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Single centre data on Role of level 2b lymph node dissection in carcinoma oral cavity.

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I. Introduction

Head and neck cancer accounts for 10 % of all malignancies worldwide and up to 40 % cancer burden in India [1]. Amongst head and neck cancers, oral cavity cancer is the most common and accounting for 30 % of all cases [2]. Squamous cell carcinoma (SCC) is the most common histological type (90 %) of all the oral cavity cancer. Oral cavity cancer is the most common in Indian males with 35 % of total cases and 3rd most common in Indian females with 18 % of total cases [2]. The high incidence of cancer is attributable largely to the habit of chewing betel nuts, tobacco and pan (mixture of tobacco, lime and other substances wrapped in a vegetable leaf). In developing country like India, only 10 to 15% of cases present in localized stages [2].

Metastasis to the regional lymph node (LN) is the single most important prognostic factor in predicting local and distant failure as well as survival. The nodal metastasis reduces the survival by 50% [3]. The primary treatment of oral cavity cancer is surgical resection with adjuvant therapy reserved for more advanced cases, unresectable disease or patient with significant comorbidities that would preclude surgery.

Cancers in the head and neck region commonly metastasize to cervical lymph nodes. The term "neck dissection" refers to a surgical procedure in which the fibrofatty contents of the neck are removed for the treatment of cervical lymphatic metastases. Neck dissection is most commonly used in the management of cancers of the upper aerodigestive tract.

Radical neck dissection was the original surgical procedure described for treatment of metastatic neck cancer. Crile described the operation in 1906, and until recently, radical neck dissection was considered the standard procedure for management of both occult and clinically positive neck disease. In the last 2 decades, a shift toward the use of more conservative surgical procedures has occurred. This shift is predicated upon the following 2 important insights that developed over a period of time: 1) the removal of lymphatic tissue is not hindered by preserving adjacent nonlymphatic structures ; and 2) the specific nodal groups at risk for metastatic disease are predictable on the basis of the size, location, and other features of the primary tumor.

Neck dissection with conservation of nonlymphatic structures was shown by Bocca, Gavilan, and others to yield equivalent oncologic outcomes, with improved functional results. [4, 5] Experimental studies of lymphatic drainage, coupled with clinical studies of the specific location of nodal metastasis within neck dissection specimens, provided the rationale for more targeted surgery. [6, 7, 8] The data allowed for reliable prediction of the lymph node groups most likely to be involved with metastatic disease from specific primary tumor location and established which lymph node groups carry negligible risk of involvement and may be safely preserved. As a result, a great variety of surgical procedures have been described for use in various clinical situations.

There are certain observations which brought the concept of Selective neck dissection (SND) in the management of neck. First, Regional LN involvement in oral cavity squamous cell carcinoma (SCC) is in predictable and sequentially progressive manner. Level IIb LN involvement in oral cavity SCC is seldom. Second, despite advances in surgical and adjuvant chemoradiation therapy, the diagnosis of oral cavity cancer continues to portend a poor prognosis. This is evidence by the fact that overall 5 year survival has remained essentially unchanged over the past 30 years [9]. Third and most important, level IIb LN dissection has been significantly associated with postoperative shoulder dysfunction as a sequel of spinal accessory dysfunction in some patients even when the nerve remains intact secondary to traction or with ischemic injury to the nerve [10, 11]. All conservative techniques try to improve the quality of life, in fact not eliminating level IIb lymph-nodes can lower the incidence of spinal accessory nerve injuries, preserve the roots of the deep cervical plexus, reduce surgical time, and prevent all the complications of modified radical neck dissection. Still most of the patients of oral cavity cancer with clinically palpable LN (cN+) are subjected to comprehensive lymph node dissection.

Even when techniques were developed to preserve the nerve, the dissection of sublevel IIB requires retraction and mobilization of the nerve, which causes postoperative shoulder pain and weakness; electromyographic evidence of accessory nerve dysfunction was reported. [12] The overall incidence of lymphatic metastasis in level IIB in head and neck squamous cell carcinoma is only 4.4%, and its incidence in OSCC was less than 4% in several clinical [13] and molecular studies. [14]

The aim of this study is to evaluate the incidence of lymphatic metastasis in sublevel IIB in oral squamous cell carcinoma patients, and to discuss whether the omission of level IIB would produce the same oncologic outcome.

RELEVANT ANATOMY

The lymphatic drainage of the mucosal surfaces and other tissues of the head and neck is directed to the lymph nodes located within the fibroadipose tissue that lies between the investing (superficial) layer of the deep fascia superficially and the visceral and prevertebral layers underneath. In this space, these lymph nodes tend to be aggregated around certain neural and vascular structures such as the internal jugular vein, spinal accessory nerve, and transverse cervical artery. [15]

In his 1964 study of lymphatic drainage of this area, Fisch, using the technique of lymphography, was able to improve upon the anatomic classification proposed by Rouviere. [8] Fisch classified these lymph nodes into the following 5 categories: junctional, jugular, spinal, supraclavicular, and retroauricular. However, the nomenclature in popular use today comes from the Memorial Sloan Kettering Cancer Center. This classification was used to describe the patterns of metastatic dissemination observed in more than 1000 patients who were treated at the center with radical neck dissection. Lymph nodes in the neck are grouped into levels IV, corresponding with the submandibular and submental nodes (level I); upper, middle, and lower jugular nodes (levels II, III, IV); and posterior triangle nodes (level V).

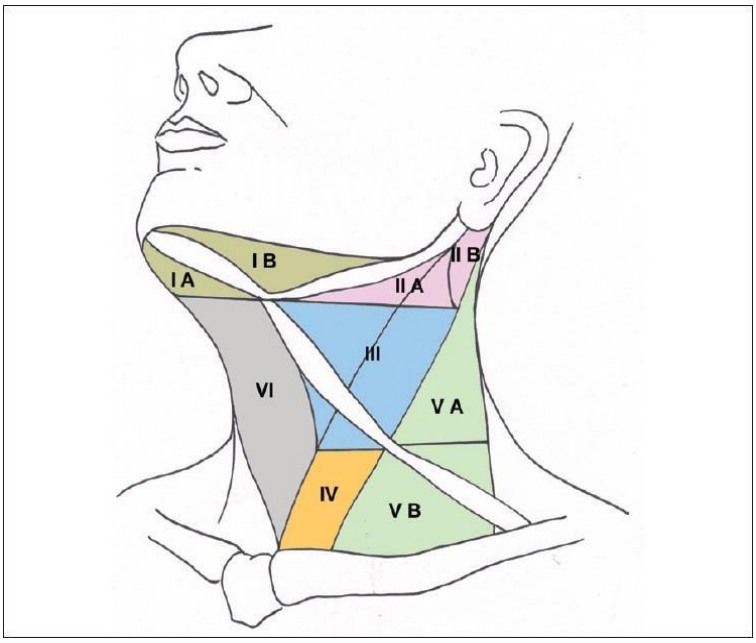


Figure 1: Lymph node levels of neck

Level I

This level has been defined as being bound by the body of the mandible superiorly, the stylohyoid muscle posteriorly, and the anterior belly of the digastric muscle on the contralateral side anteriorly. However, the 2008 classification revision proposed that, as an alternative to the stylohyoid muscle, the vertical plane marked by the posterior edge of the submandibular gland be used as a boundary between levels I and II. [16]

Level I may be divided into level Ia, which refers to the nodes in the submental triangle (bound by the anterior bellies of the digastric muscles and the hyoid bone), and Ib, which refers to the submandibular triangle nodes. The nodes of level Ia are at greatest risk of harboring metastasis from cancers that arise from the floor of mouth, anterior tongue, anterior mandibular alveolar ridge, and lower lip, while the nodes of level Ib often receive metastasis from cancers of the oral cavity, anterior nasal cavity, soft tissue structures of the midface, and submandibular gland.

Closely related, although not strictly a part of the level I group of nodes, are the perifacial nodes, related to the facial vessels above the mandibular margin, and the buccinator nodes, which may become involved with metastasis from tumors in the buccal mucosa, nose, and soft tissues of the cheek and lips.

Level II

Level II lymph nodes are related to the upper third of the jugular vein, extending from the skull base to the inferior border of the hyoid bone. The posterior border of level II is the posterior border of the sternocleidomastoid muscle, while the anterior border of level II has been defined as the stylohyoid muscle. As mentioned above, however, the 2008 classification revision proposed that the vertical plane marked by the posterior edge of the submandibular gland be used as an alternative to the stylohyoid muscle boundary. [16]

The spinal accessory nerve, which travels obliquely across this area, is used as a landmark to subdivide this group into IIb, the portion above and behind the nerve, and IIa, the part that lies anteroinferiorly and closer to the internal jugular vein. The nodes in level II are at greatest risk of harboring metastasis from cancers that arise from the oral cavity, nasal cavity, nasopharynx, oropharynx, hypopharynx, larynx, and parotid gland.

Level III

Level III nodes are located between the hyoid superiorly and a horizontal plane defined by the inferior border of the cricoid cartilage. The sternohyoid muscle marks the anterior limit of level III, and the posterior border of the sternocleidomastoid muscle is the posterior border. Level III most commonly receives metastasis from cancers that originate in the oral cavity, nasopharynx, oropharynx, hypopharynx, and larynx.

Level IV

This refers to the group of nodes related to the lower third of the jugular vein. These nodes are located between the inferior border of the cricoid cartilage and the clavicle, and, like level III, the anterior boundary is the sternohyoid muscle, and the posterior border is the posterior border of the sternocleidomastoid muscle. The nodes of level IV commonly harbor metastasis from cancer that originates in the larynx, hypopharynx, thyroid, [17] and cervical esophagus.

Level V

This refers to the lymph nodes located in the posterior triangle of the neck. These include the spinal accessory, transverse cervical, and supraclavicular group of nodes. Level V is bound anteriorly by the posterior border of the sternocleidomastoid muscle and posteriorly by the anterior border of the trapezius muscle. Level V extends from the apex of the convergence of the sternocleidomastoid and trapezius muscle superiorly to the clavicle inferiorly. This level is subdivided by a plane defined by the inferior border of the cricoid cartilage into level Va superiorly and level Vb inferiorly.

Level Va contains the nodes associated with the spinal accessory nerve, and level Vb contains the transverse cervical and supraclavicular nodes. The posterior triangle nodes are at greatest risk for harboring metastasis from cancers that arise in the nasopharynx, oropharynx, and skin of the posterior scalp and neck.

Level VI

This refers to lymph nodes of the anterior, or central, compartment of the neck. Defined by the carotid arteries laterally, the hyoid bone superiorly, and the suprasternal notch inferiorly, it is rich in lymphatics that drain the thyroid gland, subglottic larynx, cervical trachea, hypopharynx, and cervical esophagus. Lymph nodes in this compartment are located in the tracheoesophageal groove (paratracheal nodes), in front of the trachea (pretracheal nodes), around the thyroid gland (parathyroidal nodes), and on the cricothyroid membrane (precricoid or Delphian node). Lymph nodes in the central compartment are not routinely excised in radical neck dissection; most commonly, they are removed during surgery for thyroid, laryngeal, and hypopharyngeal cancer.

SURGICAL ANATOMY OF SPINAL ACCESSORY NERVE

Neck level II in neck dissection has a close relationship with the spinal accessory nerve, which is an important structure of the head and neck, and provides motor innervation to the trapezius and sternocleidomastoid muscle (SCM). Preserving the SAN during neck dissection minimizes morbidity, specifically the avoidance of shoulder syndrome. [18] This nerve crosses neck level II obliquely in a superoinferior and mediolateral direction, and divides it into two parts. The posterosuperolateral part has various names: level IIb, submuscular recess, and supraretro spinal recess. [19, 20]

The spinal accessory nerve (SAN) is formed by 2 parts. The spinal or motor portion includes fibers that originate in the ventral horn of the upper 4 or more cervical segments of the spinal cord. The fibers may originate from as low as the fifth and rarely the seventh cervical segment. These fibers ascend lateral and parallel to the spinal cord, entering the skull through the foramen magnum. These fibers join the second or accessory component of the SAN that originates in the nucleus accumbens brain stem nucleus of the medulla

oblongata in the posterior fossa. The 2 parts of the SAN, now joined, leave the skull through the jugular foramen in the same dural compartment as the vagus nerve. The nerve passes through the jugular foramen and then divides variably into the 2 original components.

The superior branch, also known as the accessory or internal branch, joins the vagus either directly or through the ganglion nodosum and then contributes to the pharyngeal, laryngeal, and cardiac sympathetic fibers.

The inferior branch, also known as the spinal or lateral branch, is essentially a pure motor nerve and innervates the sternocleidomastoid (SCM) and trapezius muscles. [21] It passes beneath the posterior belly of the digastric and the upper end of the SCM muscle along the internal jugular vein. It may travel either anterior or posterior to the occipital artery, and it communicates with the second cervical nerve before it enters the SCM.

