

Complications of neck dissections in papillary thyroid carcinoma. A modified procedure to reduce parathyroid morbidity



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Guglielmo Ardito MD. FACS

Complications of neck dissections in papillary thyroid carcinoma. A modified procedure to reduce parathyroid morbidity

Lymphatic metastasis develops in approximately 20% to 80% of patients with papillary thyroid carcinoma (PTC). Clinically evident pathologic nodes should be treated with therapeutic neck dissection. The extent of lymph node dissection, based on predictable drainage patterns from PTC, includes central compartment dissection with nodal clearance of level VI, and modified radical dissection of the lateral compartment with removal of levels II through V. Neck dissection, though a reliably safe procedure, carries certain potential complications. The most significant morbidity following therapeutic neck dissection for PTC is hypoparathyroidism, related to parathyroid damage leading to temporary or permanent hypocalcemia. This complication occurs most often when lateral neck dissection is combined with total thyroidectomy plus central neck dissection. That increased hypoparathyroidism appears not to be associated with incidental removal of the parathyroid glands or the number of parathyroid glands preserved, but to vascular compromise in the dissected central neck, related to the extension of nodal dissection to include the central neck to lateral cervical compartment. To reduce parathyroid morbidity we have modified the surgical procedure in the management of patients with PTC and neck nodal involvement, and approach, first, the lateral compartment via extrathyroideal space and perform the nodal basins dissection according to operation popularized by O.Suarez and named "functional neck dissection", which is based on the facial compartments and the facial envelope in the neck.

KEY WORDS: Cervical lymph node metastases, Neck dissections, Papillary thyroid carcinoma

Cervical lymph node metastases are a very common hallmark of papillary thyroid carcinoma (PTC) and, depending on the detection method employed, 20% - 80% of those patients harbor lymph node metastases, mostly in the central neck compartment¹ (Fig. 1). Therefore the nodal disease represents the most important issue for surgeons managing patients with PTC and the treatment of the neck has been extensively debated balancing the risk of complications against the long term benefit of any surgical procedure.

The regions typically involved in papillary nodal disease as well as the cervicocentral compartment include also the cervicolateral ones (Fig. 2), where nodal metastases predominate in the ipsilateral cervicolateral compartment

in both the primary and repeated surgery for PTC. There is a clear association between central neck involvement and the likelihood of lateral neck disease, as an increase in the number of positive central nodes is associated with a higher likelihood of lateral neck disease. The ipsilateral portion of the cervicocentral compartment is involved more frequently than the contralateral portion, and the caudal basins (level III and IV) of the cervicolateral compartment are involved more frequently than the cranial basin (level II) and the posterior triangle basin (level V). The American Thyroid Association (ATA), published in 2009 evidence-based guidelines²⁻⁴ as a contribution in the clinical management of patients with PTC and neck nodal disease, and revised them in 2012 and 2016. In such guidelines ATA proposed therapeutic lateral and central neck compartmental lymph node dissection for patients with biopsy-proven metastatic lateral and central cervical lymphadenopathy (Recommendation 37 and 36 A: Strong recommendation, Moderate-quality evidence) and considered prophylactic central-compartment neck dissection (ipsilateral or bilateral) only for

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Corrispondece to: Prof. Guglielmo Ardito, Piazza F.M. Lante 9, 00147 Roma, Italy (e-mail: arditog@libero.it)

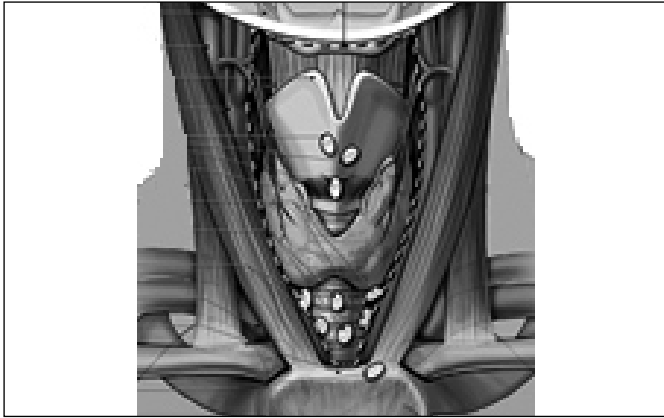


Fig. 1: Cervico central compartment.

