Interventional Techniques of Totally Endoscopic Thyroidectomy

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ABSTRACT

Historical synthesis: The techniques of totally laparoscopic thyroidectomy comes as a trend in the resection of thyroid nodules of small size, since the cosmetic result in this kind of surgery is an important factor for the patients. **Objectives**: The purpose of this article is to list the techniques of minimally invasive surgery for thyroidectomy citing its scoring procedure and their advantages and disadvantages, between itself and when compared with conventional surgery. To this end was made a literature review of recent studies that expose the results of these surgeries in various situations with a significant number of patients. **Discussion**: The approaches were considered minimally videoassisted thyroidectomy (MIVAT), endoscopic approach transaxillary (AA), axillo-bilateral-breast approach (ABBA), Endoscopic Thyroidectomy Using Bilateral Axillo-Breast Approach (BABA), Breast-Approach (BA), which all showed significant cosmetic result.

Key words: Thyroidectomy; Endoscopy; Laparoscopy; Minimally invasive surgery; AA, ABBA, BABA, BA.

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INTRODUCTION

New laparoscopic techniques have been applied in thyroid surgery. Thyroid surgery may be performed using cervical, breast or axillary incisions¹ (Choe J H et al., 2000).

Surgery for the thyroid may be divided into conventional thyroidectomy (cervical incision > 3cm) and minimally invasive procedure which can be subdivided in cervical approach (MIVAT) and extracervical approach (AA, ABBA, BABA and BA).

MIVAT, minimally videoassisted thyroidectomy, is the method that has become most widespread to date. However, this technique is limited because when small incision is performed the size of the specimen resected to be retrieved is also restricted^{1,2}. (Choe et al., 2007, Yamashita H et al.,2002).

AA or endoscopic transaxillary approach to thyroidectomy utilized three 5 mm incisions placed bellow the anterior axillary line equidistant apart which leads to an excellent cosmetic outcome, however, it can only be performed in pre-selected patients³ (Duncan D T et al; 2007).

ABBA or axillo-bilateral-breast approach is a combination of axillary and breast approaches, through two incisions on the margin of the areola and an axillary incision, avoiding a scar on the neck, therefore achieving as well as in AA excellent cosmetic results^{4 5 6 7 8 9 10}.

BABA or Endoscopic Thyroidectomy Using Bilateral Axillo-Breast Approach is the newest endoscopic technique that was developed by a modification of ABBA. It consists of a bilateral incision on the areola as well as axillar which enhance the visualization of the thyroid gland² (Yamashita H et al.,2002).

Thyroid nodules are a common occurrence in clinical practice nowadays; most of them are benign and can be followed clinically without necessity of surgery. However, surgical extirpation occasionally becomes necessary to exclude a malignant neoplasia, and although the majority of surgically excised thyroid lesions are histologically benign, patients are traditionally left with a permanent transverse surgical scar in a highly visible area¹¹. Considering that a significant number of patients are young women, the surgeon should take into consideration complete resection and a better cosmetic result simultaneously³(Yamashita H et al., 2002).

The objective of this study is to describe the technical aspects of endoscopic thyroidectomy surgery emphasizing its advantages and disadvantages.

METHODS / RESULTS

Minimally invasive surgical procedures purport to achieve the same results of the open thyroidectomy, in addition to be a procedure with less pain, faster recovery and improved cosmetic results³(AA).

The operative techniques that have been studied are:

• MIVAT (minimally invasive video-assisted thyroidectomy)¹²

MIVAT approach is based on a technique described by Miccoli et al¹³ with some modifications. The surgeon stands on the right of the patient and the first assistant on the left both at the cervical region. The assistant who is responsible for the optical trocar manipulation stands on the left of the patient and besides the first assistant (on his left). The surgical nurse stands on the right of the patient besides the surgeon, thus a 15mm central incision above the sternal notch is performed and gas insufflation was not necessary. Dissection is performed under endoscopic vision using a zero-degree 5mm optical trocar(Storz®, Germany) and other endoscopic instruments as well as conventional instruments. Hemostasis of superior thyroid pedicle is performed with the Harmonic scalpel and a CS14C clip (UltraCision®, Ethicon Endo-Surgery, Inc. - EUA). Drainage is not necessary. Skin is closed with cyanocrylate sealant(6- micoli, do mivat).