The nerve emerges from the posterior border of the SCM and obliquely crosses the posterior cervical triangle downward before entering the trapezius. The posterior or lateral cervical triangle is bordered ventrally by the SCM, dorsally by the trapezius muscle, and caudally by the clavicle. [22] The length of the SAN can vary from 4-5 cm when it is lax (chin pointing forward) to 9-10 cm when it is extended (chin pointing to the opposite shoulder). [23]

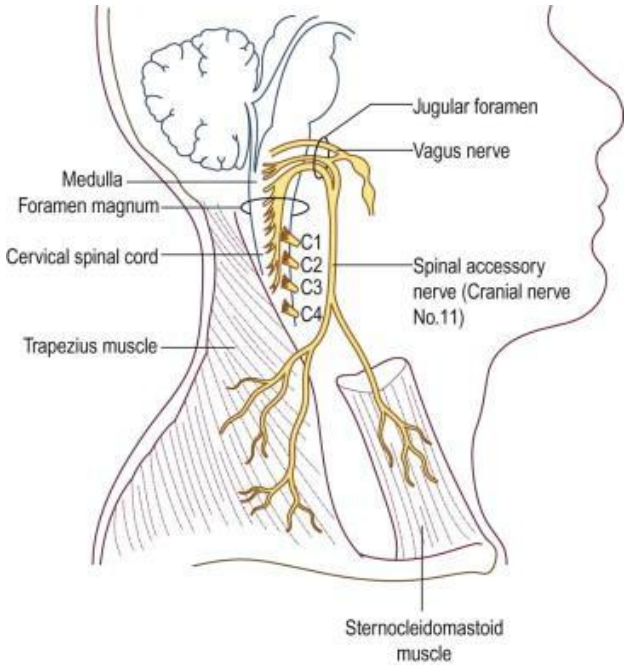


Figure 2: Anatomy of Spinal accessory nerve

The coiled and redundant nature of the nerve as it traverses the posterior triangle allows for this variability in length. A recent cadaveric study compared this distal portion of the spinal accessory nerve with the less redundant proximal segment between the skull base and sternocleidomastoid muscle. The authors concluded that this coiled, redundant appearance was purely a functional characteristic of the nerve, as the 2 segments were identical under electron microscopy. [24]

Connections to the SAN are as follows:

- Greater auricular nerve (C2, C3): The greater auricular nerve may serve as a conduit between the SAN and the lesser occipital nerve and lower divisions of the trigeminal nerve. [23]
- Cervical roots (C2, C3, C4): The cervical nerve plexus connects the SAN to the hypoglossal nerve (via the ansa hypoglossi), stellate ganglion, and mandibular branch of the facial nerve. One to three branches of the cervical plexus run to the middle and lower trapezius independent of the SAN and rarely intermingle with it. [25]
- The SAN has a single fine branch that runs to the upper trapezius without any communication with cervical nerves. This branch does not communicate with the main trunk of the nerve that runs caudally and provides independent innervation to the upper muscle fibers of the trapezius. [25]
- Phrenic nerve
- Brachial plexus

In the posterior neck, the SAN has a superficial and unpredictable course beneath the superficial cervical fascia that makes it vulnerable to injury. It is embedded in fibrofatty tissue and is found in relation to a group of 5-10 superficial nodes. [22]Several anatomic landmarks and important variations in its course require careful consideration while identifying the nerve.

IMPORTANT ANATOMIC LANDMARKS AND VARIATIONS OF THE SPINAL ACCESSORY NERVE
Surface anatomy: Draw a line from the angle of the mandible to the tip of the mastoid process. The course of the SAN is indicated by bisecting this line at a right angle and extending the second line downward across the posterior triangle. [26]

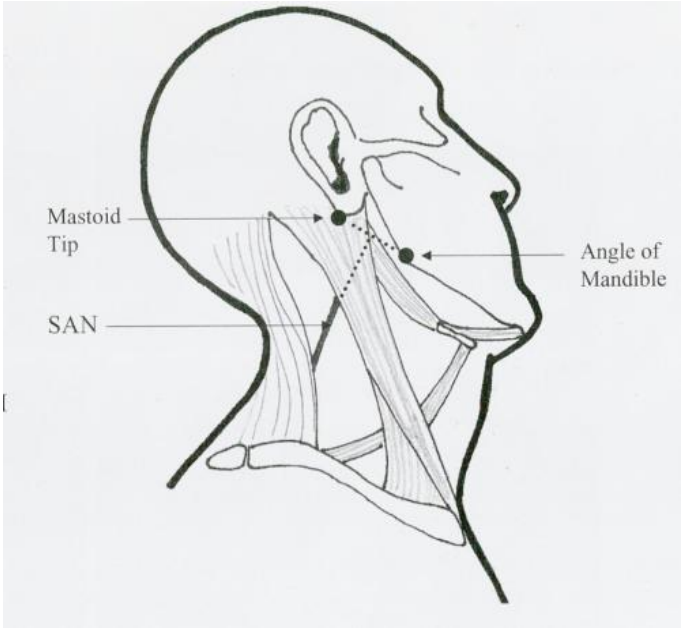


Figure 3: Surface anatomy of Spinal accessory nerve

- The greater auricular nerve has been used as a landmark to identify the SAN as it emerges from the posterior margin of the SCM muscle. The SAN is always found above the greater auricular nerve within a distance of 10.7 mm, with a standard deviation of 6.3 mm. [27]

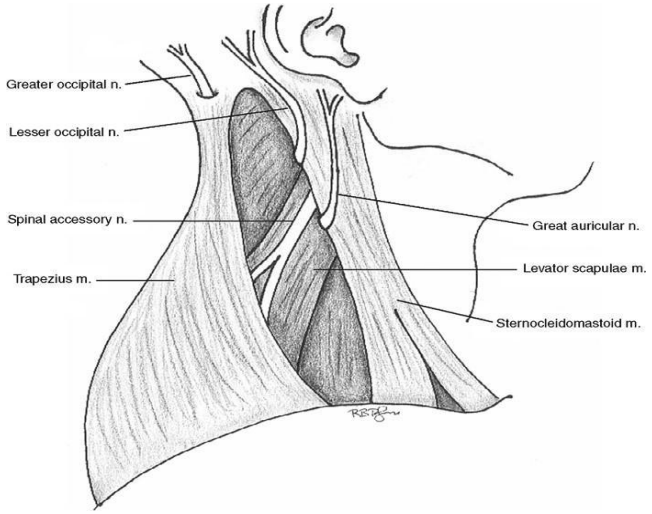


Figure 4: Location of Spinal accessory nerve in relation to greater auricular nerve

- In the upper neck, 2 arrangements of the SAN have been described in relation to the internal jugular vein (IJV). In the more common (75-90%) anterior variant, the SAN nerve crosses in front of the IJV; in the less common (10-25%) variant, the nerve crosses behind the vein. Rarely, the SAN may traverse a divided IJV and appear to travel through the lumen of the vein [28, 29] The SAN may also be palpable as a cord as it runs through the upper neck beneath the SCM muscle, dividing zone II into levels IIA and IIB. This often serves as a guide to the surgeon to begin nerve identification.

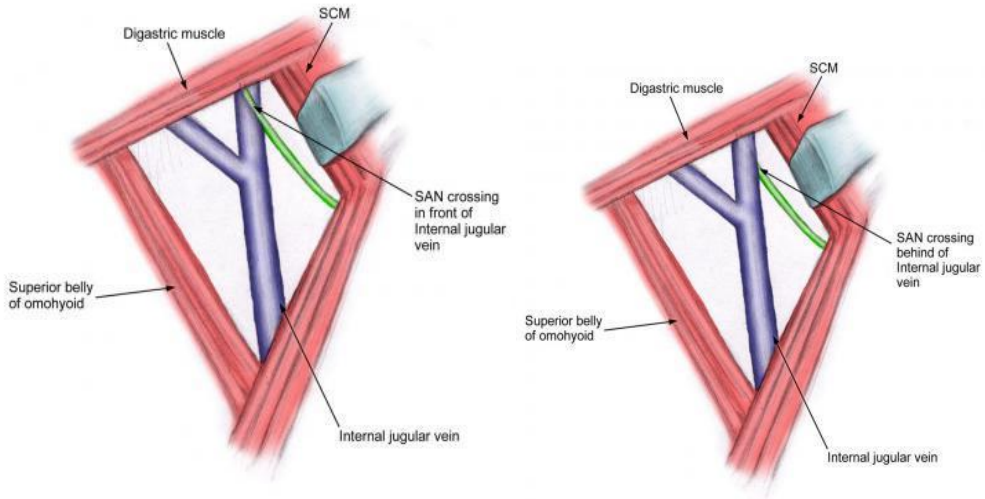


Figure 5: Variations of Spinal accessory nerve in relation to Internal jugular vein

- As the nerve approaches the sternocleidomastoid muscle (SCM), it may perforate the cleidomastoid portion of the SCM (80%) or run posterior to it (20%). [30] The following 3 types of SAN innervation of the SCM have been described:
  - Type A, the nonpenetrating type
  - Type B, the partially penetrating type
  - Type C, the completely penetrating type
- The SAN is known to form a plexus prior to its insertion into the trapezius. Shiozaki et al described 5 types of innervation of the trapezius by the main trunk of the SAN and its branches, in which the number of branches that innervate the muscle ranged from 0-4. [21] More importantly, greater branching in the nerves seems to be associated with a thinner main trunk.
- Another important landmark for the surgeon is the relationship of the clavicle to the point of insertion of the SAN into the trapezius muscle. The SAN can be identified approximately 51.3 mm (standard deviation 17 mm) above the clavicle as it enters the anterior border of the trapezius. This is a constant landmark and is often helpful in identifying the distal end of the nerve. [27, 31]
- The superficial cervical vein, a branch of the external jugular vein, vascularizes the anterior margin of the trapezius muscle close to the site at which the main trunk of the SAN innervates the trapezius muscle. The superficial cervical vein is therefore a useful anatomic landmark that runs slightly inferior to the SAN.[21]

CLASSIFICATION OF NECK DISSECTIONS

Principles of Classification

The current classification of neck dissections developed by the Committee for Head and Neck Surgery and Oncology of the American Academy of Otolaryngology Head and Neck Surgery is based on the following governing principles:

- Radical neck dissection is the standard basic procedure for cervical lymphadenectomy, and all other procedures represent one or more modifications to this procedure.
- When modification of the radical neck dissection involves preservation of one or more nonlymphatic structures, the procedure is termed a modified radical neck dissection.
- When the modification involves one or more lymph node groups that are routinely removed in the radical neck dissection, the procedure is termed a selective neck dissection.
- When the modification involves removal of additional lymph node groups or nonlymphatic structures relative to the radical neck dissection, the procedure is termed an extended radical neck dissection.

Radical Neck Dissection

Originally described by Crile in 1906, this procedure is an en bloc clearance of all fibrofatty tissue from one side of the neck, including the lymph nodes from levels IV and lymph nodes that surround the tail of the parotid gland, the spinal accessory nerve, the internal jugular vein, and the sternocleidomastoid muscle. Radical neck dissection does not include the removal of the postauricular, suboccipital, perifacial, buccinator, retropharyngeal, or central compartment nodes. Previously used for neck disease of any stage, from microscopic to bulky nodal disease, this procedure is now limited to patients with advanced neck disease, recurrent disease after chemoradiation, or gross extracapsular spread to the spinal accessory nerve, sternomastoid muscle, and the internal jugular vein.

Modified Radical Neck Dissection

This operation involves the removal of the same lymph node groups as those involved in the radical neck dissection (levels IV) but requires preservation of 1 or more of the following 3 nonlymphatic structures: the spinal accessory nerve, the internal jugular vein, and the sternomastoid muscle. The structure or structures preserved should be specifically indicated in the name of the procedure (eg, modified radical neck dissection with preservation of accessory nerve and internal jugular vein). [32]

Modified neck dissection is indicated for clinically palpable metastatic neck disease. Conversion to the radical neck dissection becomes necessary upon gross involvement of the nerve, vein, and muscle, although the involvement of all 3 is unusual, except in very advanced (N3) disease. Comprehensive neck dissection is a term that frequently appears in the literature. This term refers to any type of neck dissection that involves removal of lymph nodes from levels IV and corresponds, therefore, to radical neck dissections and modified radical neck dissections, according to the Academy's classification.

Selective Neck Dissection

This term refers to a type of neck dissection in which one or more lymph node groups normally removed in a radical neck dissection are preserved. The 1991 classification schema classified selective neck dissections into the following categories: supraomohyoid neck dissection (levels I, II, III), lateral neck dissection (levels II, III, IV), anterior compartment neck dissection (VI), and posterolateral neck dissection (levels II, III, IV, V). Because of the increased use of selective neck dissection and the increased selectivity with which lymph node groups are removed, the Committee for Head and Neck Surgery and Oncology revised the classification of selective neck dissections in 2002.

Because the 1991 classification did not provide an accurate description of procedures in which the surgeon preserves certain sublevels, the 2002 classification excludes the above listed "named" selective neck dissections. In the 2002 classification, selective neck dissections are described with respect to the lymph node levels removed. For example, a supraomohyoid neck dissection is described as a selective neck dissection (I-III).

A retrospective study by Barzan et al indicated that selective neck dissection can be safely and effectively performed as primary and salvage surgery. The report involved 827 patients with primary head and neck tumors who underwent the selective operation, with just 22 of 40 neck cancer recurrences later arising on the dissected side of the neck. The incidence of recurrence was approximately the same after primary and salvage surgery (4.4% and 5.2%, respectively). [33]

Selective neck dissection for oral cavity cancer

Selective removal of the level I, II, and III lymph nodes is the surgical procedure of choice for management of N0 and N1 disease that originates from cancers of the oral cavity; However, because of the lymphatic drainage of the oral tongue, some authorities advocate selective neck dissection (I-IV) for cancers that originate from this subsite. The operation includes the resection of soft tissue in the submental triangle, along with the submandibular triangle contents, including the submandibular gland and the fibrofatty tissue along the internal jugular vein from the skull base to the omohyoid muscle (or clavicle). The dissected contents include the fascia that covers the medial aspect of the sternomastoid muscle; the muscle itself is laterally retracted and preserved. These neck contents are peeled off from the internal jugular vein and from around the accessory nerve, sparing these structures

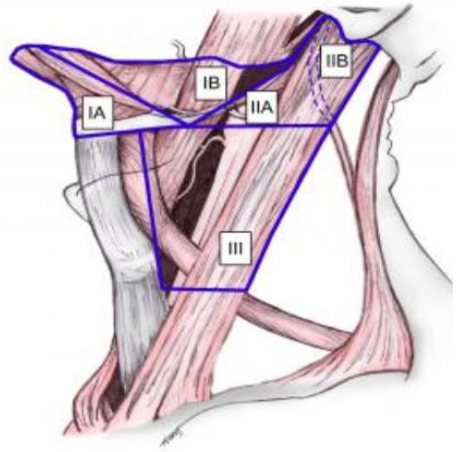


Figure 6: Selective neck dissections of levels I –III

Selective neck dissection for oropharyngeal, hypopharyngeal, and laryngeal cancer
Selective neck dissection (II-IV) is the surgical procedure of choice in the elective treatment of neck disease in patients with cancers that originate in the oropharynx, hypopharynx, or larynx. [34]
The spinal accessory nerve, sternomastoid muscle, and internal jugular vein are spared in this operation, while the lymph nodes are removed from the skull base superiorly to the clavicle inferiorly, and from the cutaneous branches of the cervical plexus at the posterior border of the sternocleidomastoid muscle posteriorly to the sternothyroid muscle anteriorly. If the jugular chain nodes above the spinal accessory nerve were preserved, the procedure would be named selective neck dissection (IIa, III, IV)

Selective neck dissection for cancer of the midline structures of the anterior lower neck
This operation involves excision of the level VI lymph nodes (selective neck dissection [VI]). The procedure is indicated for the treatment of cancers of the thyroid gland, hypopharynx, cervical trachea, cervical esophagus, and subglottic larynx.