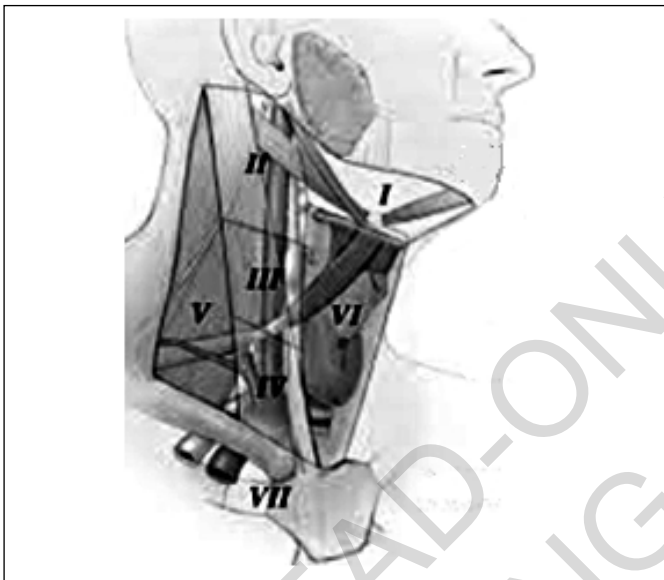


Fig. 2: Cervico lateral compartment.

patients with PTC with clinically uninvolved central neck lymph nodes (cN0) who have advanced primary tumors (T3 or T4) or clinically involved lateral neck nodes (cN1b) or if the information will be used to plan further steps in therapy (Recommendation 36 B: Weak recommendation, Low-quality evidence).

Since ATA revised guidelines, therapeutic central and lateral neck dissection, in addition to total thyroidectomy (TT) are held to be for most institutions worldwide the standard surgical management of patients with PTC complicated by neck nodal disease. While there is total agreement on the recommendation that prophylactic lateral neck dissection should be never indicated, the routine use of prophylactic central lymph node dissection at the time of the initial thyroid surgery remains a matter of debate and the decision-making continues to rely on surgeon judgment, based on pre-

operative and intraoperative evaluation of the central compartment associated to evaluation of patient's prognostic risk factors⁵⁻⁹.

The current surgical procedure for treating the lateral compartment of the neck in PTC is modified neck dissection (MND) with the removal of nodal levels from II to V, sparing the spinal accessory nerve, the internal jugular vein, and the sternocleidomastoid muscle. The extent of lymph node dissection is based on knowledge of the distribution of nodal metastases from different primary patient sites and neck dissections should remove only the lymph node groups that are considered to be at high risk of containing metastases¹⁰. On the basis of anatomic and clinical observations on distribution of neck lymph node metastases in PTC patients, the appropriate procedure of lateral neck dissection (LND), directed by the patterns of lymphatic drainage from PTC, includes levels II through V for optimal outcomes and comprehensive neck dissection with the removal of nodal basins from level I to V may be considered an inappropriate procedure¹¹⁻¹⁵.

Since low incidence of nodal metastases at level IIIb and Va, the ATA consensus review concluded that these basins may not need routine clearance, unless their proved involvement, and LND of at least nodal levels IIa, III, IV and Vb should be performed when indicated to optimize disease control in PTC.^{3,15}

A central node dissection (CND) includes removal of the nodal subgroups within the central compartment referred to as level VI of the neck, i.e. the prelaryngeal (delphian), pretracheal and both the right and left paratracheal nodal basins¹⁶. The superior mediastinal nodes (level VII) which are more of concern in patients with medullary thyroid carcinoma, should be included in cases with clinically metastatic disease at level VI. Even though LND and CND are a reliable and safe surgical procedure for metastatic thyroid carcinoma, however, due consideration must be given to certain complications.

Potential complications from CND include hypoparathyroidism, recurrent laryngeal nerve palsy, and injuries to the trachea and esophagus. Potential complications from LND include injury to the thoracic duct, to the internal jugular vein, to the carotid artery, and nerve injuries, as to the spinal accessory nerve, to the hypoglossal nerve, to the phrenic nerve, and to the sympathetic cervical plexus.