AA (axillar-approach)³

All patients are submitted to general anesthesia, and positioned in the supine position. The neck is slightly extended and the patient's ipsilateral arm on the side of the thyroid lesion is placed at a 90degree angle to the axis of the body, exposing the operative axilla. Three 5-mm incisions are placed below the anterior axillary line equidistant apart. Using blunt dissection through these incisions, the surgeon develops an initial plane beneath the platysma and on top of the pectoralis major muscle. It is used a solution of 1,000 ml of Ringer's lactate, 50 ml of 1% xylocaine and 1 ml of epinephrine, which when is infiltrated in the operative area it facilitates hemostasis and controls post-operative pain.

With carbon dioxide gas insufflation at 7–9 mmHg pressure, a 5-mm endoscope is placed for direct visualization. Scissor dissection is then used to

dissect an avascular plane between the platysma and the pectoralis major muscle. Dissection is directed toward the ipsilateral sternocleidomastoid muscle. When the sternocleidomastoid muscle is identified, a plane between the sternocleidomastoid and the sternohyoid muscle is dissected. After elevating the sternohyoid muscle the sternothyroid muscle is visualized and retracted anteriorly, exposing the ipsilateral thyroid gland. The inferior pedicle is dissected to identify the recurrent laryngeal nerve and the parathyroid gland, and then the vessels are clipped and divided. Smaller vessels were divided with the harmonic scalpel, exposing the ligament of Berry which is divided to prevent the recurrent laryngeal nerve from injury. The thyroid gland is mobilized in a way to freeing the posterior surface of the thyroid from the trachea and allowing exposure of the superior thyroid pedicle. Staying within the capsule of the gland, the surgeon dissects and divides the superior thyroid vessels. Once the lateral and posterior attachments of the gland are divided, the isthmus is exposed, allowing its division using the harmonic scalpel. After transaction of the isthmus, the ipsilateral thyroid is completely mobilized and freed. After a good hemostasis, the gland is placed in an Endocatch (Ethicon_) bag for retrieval. The specimen is extracted by extending the center axillary trocar site. Final inspection of the operative space was accomplished via an angled 5-mm endoscope. Verification of an intact recurrent laryngeal nerve was performed in all patients. The specimen is sent to the pathologist for frozen section diagnosis. A 7-mm horizontal drain is placed in the operative field and brought out through a 5-mm axillary trocar site to obliterate the dead space created and to drain residual fluid. The drain is removed after an average of 2.5 days (range, 2-8 days). All incisions were closed using 4-0 monofilament absorbable suture. Ice packs were placed on the operative chest wall site where surgery was performed and the patient was discharged to the recovery room.

BA (Breast-Approach)¹⁴

This technique consists of a direct dissection of the operative space through the subcutaneous space in the breast area and the subplatysmal space. For this reason, a 15-mm incision between the nipples is performed, and CO2 is insufflated at 6 mm Hg. After three trocars are inserted in this area, and dissection of the thyroid and division of the thyroid vessels and parenchyma is performed using an ultrasonically activated scalpel.

ABBA (Axillo-Bilateral-Breast Approach)¹⁵

ABBA is performed under general anesthesia and in supine position. The operating surgeon and the camera operator should stand on the patient's right. Regarding the patient's position, there is no necessity of neck reclination. Both arms are fixed at an elevation of 90°, with the forearms immobilized. Five mm bilateral skin incisions are made on the margin of the areola of nipple, in order to insert a 5 mm trocar, 20 cm long with a conical tip, through the subcutaneous until the jugular fossa. Under digital guidance and with median orientation, the superficial cervical fascia is perforated. With both trocars in place, a 30x5 mm endoscope is used to create a virtual space with CO2 insufflation at a gas pressure of 6–8 mmHg (Figures 1 and 2).

After an incision in the right axillar fossa a 5 mm optical trocar is inserted in the subcutaneous following the postero-anterior direction until the suprasternal spatium. A Maryland clamp in axillary position and 5 mm harmonic scalpel via the left breast trocar permit a clear view of the virtual space created.