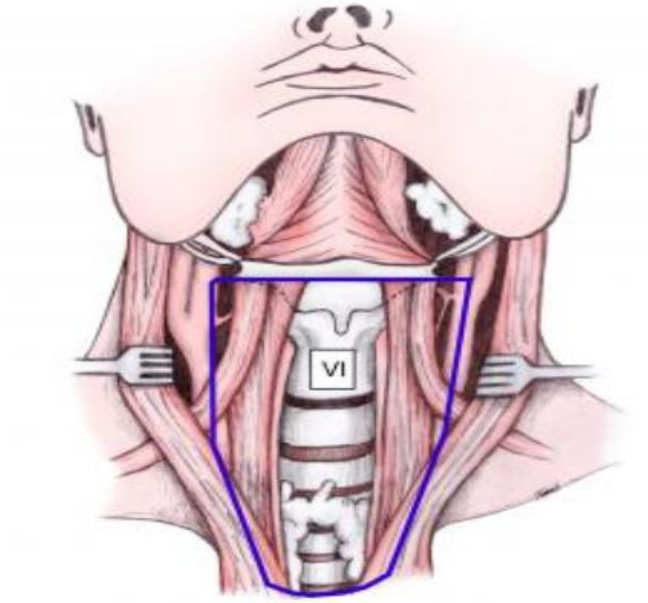


Figure 6: Anterior neck dissection

The boundaries of the dissection are the hyoid bone superiorly, the suprasternal notch inferiorly, and the carotid sheaths on both sides. Hypoparathyroidism may be a disabling complication if care is not taken to identify and preserve the parathyroid glands, and injury to the parathyroid blood supply is a risk with this procedure. Excising and reimplanting the glands into the sternomastoid or pectoralis major muscle may be necessary. Alternatively, the dissection may be limited to one side if the lesion is not close to the midline, particularly if radiation therapy can be administered postoperatively.

A study by Song et al in which robotic selective neck dissection with total thyroidectomy was compared with conventional transcervical selective neck dissection with total thyroidectomy found that patients with papillary thyroid carcinoma who underwent the robotic surgery had higher postoperative cosmetic satisfaction. However, it was also found that length of surgery and degree of anterior chest pain was greater with the robotic technique. [35]

Selective neck dissection for cutaneous malignancies
Selective neck dissection (II-V, postauricular, suboccipital) was initially described as a posterolateral neck dissection by Rochlin in 1962 and later modified and popularized by Geopfert et al for use in patients with cutaneous malignancies of the scalp and postauricular and suboccipital regions as depicted below. Unlike all other neck dissections, this operation is performed with the patient in the lateral decubitus position and consists of an en bloc removal of the lymph nodes in the suboccipital; postauricular; and upper, middle, and lower jugular nodes, along with posterior triangle nodes situated superior to the accessory nerve.

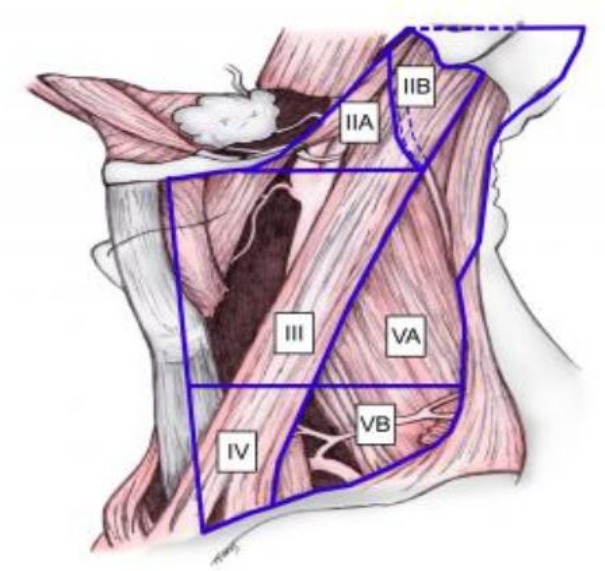


Figure 7: Selective neck dissection for posterior scalp and upper posterolateral neck cutaneous malignancies: selective neck dissection II-V, postauricular, suboccipital, or posterolateral neck dissection

Although the original description included sacrifice of the accessory nerve, internal jugular vein, and a portion of the trapezius muscle, Diaz et al from the MD Anderson Cancer Center showed in 1996 that the preservation of these nonlymphatic structures does not increase the failure rate of this operation. [36] Any variation of this operation involves naming the level of nodes removed. In cancers that arise in the preauricular, anterior scalp, or temporal region, the elective neck dissection of choice is selective neck dissection (II, III, Va, parotid, facial, external jugular nodes).

Extended Neck Dissection

In cases of advanced neck disease, certain lymphatic or nonlymphatic structures, not routinely included in the aforementioned neck dissections, may have to be removed. Extended neck dissection is the term used to describe these procedures. Retropharyngeal lymph nodes, the hypoglossal nerve, portions of the prevertebral musculature, or the carotid artery are some of the structures that may occasionally have to be excised to obtain negative margins. All additional lymphatic and nonlymphatic structures removed should be identified in parentheses.

SHOULDER SYNDROME

The shoulder syndrome, resulting from RND, was first described by Erwing and Martin in 1952. Szunyogh attributed the shoulder disability following radical neck surgery to paralysis of the trapezius muscle, muscle imbalance, displacement of the shoulder girdle, and periarthitis. [37]

Nahum in 1961 defined the shoulder syndrome, with the following features in common: [38]

1. Pain in the shoulder joint. This was not well localized and could be reproduced neither by pressure at particular points, nor by movement in any one direction. The pain was generally mild but nagging, and described as 'like a tooth ache', or 'like a pulled muscle'. It could occur at rest, but was aggravated by shoulder movement.
2. Limitation of abduction at the shoulder joint.
3. A full passive range of motion.
4. Anatomical abnormalities including drooping of the affected shoulder, prominence of the scapula and prominence of the remaining shoulder muscles, particularly the rhomboids.
5. Electromyographic abnormalities.
6. The absence of any radiographic abnormalities

This was considered to be primarily due to loss of the spinal accessory nerve with denervation of the upper third (cervical portion) of the trapezius muscle, which was considered necessary to completely eliminate regional cervical disease. [25] It is estimated that these symptoms will affect 60% to 80% of patients when the spinal accessory nerve has been sectioned. [39]

The advent of more conservative approaches in neck dissection, such as modified radical neck dissection (also termed ‘‘functional’’ or ‘‘conservative’’), allowed preservation of the spinal accessory nerve. The concept of

selective neck dissections (removal of only the nodal groups at highest risk of metastases with preservation of nonlymphatic structures) further limited the number of patients with shoulder disability. However, although current modifications to surgical neck treatment aim at preserving the spinal accessory nerve, a variable degree of shoulder dysfunction still occurs in a significant percentage of patients. [10, 39-41] Apparently, shoulder pain and dysfunction after nerve preservation cannot be attributed solely to spinal accessory nerve neurapraxia and neurotmesis.

Symptoms that occur after nerve-sparing procedures may be caused by neuropathic cervical pain, and by the presence of secondary effects in the shoulder such as adhesive capsulitis and myofascial pain in the upper trapezius, levator scapulae, and rhomboid muscles. [42] Primary and postoperative radiotherapy have also been reported to be responsible for shoulder
complaints.

Assessment of shoulder function

Shoulder function is evaluated from a clinical point of view using the neck dissection Quality of life questionnaire, arm abduction test and Constant's shoulder assessment

Question	Score
Are you bothered by neck or shoulder stiffness?	1-5
Are you bothered by constriction of your neck?	1-5
Are you bothered by neck or shoulder pain?	1-5
Are you bothered by numbness of your neck?	1-5
Do you think your shoulder is dropped?	1-5
Have you been limited in your ability to reach above for objects because of your shoulder or neck?	1-5
Are you bothered by the appearance of your neck?	1-5
Total	7-35

Table 1: Neck Dissection Quality of Life questionnaire

Neck dissection Quality of life questionnaire investigated seven items each with a value between 1 and 5 (1 severe impairment; 5 normal activity)

ARM ABDUCTION TEST (score)
You can raise your arm: • Up to 180˚ without pain or effort (5) • Up to 180˚ but with pain or effort (4) • Up to more than 150˚ but less than 180˚ (3) • Up to more than 90˚ but not less than 150˚ (2) • Up to less than 90˚ (1)

Table 2: Arm abduction test score

The arm abduction test studied the degree of abduction of the arm, resulting in a value between 1 and 5. 1 was abduction less than 90°; 5 was abduction more than 180°

Constant's shoulder assessment: Constant shoulder test is a validated clinical assessment of shoulder function that has established usefulness and accuracy across many diseases affecting shoulder. This validated, widely used clinical test has been shown to be accurate and sensitive measure of shoulder function, detecting subtle changes in shoulder function. [43, 44] The assessment takes approximately 10 minutes to perform. It is a

weighted test that combines patient symptom scores (35%) and objective measures of active shoulder function (65%). The symptoms score assesses pain, sleep, recreation, and vocational activities. The objective score measures active range of motion, combined internal rotation, combined external rotation and shoulder strength in the plane of scapula. Scores range from 0 to 100, with higher scores indicating better shoulder function.

II. Review Of Literature

Involvement of the cervical lymph nodes by metastasis from head and neck tumors poses a serious obstacle to patient survival even when the primary cancer was treated successfully. [45] Sometimes cervical lymph node metastasis can be found, although the primary tumor is not large and not even progressive. [46] Metastasis to neck lymph nodes (especially levels I, II and III) from oral cavity primary tumors demonstrates almost the same pattern of metastasis. [47]

The most common morbidity associated with neck dissection is spinal accessory nerve dysfunction and related shoulder disability. Even when techniques were developed to preserve it, the dissection of sublevel IIB requires retraction and mobilization of the nerve, which causes postoperative shoulder pain and weakness; electromyographic evidence of accessory nerve dysfunction was reported. [12] Keeping in mind the postoperative shoulder dysfunction and quality of life [48] and the incidence of level IIb metastasis from head and neck tumors, is it worth to preserve this level during neck dissection or not?

Silverman et al [49] did a prospective study of 90 selective neck dissections which showed the incidence of level IIb lymph nodes metastasis for clinical N+ 11.1%, for N0 1.6% and for all 4.4%.**[4]** There was a statistically significant association between level IIb metastases and advanced pathologic N stage (P =.003), particularly with positive nodal disease in level IIa (P =.001). Extracapsular tumor spread was also shown to have a statistically significant association with metastases in the level IIb (P =.01). No significant associations were observed between level IIb metastases and primary tumor site (P =.06), clinical N stage (P =.09), a history of primary tumor recurrence (P =.52), or previous radiation therapy (P =.68). The study suggests that nodal metastases in the level IIb are rare in head and neck cancer patients undergoing selective neck dissection.

Bhattacharya et al [50] concluded for tumors in oral cavity (N0/N1), while performing elective or therapeutic selective neck dissection, the dissection of Level IIB nodes could be omitted as it will provide significant decrease in operative time and also less of spinal accessory nerve trauma-related complications. Only 2 of 30 patients (6.6%) had the involvement of Level IIB neck nodes. There was no relation between the site, size, and histologic grade of primary tumor with the metastasis to Level IIB. The Level IIA nodes were positive in both the positive cases of Level IIB.

Santoro et al [14] reviewed 114 patients with head and neck cancer undergoing neck dissection and concluded dissection of level IIb could be unnecessary in N0 necks as the incidence of metastases at level IIb is low, also in the N1 necks. Of 148 neck dissections performed, level IIb resulted positive in 5 cases (3.3%): 1 patient with laryngeal cancer, 1 patient with oral cavity cancer, and 2 patients with oropharyngeal cancer, of which 1 underwent bilateral neck dissection. For N0 and N1, the incidence of positive level IIb was 2% and 5%, respectively. All the cases with metastases at level IIb also showed metastases at level IIa. A statistically significant association between the presence of nodal metastases at level IIb and those at level IIa (p <.001) was found.

Jane Lea et al [51] conducted a meta-analysis study that screened 729 abstracts and 177 full texts papers about squamous cell carcinoma of oral cavity, 332 patients of only 9 papers were included in that analysis. 20 (6%) patients were positive for level IIb lymph node metastasis. Three of them (3/20) were isolated and (17/20) were accompanied by other positive neck levels lymph nodes.**[13]** The study recommended that dissection of level IIb remain the standard of care in oral cavity squamous cell cancer.

Young Chang Lim et al [52] conclude Level IIb lymph node metastasis was rare, and nodal recurrence in this area after SOHND in squamous cell carcinoma of the oral cavity was infrequent. Therefore, this region may be preserved in elective SOHND in patients with squamous cell carcinoma of the oral cavity. Of the 74 patients, 24 (32%) had lymph nodes positive for microscopic metastatic squamous cell carcinoma. Four (5%) of the 74 patients had involvement of level IIb lymph nodes. There was no instance of isolated metastasis to level IIb lymph nodes without involvement of other nodes in the SOHND specimens.

Kim YH et al [53] analysed 93 neck dissections in prospective study. Of these dissections, 59 (63%) were elective and 34 (37%) were therapeutic. Three percent (2 of 59) of all N0 necks and 32% (11 of 34) of all N+ necks had level IIb LN metastases. Level IIb nodal metastases were significantly more prevalent in N+ necks (P=.007) than in N0 necks and in the presence of other positive LNs (P=.01) than in the absence of other positive LNs. Of the 35 patients with pathologic LNs, the regional recurrence rate was significantly higher in cases with positive level IIb LNs (33% [4 of 12]) than without (4% [1 of 23]; P=.04). The study concluded that Level IIb LN pads may be preserved during elective neck dissection in the treatment of patients with clinically N0 necks with Hypopharyngeal squamous cell carcinoma. This area should be removed during therapeutic neck dissection in the treatment of clinically N+ necks.

Corlette et al [54] studied 106 elective neck dissections (N0 necks) from upper aerodigestive tract and skin/parotid squamous carcinoma primaries, level IIb was involved in 4.5% and 33%, respectively. In 54 therapeutic neck dissections (N+ necks) from upper aerodigestive tract and skin/parotid squamous carcinoma primaries, level IIb was involved in 25% and 71%, respectively. Apart from skin/parotid squamous carcinoma primaries, level IIb was never involved unless level IIa was also involved. The study concluded that level IIb nodes can be left in situ in upper aerodigestive tract primary carcinomas in nontonsillar N0 necks without significantly compromising regional clearance of micrometastases.

