyroid gland is approached as in conventional thyroidectomy but in a cranio-caudal orientation. In cases where a pyramidal lobe is present, its recognition is done with relative ease directly after splitting the strap muscles due to the orientation of the endoscope and the surgical field. The incision of the isthmus is performed in parallel with the pyramidal lobe. This is a key step in the procedure in order to facilitate lateral lobe mobilization, which creates an adequate operating field. Afterwards, the lateral lobe of the thyroid gland is dissected and mobilized further by ligating the superior thyroid vessels and retracting it to the midline. The pyramidal lobe is then dissected and removed along with the rest of the specimen.

Conclusion

The presence of the pyramidal lobe can affect the completeness of total thyroidectomy. Residual thyroid tissue can complicate the postoperative treatment and follow-up of the patients. In the era of minimal access thyroid surgery special care must be taken in order to identify the pyramidal lobe intraoperatively and apply the correct surgical maneuvers to remove it along with the rest of the thyroid gland.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

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