The next step is to prepare the trachea and isthmus. Using delicate blunt dissection, both thyroid lobes are exposed and examined for pathological changes. With a median orientation, the primary isthmus transection is performed with a harmonic scalpel. With mobilization of the upper thyroid pole, the vessels are isolated and divided with the harmonic scalpel close to the thyroid capsule. A clip closure is not performed. It is absolutely necessary to observe where the superior laryngeal nerve is running and to visualize the recurrent laryngeal nerve. The inferior veins should be divided closely to the thyroid capsule. Sufficient distance should be ensured among the heated harmonic scalpel from the recurrent laryngeal nerve and the parathyroids. The resection is performed without bleeding with the harmonic scalpel (Figure 3). If necessary, the opposite side is attended to in the same way.

Via the axillary approach with the incision being widened, a 20 mm trocar is inserted and advanced up to the thyroid lodge to remove the specimen. For large specimens, it is recommendable to use a small bag. If the 20 mm trocar sleeve is too small, blunt digital widening of the subcutaneous tunnel should be performed. This procedure is surprisingly easy which means to say that the technique is not limited by the specimen size. Facultatively, a drain may be placed in the operative area through the axilla.

BABBA (Endoscopic Thyroidectomy Using a Bilateral Axillo-Breast Approach)¹

This technique was developed from a modification of axillo-bilateral breast approach –



Figure 1 - Instruments for Laparoscopic thyroidectomy.



Figure 2 - ABBA (Axillo-Bilateral-Breast Approach).



Figure 3 - Intraoperative aspect of inferior thyroid vessels using ultrassonic dissection.

ABBA, where an axillar incision was added. In this way, a better visualization of the thyroid was obtained.

The surgery is performed under general anesthesia with the patient placed in supine position. The neck is extended and both arms are abducted to provide axillar surgical incisions. Diluted epinephrine solution is injected (1:200,000) into the subcutaneous space in both breasts and bellow the platysmal muscle, in order to reduce perioperative bleeding.

Other two incisions are made on both upper circumareolar areas, and ascendant subcutaneous dissection is performed passing by the subplatysmal region until the region of the procedure is reached (which was extended to the level of the thyroid cartilage superiorly and to the medial border of each sternocleidomastoid muscle). After establishing the working space, a 12 mm port is inserted ipsilateral to the thyroid gland through which the flexible endoscope was introduced. The operational instruments including the Harmonic Scalpel are inserted through the contralateral 12mm port. The working space was established with CO2 insufflation at a pressure of 5– 6 mmHg.

First, a midline incision is made on the gland (in the same place for conventional thyroidectomy). After full visualization of the crico-thyroid membrane, the isthmus, and the central lymph node group, the isthmus is dissected and may, in this way, obtain an optimal lateral and posterior retraction of the thyroid tissue for dissection. Thyroidectomy is performed using Harmonic Scalpel under full visualization of superior and inferior thyroidal arteries, parathyroid glands, and recurrent laryngeal nerves. The resected specimen is inserted into a plastic bag and retrieved through the 12-mm port (areolar). A hispathologic frozen section of the resected specimen is performed intraoperatively for histologic confirmation.

Finally, meticulous hemostasis is attained with endosuture in the midline and a suction drain (Jackson-Pratt) is left in the place, so the skin is reapproximated cosmetically.

DISCUSSION

According Dedivitis RA e col¹², MIVAT is a safe procedure with additional advantages in terms of cosmetic results and postoperative distress¹⁶, when compared to conventional thyroidectomy, as this technique has a small scar and less postoperative pain, because the dissection area is reduced and there is no

necessity of hyperextension of the neck during the procedure. However, only 15% of the patients accomplished the following inclusion criteria¹⁷: thyroid nodule not exceeding 35 mm of maximum diameter; thyroid volume not exceeding 20 ml, absence of both ultrasonographic and laboratory signs of thyroiditis¹⁸. In this study the operative time, as well as the length of hospital stay was not different. There was no conversion to open surgery and no important complications were observed.