Maher NG et al [55] did a retrospective cohort study based on a review of the pathology records of a total of 71 patients with clinically node-negative, primary OCSCC. The overall frequency of sublevel IIb lymphatic metastases at neck dissection was 5.6% of the patient cohort. Sublevel IIb metastases occurred from the primary sites involving the tongue (n = 3) and retromolar trigone (n = 1). The incidence of perilymphatic and perivascular invasion was significantly associated with sublevel IIb lymphatic metastases ($P < .02$). They concluded that sublevel IIb is likely to be an important region to incorporate in elective neck dissections for primary OCSCC involving the tongue. More studies are needed, with greater numbers, to clarify the risk of metastasis to sublevel IIb from oral cavity subsites in primary OCSCC with clinically node-negative necks.

Elsheikh MN et al [13] studied the incidence of level IIb lymph nodes metastasis in elective supraomohyoid neck dissection (SOHND) as a treatment for patients with squamous cell carcinoma (SCC) of the oral cavity. Of the 48 patients, 15 (31%) by pathologic analysis and 22 (46%) by molecular analysis had lymph nodes positive for metastatic SCC. By molecular analysis, 5 (10%) of the 48 patients had involvement of level IIb lymph nodes. All patients with metastasis to level IIb lymph nodes have their primary lesions in the tongue and constituted 22% of patients with tongue lesions. There was no instance of isolated metastasis to level IIb lymph nodes without involvement of other nodes in the SOHND specimens. The study concludes that level IIb lymph node metastasis was only found in association with tongue carcinoma. Although this region may be preserved in elective SOHND in patients with SCC of the oral cavity, it should be included whenever the tongue is the primary site.

The main prognostic factor associated with head and neck cancer is the presence of lymph node metastasis in the neck, and neck dissection is the gold standard treatment for such metastases. 1 However, this procedure may cause severe morbidity. One of the most common complications stemming from ND is shoulder dysfunction caused by manipulation of the spinal accessory nerve (XI cranial nerve) - which causes atrophy of the trapezium muscle.

Cappiello et al. [25] observed that the MRND increase shoulder morbidity when compared to Selective neck dissection.

On the other hand, **Koybasioglu et al.** [40] reported that the accessory nerve function is better in MRND when compared to the lateral ND, because of the traction applied to the nerve during sternocleidomastoid muscle retraction, in order to expose the surgical field.

Another study led by **Tsuji et al.** [56] also confirms the complete or incomplete denervation of the trapezium muscle caused by the axonal injury to the XI cranial nerve, even if it is preserved, because of the traction caused to the accessory nerve during ND.

Inoue et al. [57] reported that the cutting of the sternocleidomastoid muscle and/or that of the spinal accessory nerve had a significant impact on daily activities, work and leisure activities.

Dijkstra et al. [58] reported that the shoulder pain was clinically present in 70% of the patients after the ND surgery.

Cheng et al. [10] reported that 100% had shoulder pain and that 80% had shoulder drop after the RND surgery.

PART B

AIM

The aim of this study is to determine the role of level IIb lymph node dissection in carcinoma oral cavity

OBJECTIVES:

The following parameters will be assessed:

a) Incidence of level IIb lymph node metastasis in oral cancers in our hospital

b) Incidence of level IIb lymph node metastasis in association with site of cancer in the oral cavity in our hospital

c) Incidence of shoulder syndrome in patients undergoing level IIb lymph node dissection.

MATERIAL AND METHODS

Study Site: Yashoda Super speciality Hospital, Somajiguda, Hyderabad.

Study Population:
Study Design: A Prospective analytical study
Sample Size: 50 patients
Sample size is calculated based on the following formula.

$$N = \frac{(Z^2 \times p \times q)}{l^2}$$

Where,

- N = Number of eligible participants included in the study
- Z=1.96
- p = 6 (based on previous studies) [13,50,51,55]
- q = 100 - p
- l = allowable absolute error, here taken at 7 %
- standard normal deviate (1.96) and corresponds to 95% confidence level

Hence, the sample size is

$$N = \frac{4 \times 6 \times 94}{7x7}$$
$$= 46$$

The minimal sample size required for the study is 46. To avoid fall outs from the study, the final sample size taken is 50.
Time Frame: The study was conducted from May 2015 to March 2017, enrolling the cases which fit into the inclusion criteria.

❖ **INCLUSION CRITERIA**

✔ Patients with primary tumour confined to oral cavity
✔ Patients with histological Squamous cell carcinoma only
✔ Patients who will be undergoing surgery in our institute only

❖ **EXCLUSION CRITERIA**

✔ Patients with clinically positive level IIb
✔ Patients with synchronous oral cavity tumours
✔ Patients who had previous head and neck tumour that were treated surgically, by radiotherapy and/or chemotherapy.
✔ Patients with recurrent head and neck cancers

Methodology:
After obtaining informed consent, all patients with carcinoma oral cavity underwent thorough history taking, clinical examination which includes oral cavity examination, indirect laryngoscopic examination, bilateral neck examination and general examination. In all patients, biopsy confirmation was done preoperatively. Computer Tomography Scan or Magnetic Resonance Imaging was used as an investigation tool to confirm the operability in patients with large lesions having trismus, lesion reaching up to retromolar trigone (RMT) and lesions abutting the mandible where marginal mandibulectomy is being planned. Clinical N stage was confirmed by Ultrasonography. All patients are staged clinically using AJCC/TNM classification.
TNM classification of carcinomas of the oral cavity

T — Primary tumour

TNM	
TX	Primary tumour cannot be assessed
T0	No evidence of primary tumour
Tis	Carcinoma in situ
T1	Tumour 2 cm or less in greatest dimension
T2	Tumour more than 2 cm but not more than 4 cm in greatest dimension
T3	Tumour more than 4 cm in greatest dimension
T4a (lip)	Tumour invades through cortical bone, inferior alveolar nerve, floor of mouth, or skin (chin or nose)
T4a (oral cavity)	Tumour invades through cortical bone, into deep/extrinsic muscle of tongue (genioglossus, hyoglossus, palatoglossus, and styloglossus), maxillary sinus, or skin of face
T4b (lip and oral cavity)	Tumour invades masticator space, pterygoid plates, or skull base; or encases internal carotid artery

Note: Superficial erosion alone of bone/tooth socket by gingival primary is not sufficient to classify a tumour as T4.

N - Regional Lymph Nodes

NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension
N2	Metastasis as specified in N2a, 2b, 2c below
N2a	Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension
N2b	Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension
N2c	Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
N3	Metastasis in a lymph node more than 6 cm in greatest dimension

Note: Midline nodes are considered ipsilateral nodes.

M – Distant metastasis

MX	Distant metastasis cannot be assessed
M0	No distant metastasis
M1	Distant metastasis

Stage grouping

Stage 0	Tis	N0	M0
Stage I	T1	N0	M0
Stage II	T2	N0	M0
Stage III	T1, T2	N1	M0
	T3	N0, N1	M0
Stage IVA	T1, T2, T3	N2	M0
	T4a	N0, N1, N2	M0
Stage IVB	Any T	N3	M0
	T4b	Any N	M0
Stage IVC	Any T	Any N	M1

All patients underwent modified radical neck dissection irrespective of nodal status as per institutional protocol. During surgery, all lymph node stations including level IIb are dissected, labelled, and processed separately from neck dissection specimen. Analysis of clinical stage, pathological stage and other variables like differentiation, lymphovascular invasion (LVI), and positive LNs are done.

Technique adapted for modified radical neck disseciton:

Anaesthesia: General anesthesia.

Position: Reverse Trendelenberg's position with neck extended at atlanto-axial joint and head elevated 10 degree above the table. Face should be turned to the opposite side of the dissection

Incision: Apron flap incision

STEP 1

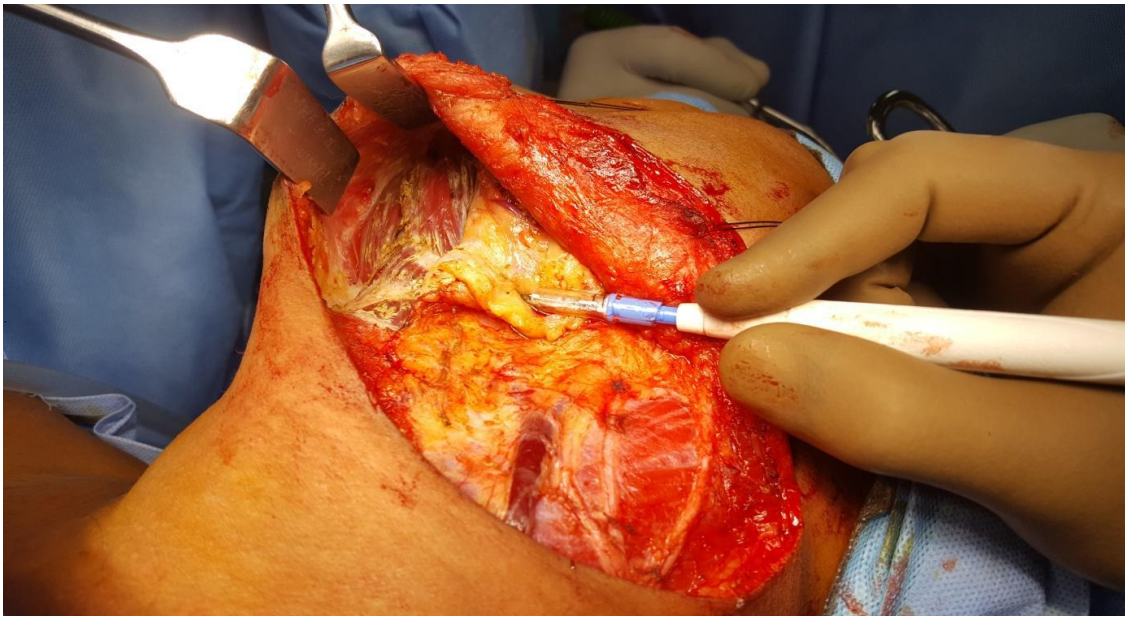
INCISION AND FLAP RAISING

The skin incision is made to expose the platysma which is then also incised. The skin and platysma flap is raised in the subplatysmal plane by following the deep surface of the platysma. Inferior border of the mandible is exposed superiorly, the clavicle inferiorly, the anterior border of the trapezius posteriorly and the midline of the neck anteriorly.

STEP 2

LEVEL I DISSECTION

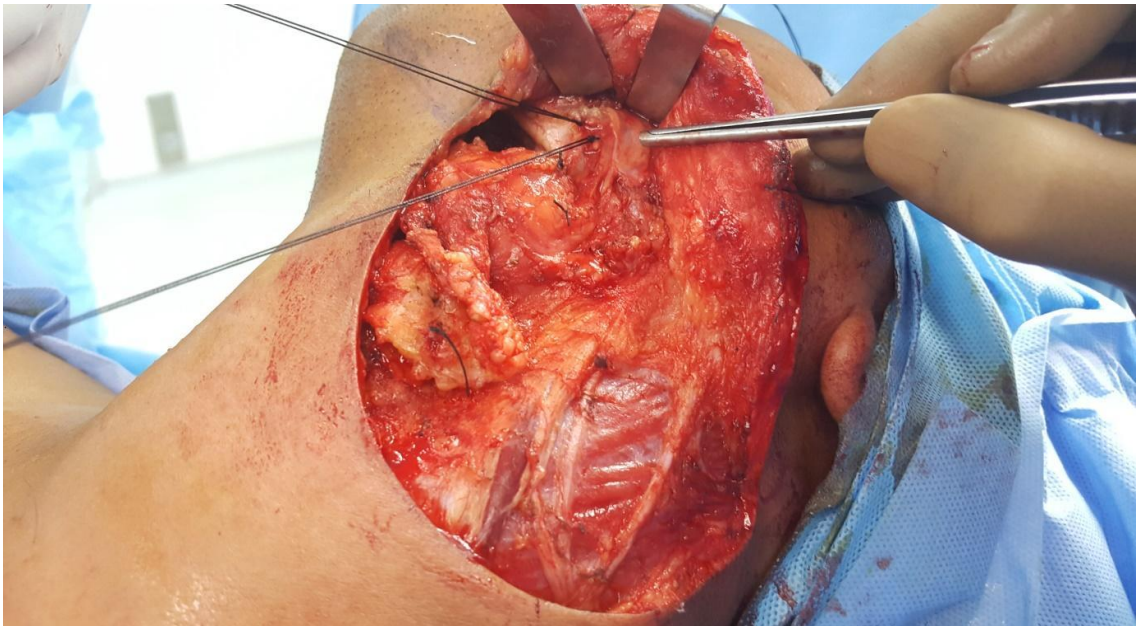
Dissection is started at Level Ia with clearance of fibrofatty tissue in the submental triangle to expose both anterior bellies of the digastric (DG) muscles and the mylohyoid (MH) muscle between them.



POSITIVE IDENTIFICATION OF MARGINAL MANDIBULAR NERVE

The marginal mandibular nerve crosses the facial artery and vein. The facial artery and vein are identified by blunt dissection with a fine haemostat at the mandibular notch where the facial vessels cross the mandible. After identification of the nerve, the facial vein is divided and slung upwards to protect the marginal mandibular nerve during the dissection. Next, attention is directed to the fibrofatty tissue anterior to the gland between the anterior belly of digastric and mylohyoid muscle. Anterior belly of digastric is retracted anteriorly and the tissue is deliverd using electrocautery dissection with the deep dissection plane being on the mylohyoid

muscle. The posterior free edge of the mylohyoid muscle is retracted with a right angle retractor to identify lingual and hypoglossal nerves. Inferior traction on the submandibular gland (SMG) brings the lingual nerve and the submandibular duct into view. The submandibular ganglion is divided under direct vision with special care taken not to injure the lingual nerve. The duct is divided after clear identification of both the lingual and hypoglossal nerves. By following the posterior belly of digastric, the proximal portion of the facial artery and vein are identified and divided.



STEP 3

IDENTIFY ACCESSORY NERVE (CN XI)

The accessory nerve is identified 1-2 cm posterior to the exit site of the greater auricular nerve at the posterior border of Sternocleidomastoid (SCM). The nerve is traced distally until it goes under or deep to the trapezius muscle as well as proximally towards the IJV by dividing the SCM if performing type II neck dissection. The branches to SCM need to be divided and occasionally there will be a contribution to the accessory nerve from the cervical plexus at the posterior border of SCM.