Dangers of hypoparathyroidism to be avoided

There is a large body of evidence documenting that hypoparathyroidism, both transient and permanent, represents the most significant morbidity following neck surgery for PTC patients^{1,17,18,19,20}.

Permanent hypocalcemia after TT has been reported to occur in 0.4 to 13.8% of cases. Transient hypocalcemia

after TT is usually more commonly observed from 8.3 to 36.5%.

Patients undergoing TT with CND may experience greater overall hypocalcemic morbidity compared with patients who undergo a TT alone. As documented by Giordano D. et al. in their study, the node dissection plus TT group experienced an increased incidence of postoperative transient and permanent hypocalcemia, from 27.7% (TT group) to 51.9% (TT plus CND group) and from 6.3 (TT group) to 16.2% (TT plus CND group) respectively (20). The addition of LND to CND plus TT results in an increased risk of postoperative hypocalcemia compared with patients undergoing TT plus CND^{18,19}. Roh J.L. et al. found a highest incidence of hypocalcemia in patients undergoing TT combined with CND plus LND compared with patients undergoing a TT plus CND (TT plus CND 30.5% versus TT plus CND plus LND 46.2%) and suggested vascular imbalance as possible reason¹⁹. Hypocalcemia appeared not to be associated with incidental removal of the parathyroid glands or the number of the parathyroid glands preserved during surgery. The extension of nodal dissection to include the central neck to lateral compartment increased the vascular compromise in the dissected central neck and in the parathyroid glands, which caused a higher rate of hypoparathyroidism during the early postoperative weeks. A possible explanation should be that the nodal clearance between the internal jugular vein and the carotid artery, when performing LND, may disturb the inferior thyroid artery at its origin thereby interrupting its blood supply to the parathyroid glands. The tiny and terminal parathyroid vessels, just accurately preserved in the dissected paratracheal area, respond to that injury disrupting even more the blood supply to the glands prolonging the ischemic damage with significant parathyroid morbidity. In addition, the dissection at level IV, in the supraclavicular space, very close to the inferior parathyroid glands, may compromise the parathyroid drainage system and favour the venous congestion²¹.

Suggestion to change the surgical technique in papillary thyroid carcinoma. A modified procedure to reduce parathyroid morbidity

Taking in due account these potential vascular implications, we have modified the surgical procedure in the management of patients with PTC and neck nodal involvement and perform, as first step, the clearance of the lateral compartment by an access totally external to the thyroid space. After lateral nodal basins dissection is completed, in the same session, we accomplish total thyroidectomy combined with central neck dissection via the usual cervical medial approach^{22,23,24}. The removal of all the lymph nodes regions, II through V,

is performed according to the criteria of the *functional neck dissection* proposed by Osvaldo Suarez^{25,26}. This type of regional neck dissection, inaccurately called "modified neck dissection" is not just a comprehensive operation but a conceptual approach to the neck through fascial spaces and the rationale for this surgical procedure was defined on the basis of the anatomic studies of Truffert²⁷ and Pernkopf²⁸.

The term functional neck dissection (FND) and the technique of FND must be associated with the name of Suarez and represent a different accepted procedure based on anatomic concepts derived from fascial compartmentalization of the neck. FND removes all the connective tissue together with lymph nodes at level II, III, IV and V as well as modified or radical neck dissection, and may preserve the cervical fascial envelope, unless interested by the tumor, along with the three important structures, the sternomastoid muscle, the accessory nerve, and the internal jugular vein. Given that the majority of patients with PTC present neck nodal disease without invasion of the fascial planes (nodal cancer) FND may be considered the procedure of choice in the management of PTC with nodal disease. When the tumor invades the fascial planes (neck cancer) and in patients previously treated with radiotherapy or other types of neck surgery, the use of FND is no longer possible.

Suggested modified operative technique for LND in PTC with nodal disease

Before to set out neck surgery we perform a preoperative ultrasound lymph node mapping of both the lateral and central compartment to confirm the sites of nodal metastases and evaluate the possibility of a FND by approaching the neck through fascial spaces.