In the study of T.D. Duncan and col.³, is considered a less invasive and more direct, in spite of leaving scars in a highly visible region of the patient's neck. Although such scars are usually well tolerated, hypertrophic scarring may occasionally occur, and diminish the patient's self-esteem⁶. Furthermore this direct technique typically limits the size of the specimen to be removed to 3 cm to avoid an undesirable cosmetic outcome¹⁹. The ABBA approach allows a better visualization of the gland; however, it limits the size of the specimen to be retrieved in addition to leave a visible scar (even if small). Whereas the AA approach does not leave a visible scar when the patient is with the arm in the normal posture position, besides it is possible perform extended incisions in the axillary region to extract the gland completely. Another advantage of this approach is the good visualization of the gland, which allows a safest dissection. The limiting factor of this technique is the necessity of handling a large amount of tissue to create an operative space. Herewith, the postoperative pain is a concern which controlled with analgesics.

It was performed a study in 5 female patients depicting a technique through the sternal region. According to Ohgami M e col⁷, the BA is a safe and feasible approach which provided a good cosmetic outcome for the patients. In this study, there was no conversion to open surgery and the patients did not have any complications.

According to a study performed by Shimazu K e col.⁹with 12 patients, a technique derived from the BA (Breast-Approach) was developed and called ABBA (Axillo-Bilateral-Breast-Approach), this technique was described and compared to the BA. Some advantages such as a better visualization of the operative space were observed. When compared to the BA approach the mean operative time was significantly shorter in the ABBA approach. Furthermore, less bleeding was observed. Neither conversion to open surgery nor complications were

experienced. The scar is very small and it became inconspicuous in few weeks. In conclusion ABBA is a better approach than BA, as it is a safe and feasible option particularly for young patients who opt for better cosmetic outcomes.

Benhidjed T e col.¹⁵, in a study of 13 patients treated by ABBA, achieved an excellent cosmetic outcome. The authors observed that with the technical prerequisites and perfect execution of this approach, it can be carried out safely and with a minimum of complications. In this same study he compared this method with the video-assisted method practiced by Miccoli; he defined as the main advantage the absence of a scar on the anterior neck region, in addition to that this technique is not limited to a maximum nodule size of 30mm. Even though this technique is more advantageous, this method is not indicated for surgery in patients with recurrent nodules and malignant tumors. In comparison to other approaches, ABBA permits bilateral thyroid exploration, more space for instrument use, and the removal of larger nodules. The only residuum of the approach is an inconspicuous scar in the axilla and two almost invisible scars in both nipple areolas.

In a second study performed by Benhidjeb T e col.¹⁸ using ABBA technique in 26 women the main objective of the method was the cosmetic result. Conversion to open surgery was not observed, and postoperatively recurrent laryngeal nerve palsy and brachial plexus paresis was observed only in one patient.

In the study of Choe e col.¹, 102 patients were submitted to BABA technique, where the total operative time was 165,3 minutes and length of hospital stay was 1 to 4 days, it did not differ from conventional thyroidectomy. Complications such as unilateral vocal cord (n=4), transient hypocalcemia (n=4), pneumothorax (n=1) and postoperative infection (n=1). There was no postoperative bleeding in any of the cases. However, there were 4 cases of conversion to open surgery, due to uncontrollable bleeding during the procedure, tracheal perforation, multiple nodules and cancer with capsular invasion.

BABA tends to be more invasive than the cervical approach because it requires a wide skin flap to obtain a bigger virtual space.

Cosmetic result of this approach is excellent, as the scars are almost invisible, even if the patients elevated their arms. A simple postoperative questionnaire evaluated patients' satisfaction, in which the result was: 76,5% (78 out 102) excellent, 20,6% (21 out of 102) good, 2.9% (3 out of 102) fair, and there were no bad responses.

CONCLUSION

We can conclude that all endoscopic techniques are safe. Among its advantages, the most noteworthy is a better cosmetic result, which is relevant because as it was said before a significant number of patients are young women with histopathologic benign nodules.

Among the minimally invasive surgeries the AA (Axillar-Approach) is the one with better cosmetic outcome, and BABA (Bilateral-Axillo-Breast-Approach) is the one which allows a better visualization and operative space. However, there are not enough studies to demonstrate that a method is superior to other methods, as all of them have advantages and disadvantages.

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