STEP 4

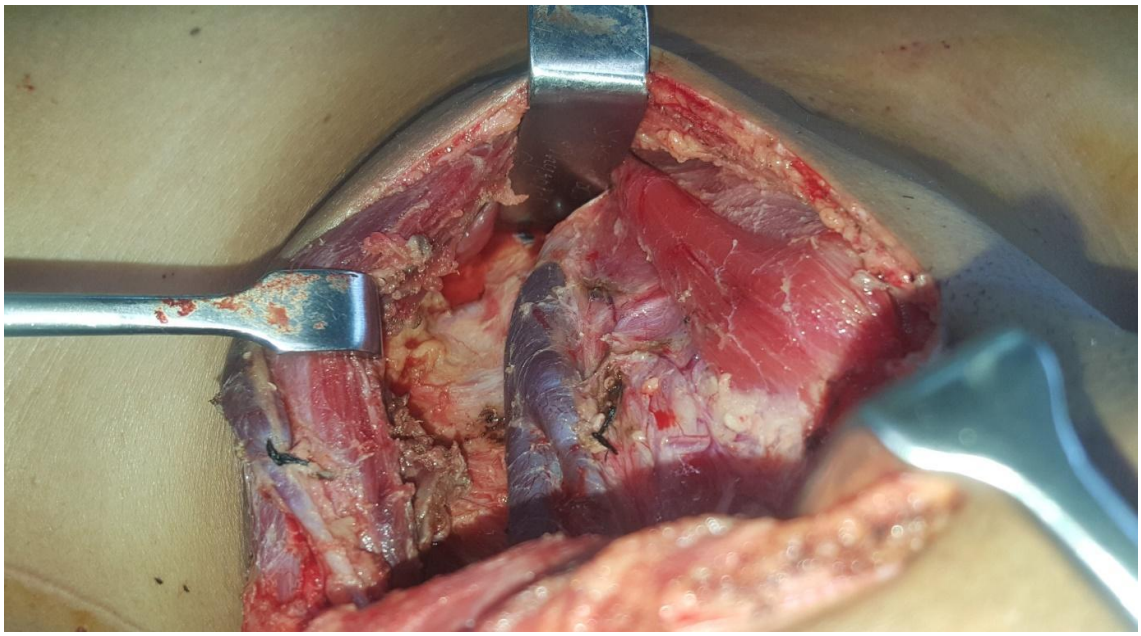
LEVEL IIB DISSECTION

The superior end of SCM is retracted laterally until the fatty tissue of Level IIb is exposed. Level IIb lymphatics are further dissected down to the deep muscle that runs in a posteroinferior direction. The occipital artery is usually encountered and may be divided during the dissection. The contents of Level IIa and IIb are dissected off from the IJV and the deep muscles of the neck until the cervical plexus comes into view. The dissected accessory nerve is translocated posteriorly and the dissection of Levels IV and V continues.

STEP 5

LEVEL IV & V DISSECTION

The SCM is mobilised and retracted laterally until the IJV within the carotid fascia is identified. The dissection continues in the supraclavicular fossa but the lymphatic tissue posterior to IJV is left intact to prevent injury to the thoracic duct located in Level IV. Omohyoid muscle and the external jugular vein in the supraclavicular fossa are identified. The external jugular vein is ligated and divided. The dissection goes deep until the transverse cervical vessels and the prevertebral fascia come into view. The brachial plexus can be identified below the fascia and are kept intact. The phrenic nerve is identified descending on the scalenus anterior muscle running in a medial direction. Finger dissection is done postero-superiorly with care taken not to rupture the transverse cervical vessels. The dissected accessory nerve should now be identified again because the supraclavicular nerve running in the fibrofatty tissue can be divided with diathermy or a knife but not the spinal accessory nerve. The transverse cervical artery is dissected free from the lymphatic tissue by dividing the ascending branch alone, preserving it for future use.



Statistical methods: Data will be entered using Microsoft Excel 2010 version and analysis using EPI INFO version 7. Data will be summarized in percentages and proportions. Statistical significance is calculated using Fisher exact test ($p<0.05$ considered statistically significant)

III. Observation And Data Analysis:

Graph 1: Gender Distribution

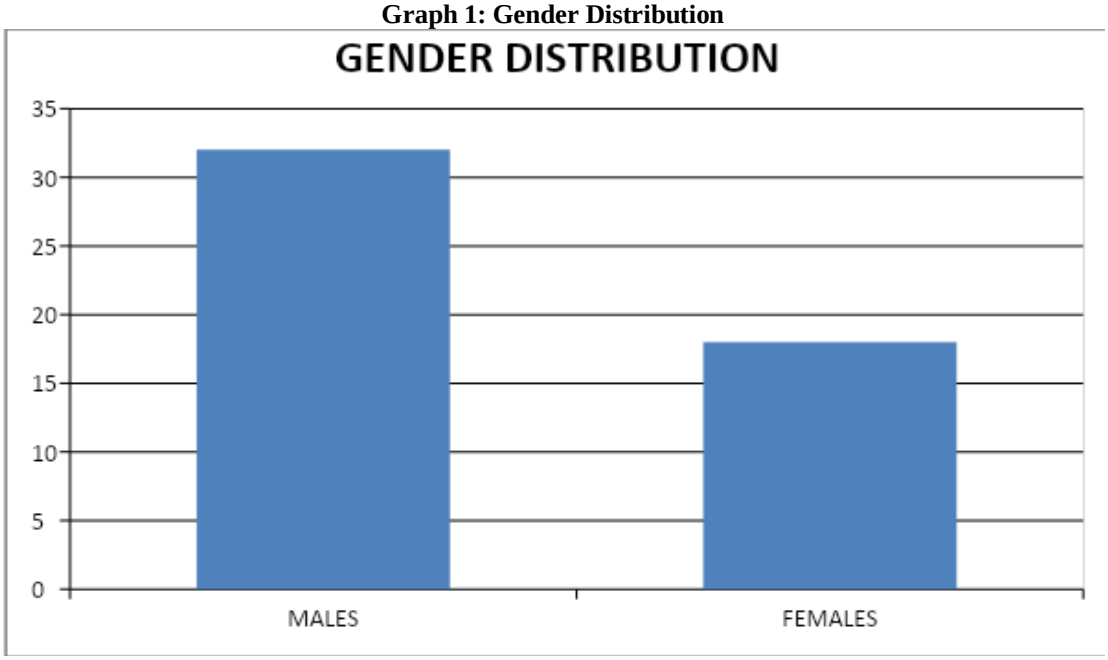
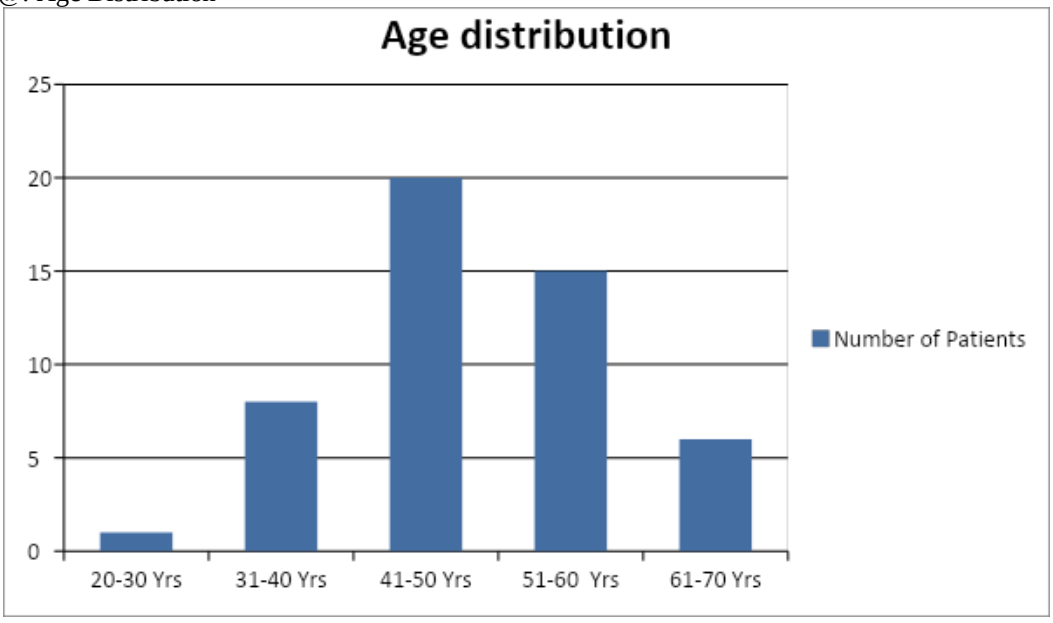