We dissect, first, the lateral neck compartment via extrathyroidal space. Through a high cervical incision we enter into the lateral compartment between the strap muscles and the sternocleidomastoid muscle (SCM), after the incision of the superficial fascia of the neck and the pretracheal layer (Figs. 3, 4). The anterior margin of the SCM muscle is freed, and the muscle is retracted laterally. The neurovascular bundle is reached, running along the superficial fascia of the neck, posteriorly to the SCM, and finally is approached the cervicolateral lymph node system (Fig. 5). The described access is totally external to the thyroid area and provides a fully operative field allowing us to dissect the lateral compartment' nodes from the supraclavicular space (level IV) to the level of the carotid artery bifurcation (level II). If we confirm, intraoperatively, that the tumor is a nodal cancer and the indication for the FND, we preserve the fascial planes, and the nodal dissection is confined into the lateral compartment, which is encased in fascia and can be dissected cleanly at the

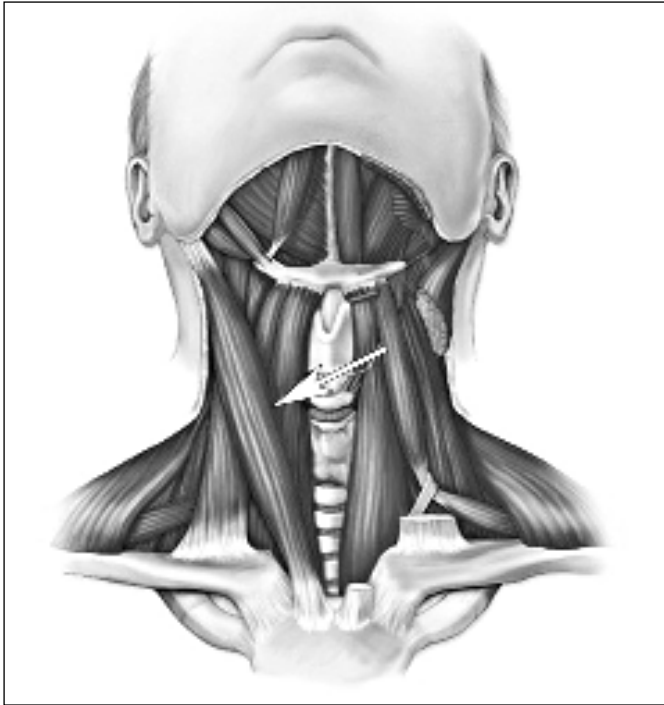


Fig. 3: Extrathyroidal access (white arrow) to the lateral compartment, frontal view.

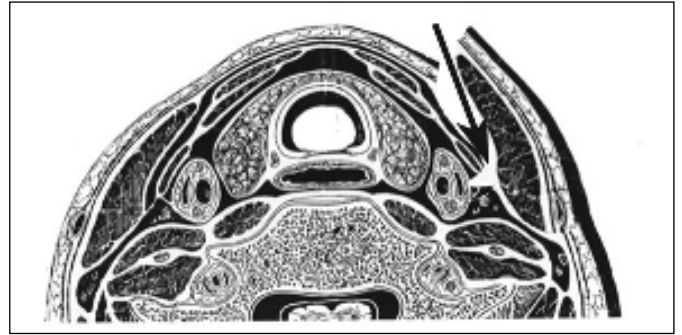


Fig. 5: Transverse section of the neck to show the approach (black arrow) to the lateral compartment.

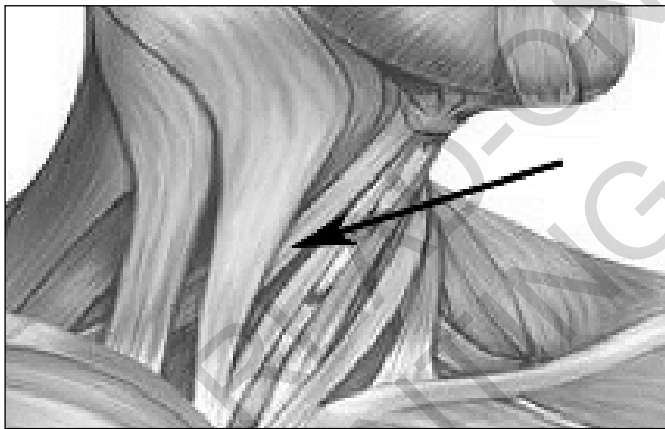


Fig. 4: Extrathyroidal access (black arrow) to the lateral compartment, lateral view.

surface of the fascia, without entering into the central compartment. The central compartment with its content, is protected from the injury risk by the carotid sheath and the potential complications should be only those affecting the lateral compartment. The dissected area of the lateral neck nodes is the superficial layer anteriorly and laterally, the carotid sheath medially, the prevertebral layer posteriorly.