Table 6 : Gender Distribution

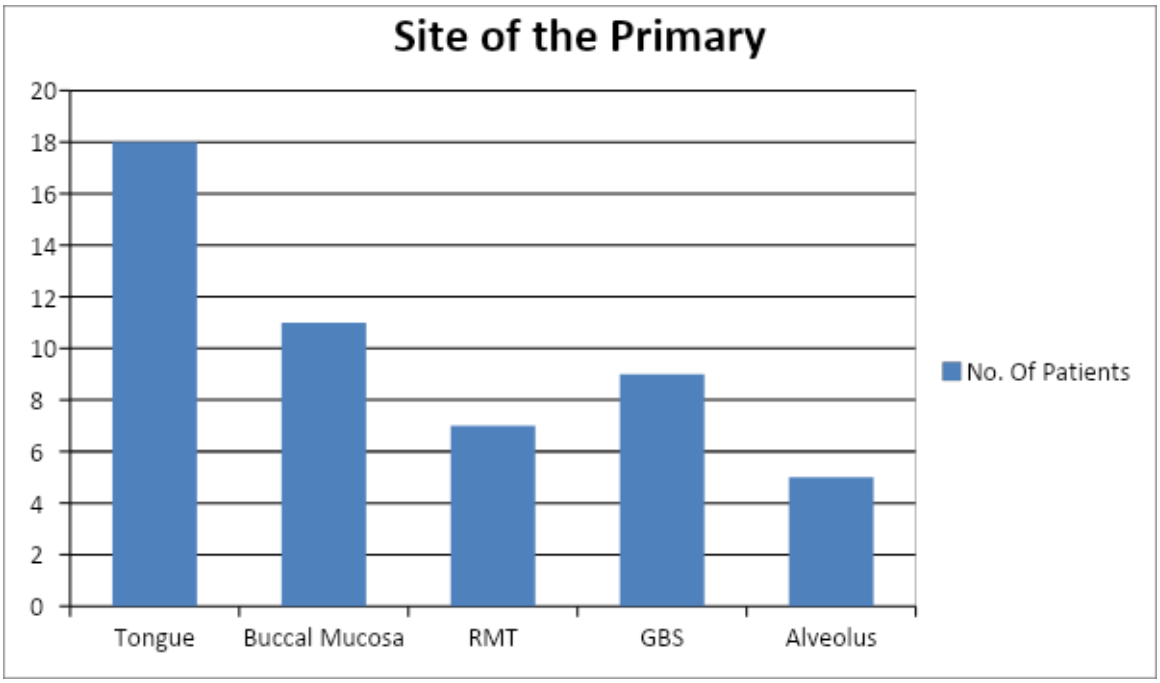
MALES	32
FEMALES	18

Graph @: Age Distribution

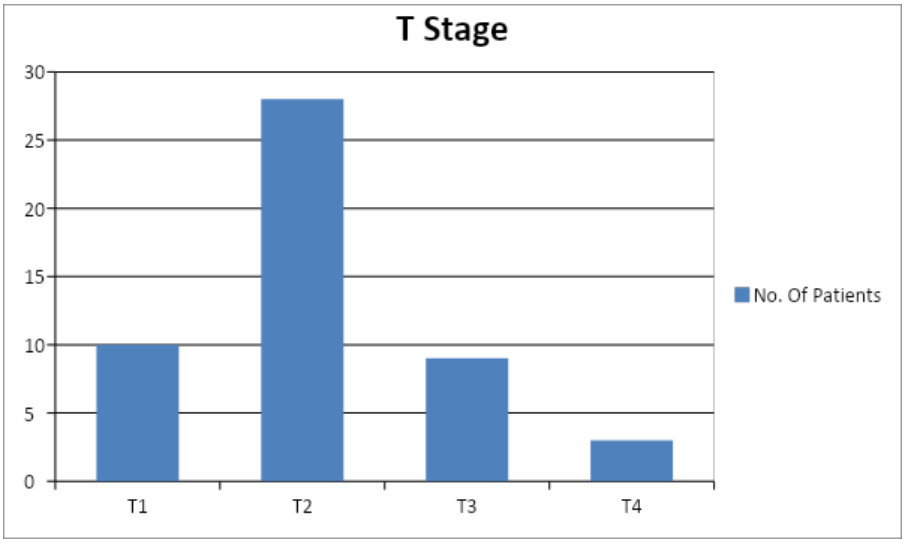


Age In years	Number Of Patients
20-30	1
31-40	8

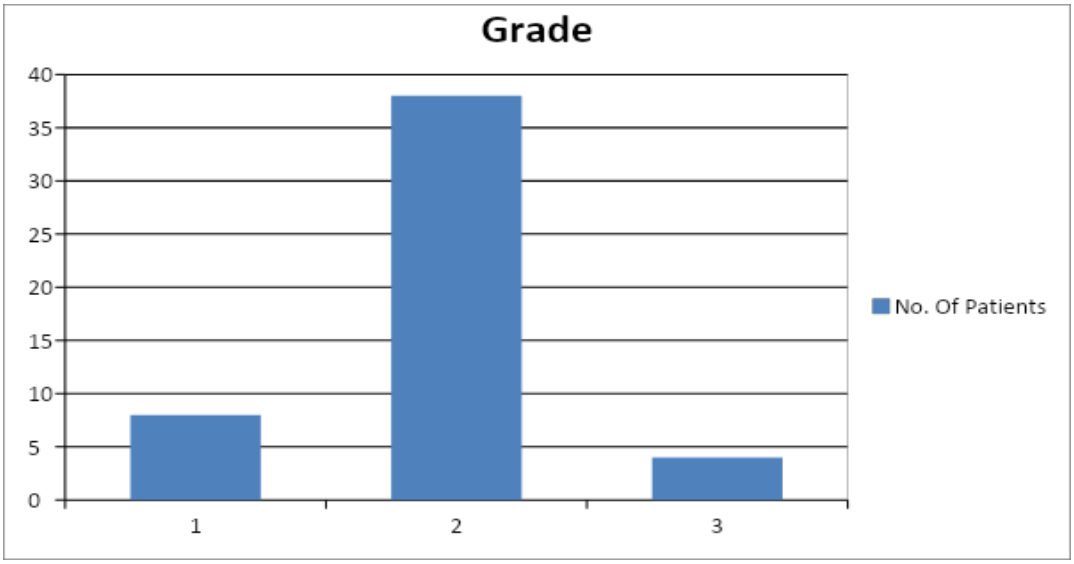
41-50	20
51-60	15
61-70	6



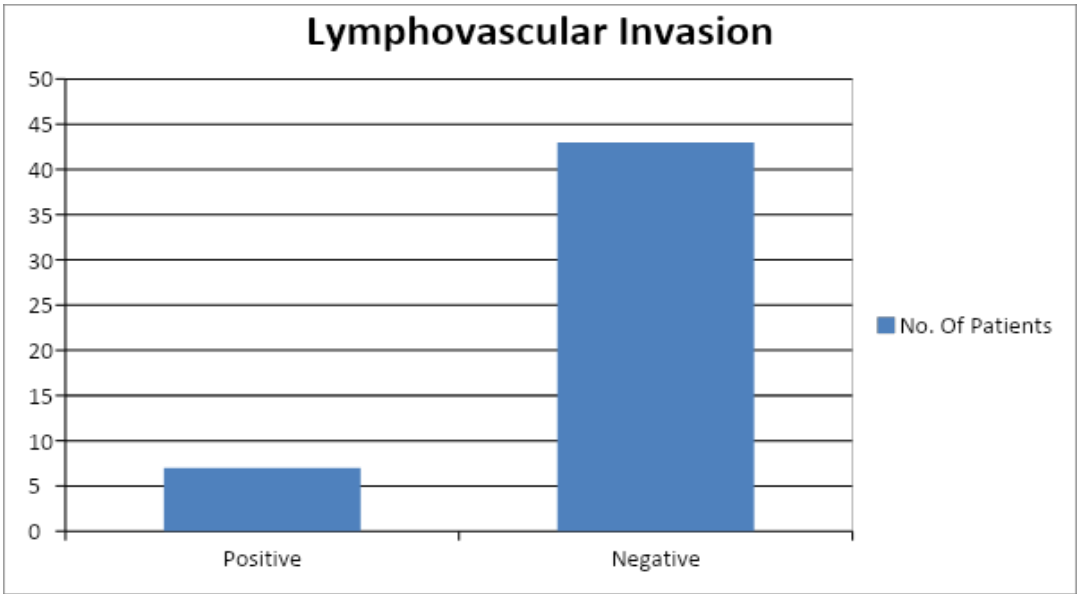
Site Of Lesion	No. Of Patients
Tongue	18
Buccal Mucosa	11
RMT	7
GBS	9
Alveolus	5



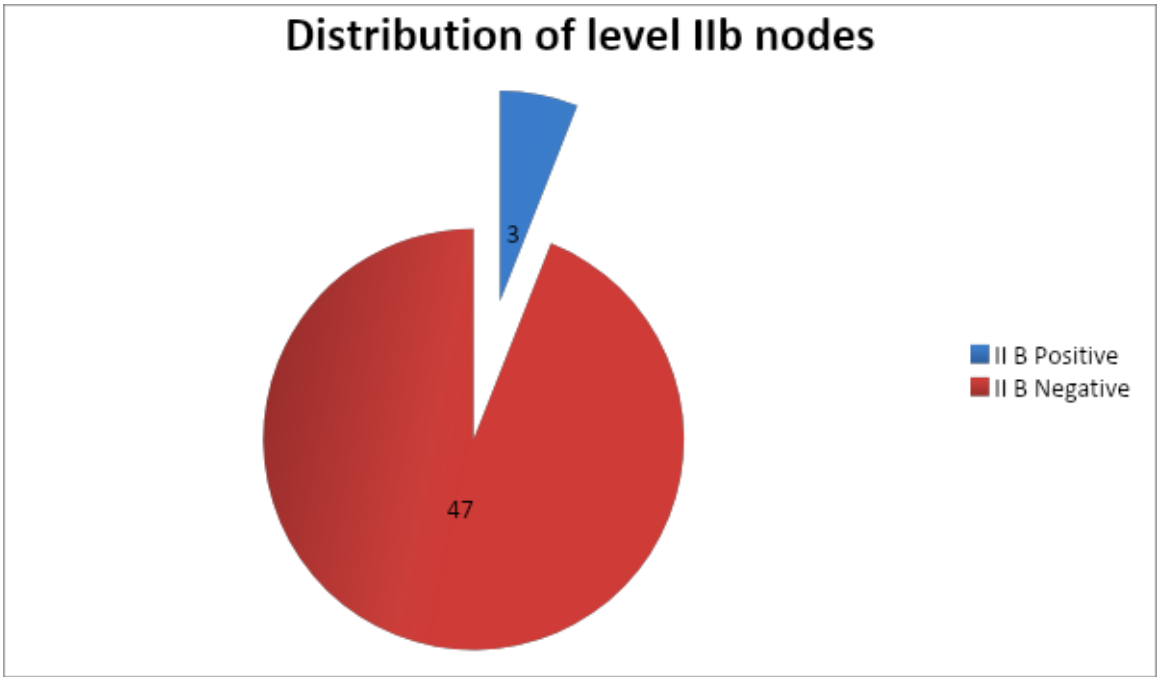
T stage	No. Of Patients
T1	10
T2	28
T3	9
T4	3

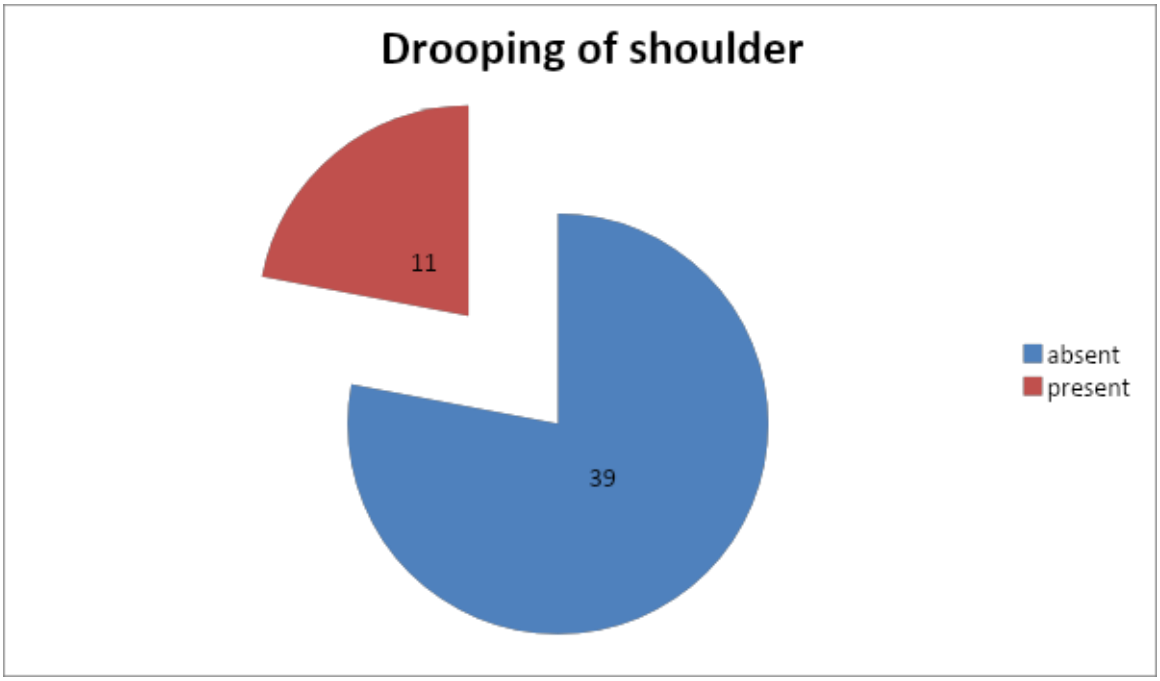


Grade	No. Of Patients
1	8
2	38
3	4



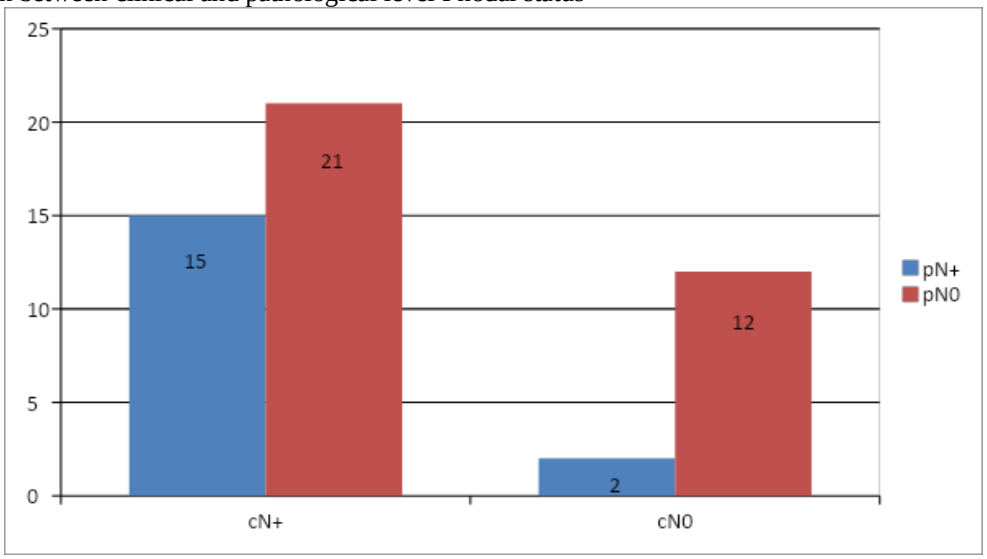
LVI	No. Of Patients
Positive	7
Negative	43





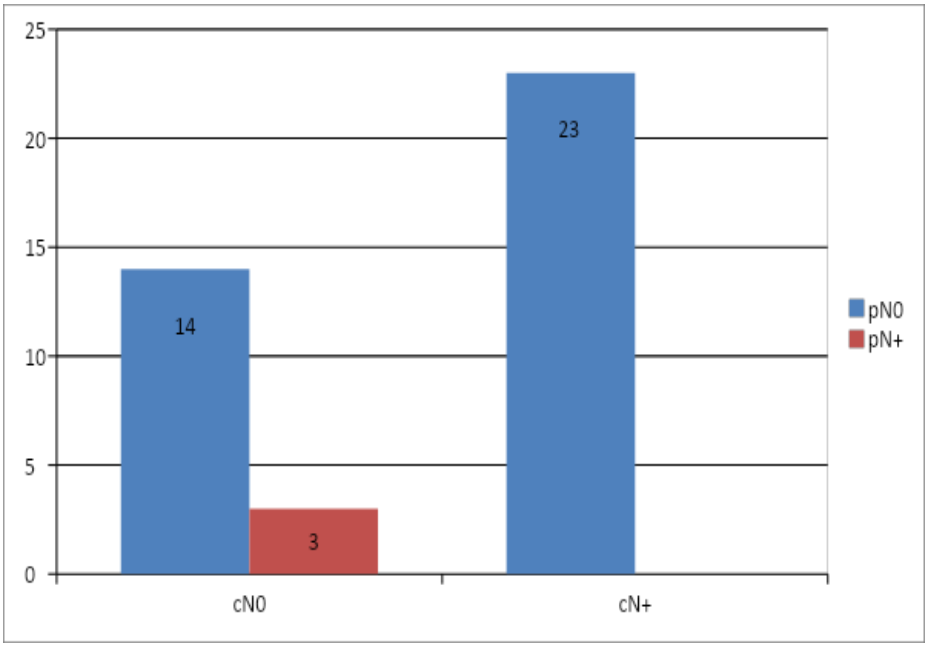
COMPARISION OF DATA

Correlation between clinical and pathological level I nodal status



	Pathological node positive pN+	Pathological node negative pN-	Total
Clinical node Positive cN+	15	21	36
Clinical node Negative cN-	2	12	14
Total	17	33	50

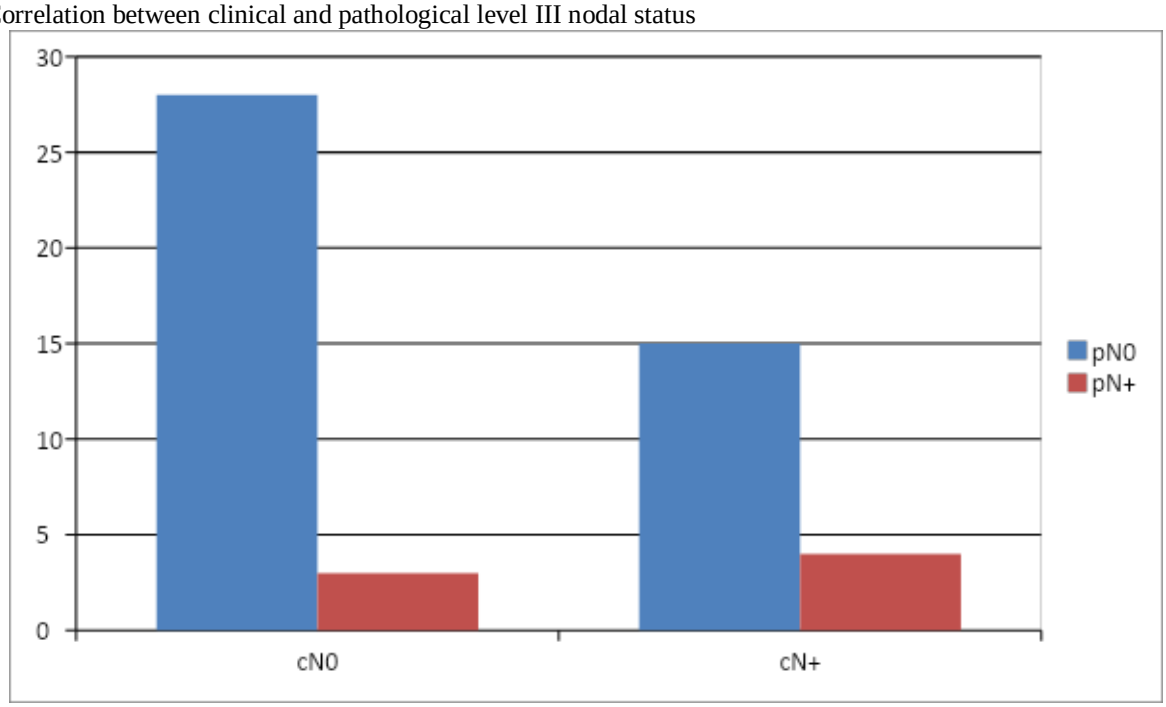
Correlation between clinical and pathological level II nodal status



	Pathological node positive pN+	Pathological node negative pN-	Total
Clinical node Positive cN+	0	23	23

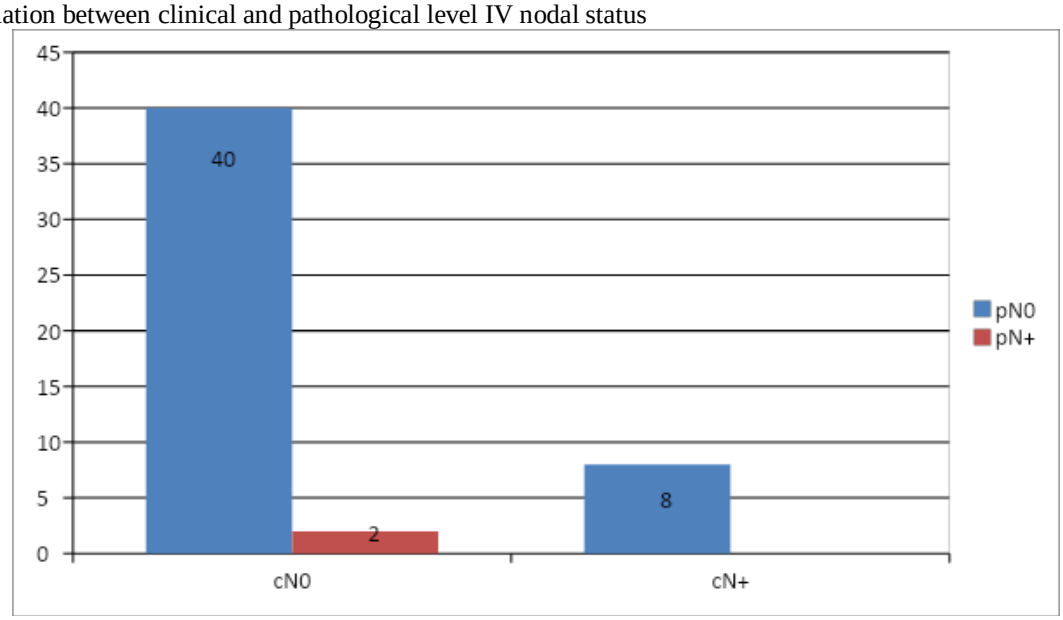
Clinical node Negative cN-	3	14	17
Total	3	37	50

Correlation between clinical and pathological level III nodal status



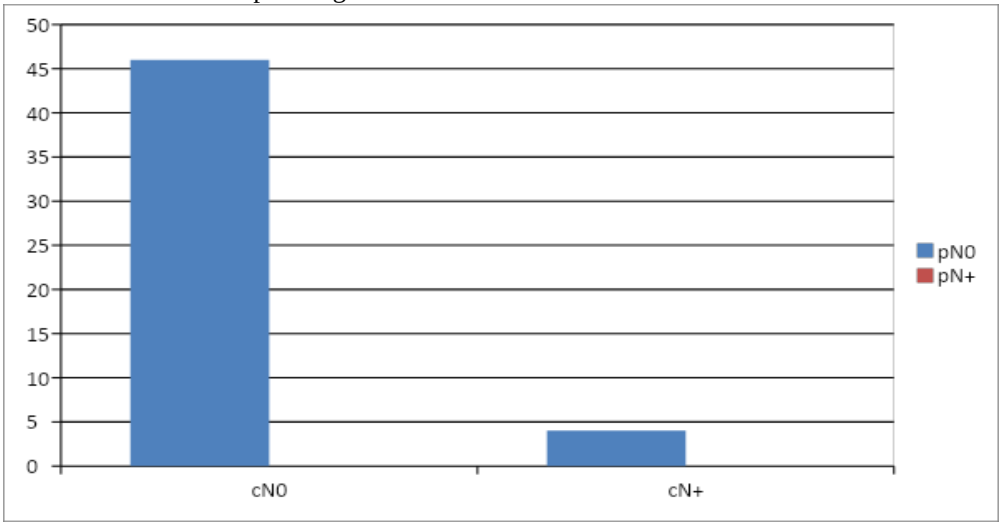
	Pathological node negative pN0	Pathological node positice pN+	Total
Clinical node negative cN0	28	3	31
Clinical node positive cN+	15	4	19
Total	43	7	50

Correlation between clinical and pathological level IV nodal status



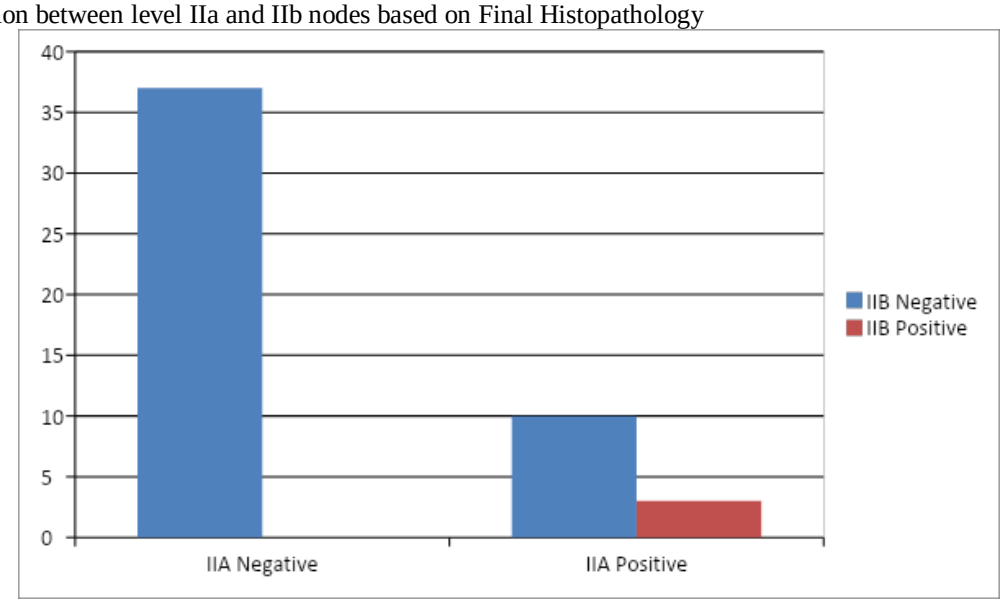
	Pathological node negative pN0	Pathological node positice pN+	Total
Clinical node negative cN0	40	2	42
Clinical node positive cN+	8	0	8
Total	48	2	50

Correlation between clinical and pathological level V nodal status



	Pathological node negative pN0	Pathological node positice pN+	Total
Clinical node negative cN0	46	0	46
Clinical node positive cN+	4	0	4
Total	50	0	50

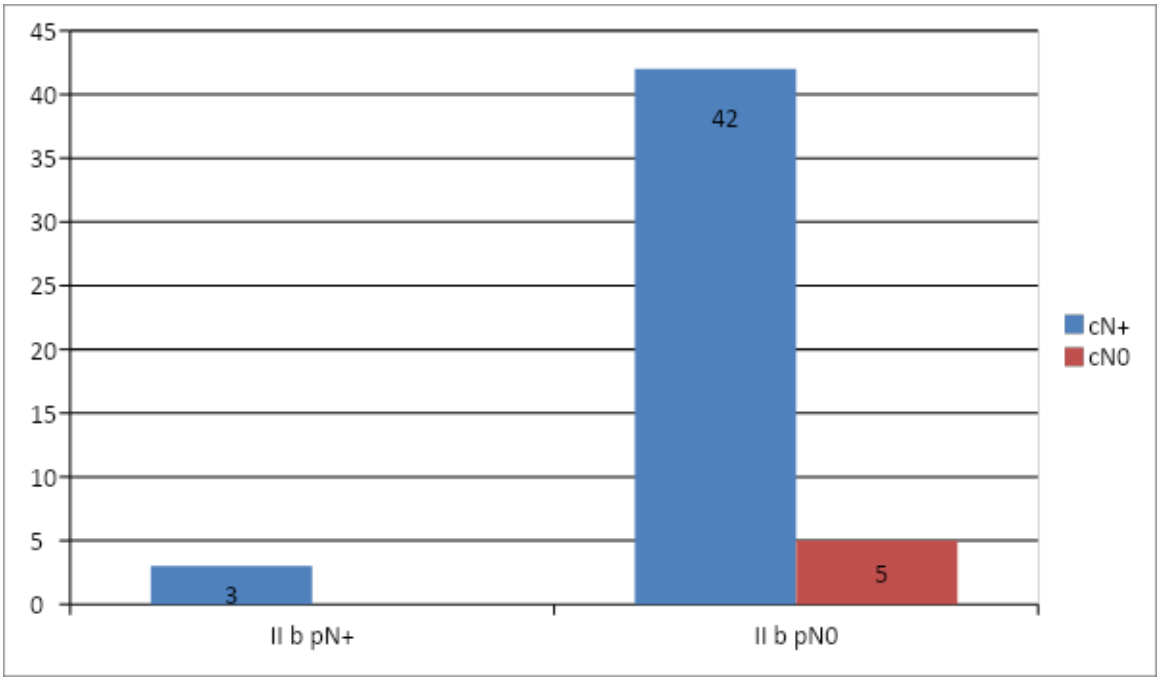
Correlation between level IIa and IIb nodes based on Final Histopathology



	II B negative pN0	II B positive	Total
II A negative	37	0	37
II A positive	10	3	13
Total	47	3	50

The Fisher Exact Test Statistical Value is 0.014592, which is significant ($p < 0.05$).
A statistically significant result was achieved suggesting that metastasis to level IIb is significantly associated with metastasis to Level IIA.

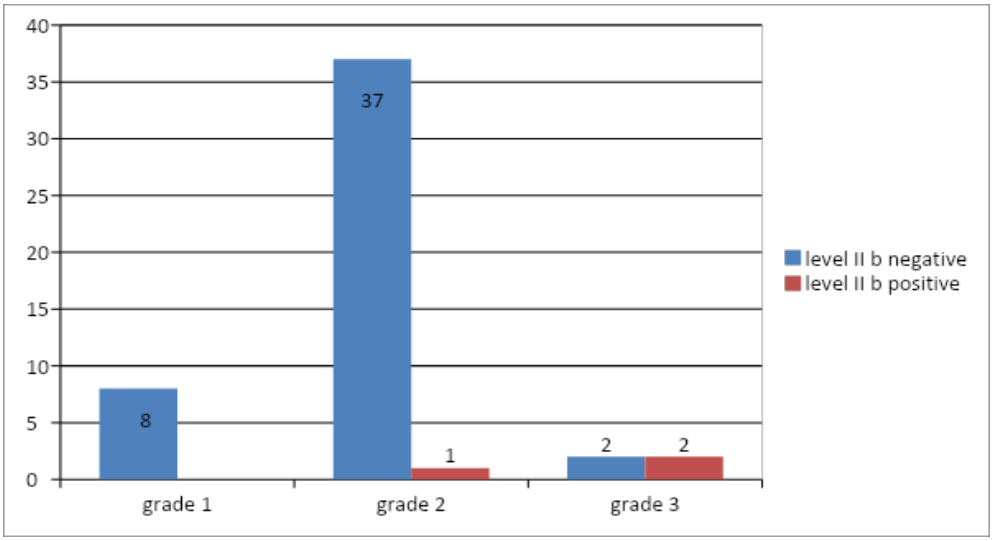
Correlation between clinical examination and pathological level IIb nodal status



	Clinically positive neck	Clinically negative neck	Total
II b positive	3	0	3
II b negative	42	5	47
Total	45	5	50

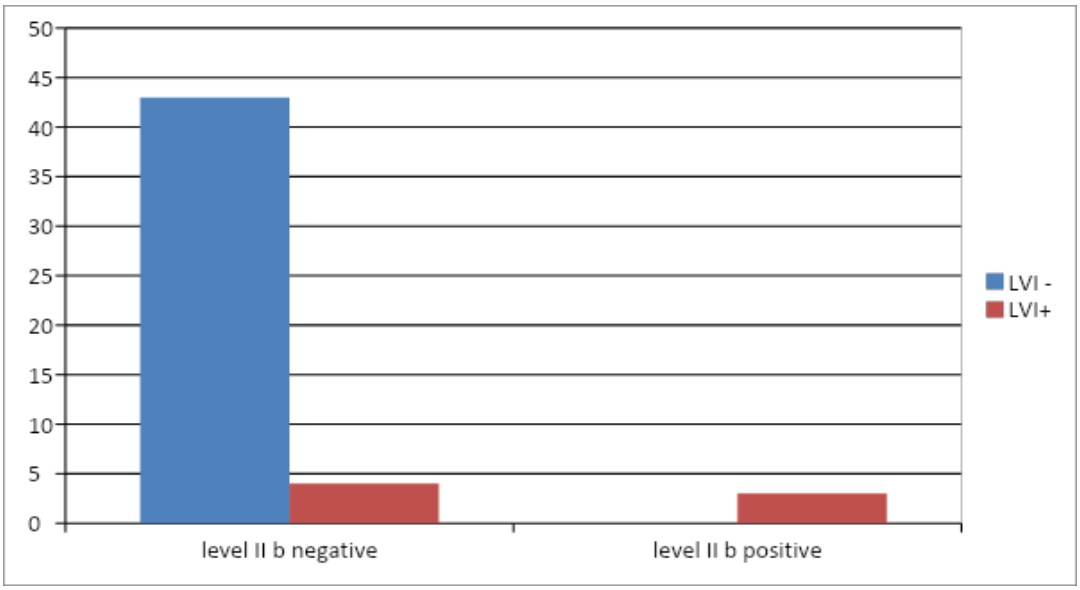
The fisher exact test statistic value is 1. The result is not significant as $p > 0.05$
Hence decision to dissect level IIb should not be depend on clinical examination.