After the lateral node dissection has been completed, thyroidectomy with cervicocentral nodal compartment dissection will be performed at the same surgical session entering into the thyroid space through the traditional middle line of the strap muscles.

Approaching the neck via extrathyroidal space and performing fascial dissection of the lateral node basins in accordance to technique of FND by Suarez, the vascular dysfunction, which may occur during the nodal clearance at levels II, III and IV, should produce irrelevant injuries in the paratracheal area, surgically safe and with an intact parathyroid vascular system. The complications of the lateral compartment, approached and dissected separately from the central compartment, should be only those related to that area and may not include hypocalcemic morbidity, and the rates of temporary and permanent hypoparathyroidism should not differ from those reported when TT plus CND is combined or not combined with a LND.

With the aim to convalidate the rationale of the anatomic and surgical concepts previously debated and legitimate the approach to the neck through fascial spaces, we have enrolled 62 patients with PTC and neck disease and have performed total thyroidectomy plus central and lateral neck dissection, according to the presented operative technique. The results of our study (29) proving that patients operated on with the modified procedure experienced lower parathyroid morbidity compared with patients operated on with the traditional ones, encourage us in performing the proposed neck surgery for PTC with nodal involvement as well as vascular imbalance should be a potential risk factor of postoperative hypoparathyroidism.

Riassunto

Il carcinoma papillifero della tiroide è la neoplasia endocrina più frequente e la sua caratteristica peculiare è la spiccata linfonia. Infatti, con incidenza variabile dal 20 all'80 % in relazione al criterio diagnostico impiegato, i pazienti con carcinoma papillifero si presentano al momento della diagnosi con linfonodi metastatici nel distretto cervicale, prevalentemente nel compartimento centrale. Non essendo, ancora, stato oncologicamente interpretato il significato prognostico della metastasi linfonodale il ruolo e l'estensione della linfadenectomia

sono tuttora oggetto di controversia, pur tuttavia tutte le Società di Endocrinochirurgia sono concordi nel ritenere la linfettomia terapeutica del compartimento centrale (livello VI) e del compartimento laterale (livelli II, III, IV e V) la procedura chirurgica più appropriata. Dai dati della letteratura risulta che l'ipoparatiroidismo rappresenta la complicanza più frequente nei pazienti sottoposti ad intervento di tiroidectomia totale associato a linfettomia cervicale centrale e laterale con la diagnosi di carcinoma papillifero metastatico. Il dato interessante è che tale complicanza si riscontra con frequenza significativamente più marcata nei pazienti che hanno subito interventi di tiroidectomia totale e linfettomia cervicale laterale e centrale rispetto a pazienti sottoposti alla sola tiroidectomia totale con linfettomia centrale. La causa di questa maggiore incidenza potrebbe essere messa in relazione ad una sopraggiunta compromissione vascolare nell'apparato ghiandolare paratiroideo, che si potrebbe verificare quando la dissezione cervicale si estende al compartimento laterale, con una conseguente ulteriore sofferenza funzionale per deficienza di flusso o per congestione venosa. Per tale interpretazione patogenetica della complicanza paratiroidea abbiamo modificato la condotta chirurgica nell'esecuzione della linfettomia cervicale, eseguendo, come primo atto chirurgico la linfettomia del compartimento laterale, utilizzando la tradizionale incisione cervicale, ma accedendo alla loggia sopraclaveare per via extra-tiroidea, ed eseguendo la dissezione delle stazioni cervicali secondo i canoni della linfettomia funzionale del collo, ben codificata da O. Suarez in base agli studi sul sistema aponevrotico e la compartimentalizzazione fasciale del collo.

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