Correlation between level IIb nodal status and histological grade



	Grade 1	Grade 2	Grade 3
Level IIb negative	8	37	2
Level IIb positive	0	1	2

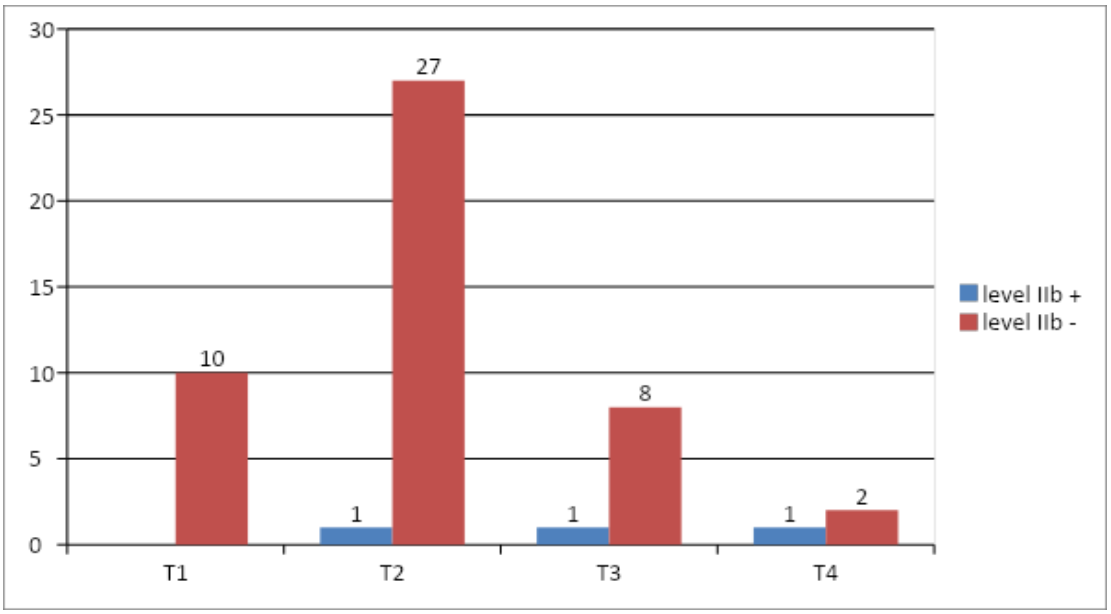
Fisher exact test shows probability 1.2E-02. The sum of the probabilities is significant, $p = 0.023$ suggesting grade has a significant correlation for level IIb metastasis.
Correlation between level IIb nodal status and lymph vascular invasion



	LVI negative	LVI positive	Total
Level II b negative	43	4	47
Level II b positive	0	3	3
Total	43	7	50

Fisher exact test shows probability 1.8E-03.
The sum of the probabilities, $p = 0.002$ suggesting that Lympho vascular invasion has a significant correlation with level IIb lymph node metastasis

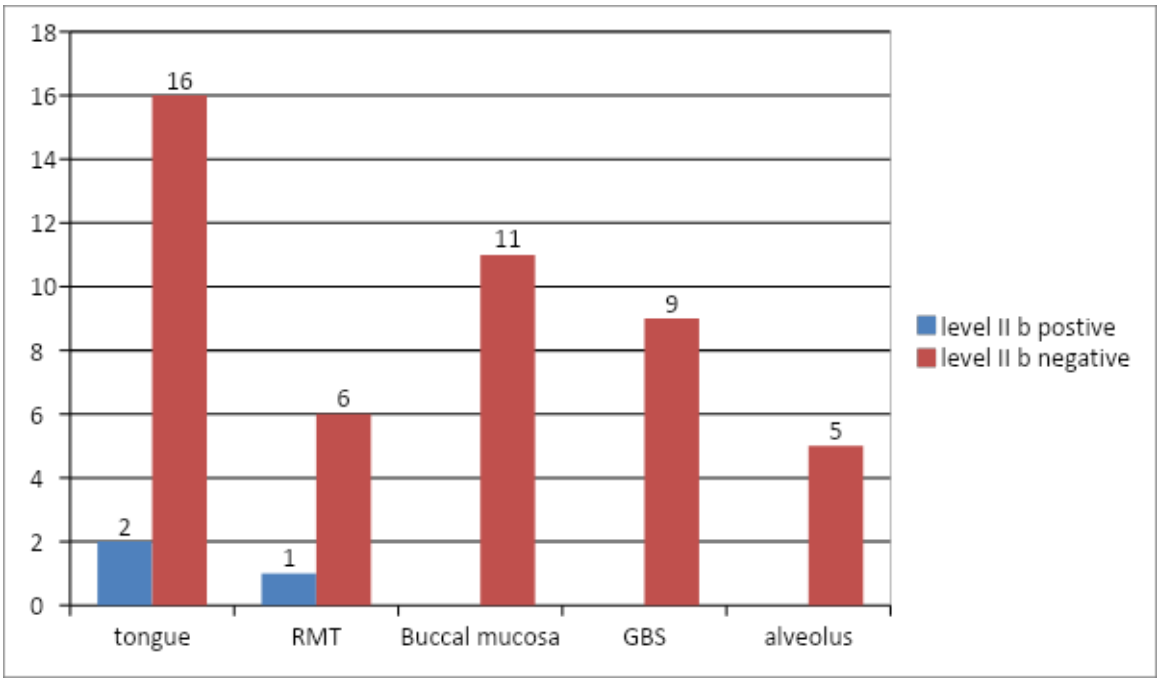
Correlation between level IIb nodal status and T stage



	Level IIB Positive	Level IIB negative	Total
T1	0	10	10
T2	1	27	28
T3	1	8	9
T4	1	2	3
Total	3	47	50

The calculated p value using Fisher exact test is 0.12 and is not significant.
This suggests T stage has no role in deciding level IIb lymph node dissection

Incidence of level IIb metastasis in relation to site of primary



	Level II b positive	Level II b negative	Total
Tongue	2	16	18
RMT	1	6	7
Buccal mucosa	0	11	11
GBS	0	9	9
Alveolus	0	5	5
Total	3	47	50

IV. Discussion

Dissection of level IIb in oral cavity SCC is controversial. The controversy arises from the relatively low reported risk of level IIb nodal metastases and the potential for shoulder disability with manipulation of the accessory nerve to clear the level IIb region. The frequency of level IIb nodal metastases ranges widely in the literature, from 0% to 10.4%, with wide 95% confidence intervals (0% to 44.4%). [10, 13, 48, 49, 52, 54] Difficulties exist in extrapolating the results of these individual studies to one's practice secondary to small sample sizes, with the largest study including only 74 patients. [52] Each study had its own unique inclusion and exclusion criteria, some including only clinically negative necks and others including all patients regardless of nodal disease status. Many studies set out to assess the rate of level IIb nodal metastases in patients with head and neck cancer, comprising numerous sites of which the oral cavity is 1 subsite. As TNM was often reported for the study population as a whole, limited TNM data were available for the oral cavity subset. In addition, the accuracy of reported level IIb nodal disease comes into question, as each study had variable methods of identifying and delineating level IIb for pathologic analysis.

Similarly, there are varying reports of the extent of shoulder disability that results from a selective neck dissection. Even when techniques were developed to preserve the nerve, the dissection of sublevel IIB requires retraction and mobilization of the nerve, which causes postoperative shoulder pain and weakness; electromyographic evidence of accessory nerve dysfunction was reported. [12]

The aim of this study is to evaluate the incidence of lymphatic metastasis in sublevel IIB in oral squamous cell carcinoma patients, and to discuss whether the omission of level IIB would produce the same oncologic outcome

Fifty patients between 20 and 70 years with a mean age of 48.62 ± 10.23 participated in our study. Majority of the patients were among 41-50 years age group i.e., 20 (40%) followed by 31-40 years age group

i.e., 18 (36%). Out of 50, 32 were men and 18 were women. Level IIb lymph nodes involvement by metastasis were in 3 (6%) out of 50 patients and all 3 of them were males.

Site of the tumor

Most of the tumors were located in the Tongue 18 (36%) followed by the buccal mucosa 11 (22%). Out of 3 cases with positive level IIb lymph nodes 2 were associated with a primary in tongue and 1 with a primary lesion in retro molar trigone.

T stage

According to histopathological TNM staging, majority of the tumors were T2 28 (56%) followed by T1 10 (20%) then T3 9 (18%) and T4 3 (6%). Among them 3 cases with level IIb lymph node positivity, there was one patient each in all T stages except T1. T stage is not significantly correlated with lymph nodal metastasis to level IIb (p=0.12)

Clinical N stage

Clinically, out of the fifty neck dissections; 5 necks (10%) were N0 and 45 (90%) were N+. All the three cases with level IIb lymph node positivity were found in the clinically classified N+ necks (P = 1).

Level IIa

Level IIa lymph nodes metastasis was documented in 13 (26%) neck dissections and all the 3 (6%) positive IIb lymph nodes were among them. There was an obvious significant statistical association between metastasis to both levels (P<.01).

Grade of the tumor

While co-relating the histologic grade of malignancy and pattern of metastasis to level IIb nodes in neck, out of 3 cases with level IIb positivity, 2 were poorly differentiated and 1 was moderately differentiated. The sum of the probabilities is significant, $p = 0.023$ suggesting grade has a significant correlation for level IIb metastasis.

Lympho vascular invasion

Out of 50 cases in the study, 7 (14%) patients had lymphovascular invasion. Out of 3 patients who had level IIb lymph node metastasis, all patients had lympho vascular invasion suggesting a significant correlation (p=0.002).

Shoulder syndrome

Out of 50 cases in the study, 11 (22%) patients developed shoulder syndrome after surgery. Out of 3 patients who had level IIb lymph node metastasis, 1 patient did not develop shoulder syndrome. Since level V lymph node dissection can also cause shoulder syndrome which is a confounding factor in this study as all patients underwent MRND, the results cannot be correlated to level II b dissection.

Comparison with other studies

Author (s)	**Year**	**No. of Patients**	**Subsites of Detection (n)**	**Metastasis Detected in Sublevel IIB by Pathologic Analysis (%)**	**M:F Ratio**	**Mean age (yrs)**
Bhattacharya et al [50]	2015	30	Lower alveolus (1) Buccal mucosa (1)	2(6.6)	22:8	50.50
Ghantous et al [59]	2015	70	Tongue (1)	1(1.4)	48:22	70.22
Maher et al [55]	2014	71	Tongue (3) Retromolar trigone (1)	4 (5.6)	50:21	59
Santoro et al [14]	2008	114	Larynx (1) Oral cavity(1) Oropharynx (2)	5 (3.3)	80:34	62
Villaret et al [60]	2007	297	Oral cavity (13)	25 (8.4)	3.5:1	58.8
Elsheikh et al [13]	2005	48	Tongue (3)	3 (6)	38:10	58.2

Lim et al [52]	2004	74	Tongue (4)	4 (5)	64:10	56.2
Kraus et al [61]	1996	47	Tonsil (1)	1(2.12)	32:12	NR
Present study	2017	50	Tongue (2) Retromolar trigone (1)	3 (6)	32:18	48.62

The incidence of occult metastasis in level IIB varies in the literature.

Kraus et al [61] reported 1 patient with level IIb metastasis in among 47 OSCC patients who underwent a neck dissection in a prospective study. The present study has a higher incidence (6%) of level IIB lymph node metastasis.

Villaret et al [60] stated that the oral cavity has the highest overall prevalence of level IIB metastasis (10%) among head and neck squamous cell carcinomas, but these metastases are only found in 2% of N0 patients; thus, they concluded that dissecting this level in clinical N0 could be avoided. Santoro et al [14] conducted a retrospective study of 114 patients, of which 47 patients originated from oral cavity SCC; one of the OSCC metastasized to sublevel IIB and concluded that the incidence of metastases at level IIb is low, also in the N1 necks, therefore dissection of this level could be unnecessary in N0 necks. Lim et al [52] study shows similar conclusions that level IIb nodal dissection can be avoided in elective neck dissections.

In the present study, out of the fifty neck dissections; 5 necks (10%) were N0 and 45 (90%) were N+. All the three cases with level IIb lymph node positivity were found in the clinically classified N+ necks (P = 1). However, the results were not statistically significant to suggest that level IIb dissection can be avoided in N0 neck which correlates with the study conducted by Ghantous et al [59]. The study concludes that level IIb nodal dissection remains the keystone of treating OSCC. Its prognostic and therapeutic value exceeds its associated morbidity; therefore, dissecting level IIB is recommended in treating OSCC even in clinically N0 patients

In Elsheikh et al [13] study, all patients with metastasis to level IIb lymph nodes have their primary lesions in the tongue and constituted 22% of patients with tongue lesions. There was no instance of isolated metastasis to level IIb lymph nodes without involvement of other nodes in the SOHND specimens. While in the present study, 2 out of 3 patients had primary in tongue and one patient had primary in RMT and none of them were isolated level IIb metastasis.

Bhattacharya et al [50] concluded for tumors in oral cavity (N0/N1), while performing elective or therapeutic selective neck dissection, the dissection of Level IIB nodes could be omitted as it will provide significant decrease in operative time and also less of spinal accessory nerve trauma-related complications. There was no relation between the site, size, and histologic grade of primary tumor with the metastasis to Level IIB. The Level IIA nodes were positive in both the positive cases of Level IIB. While in the present study, 3 out of 50 patients showed level IIb metastasis and there was a no significant correlation with site and size of tumour with level IIb nodal metastasis. However, tumour grade shows a significant correlation (p = 0.023) with level II b nodal metastasis which does not correlate with the above study.

In Maher NG et al [55] study, the overall frequency of sublevel IIb lymphatic metastases at neck dissection was 5.6% of the patient cohort. Sublevel IIb metastases occurred from the primary sites involving the tongue (n = 3) and retromolar trigone (n = 1). The incidence of perilymphatic and perivascular invasion was significantly associated with sublevel IIb lymphatic metastases which correlate with the present study. The present study shows lymphovascular invasion has a significant correlation with level IIb lymph node metastasis (p= 0.002)

V. Conclusion

Despite the low rate of level IIb nodal metastases reported in this study, evidence is insufficient to warrant a change in practice at this time. Although the incidence reported of level IIb metastases is only 6%, the optimal time to manage these nodes is at the time of initial dissection. Although a change in practice may be on the horizon, data from a large prospective multi-institutional cohort study are recommended, with standardized intraoperative methods of delineating level IIb for pathologic analysis, as well as assessment of shoulder dysfunction and disability using standardized methods of assessment. At the present time, given the quality of evidence to date, we feel it is recommended that dissection of level IIb remain the standard of care in oral cavity squamous cell cancer.

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