"EVALUATION OF POSTERIOR TRIANGLE AND SUPRACLAVICULAR LYMPH NODES FOR METASTASIS IN PATIENTS WITH ORAL CANCERS WITH N_1 NECK"

BY

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Dissertation submitted to

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH,
TAMAKA, KOLAR, KARNATAKA

in partial fulfillment
of the requirements for the degree of
M.S.

in

OTORHINOLARYNGOLOGY

under the guidance of

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APRIL -2013

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ACKNOWLEDGEMENT

Gratitude cannot be expressed through words, yet I may be permitted to record here the invaluable guidance, help, co-operation and encouragement I received from distinguished luminaries referred to in this dissertation.

First I record my deep sense of regards and earnest gratitude to **Dr.Narayana GK**, Former HOD, Department of Otorhinolaryngology, for guiding me through the intricacies of writing a dissertation.It is his step-by-step guidance that enabled me to successfully complete the dissertation work.

I express my gratitude and humble thanks to **Dr.Azeem Mohiyuddin S.M,** Professor and Present Head, Department of Otorhinolaryngology ,Sri Devaraj Urs Medical College, Kolar, my co-guide for his extended relentless support and meticulous expert advice that enhanced the stature of this dissertation.

I sincerely thank **Dr.Suresh TN,** Associate Professor, Department of Pathology, Sri Devaraj Urs Medical College, Kolar, who was my co-guide, for exposing me to the intricacies of the pathological aspects of this study.

Dr.Khaja Naseeruddin, Professor and Head of Unit, **Dr.Thomas Prasannaraj,**FormerHOD,**Dr.Shivaprakash,**Lecturer, **Dr.Venkatesh,** Professor**, Dr. Vinay babu,** Associate Professor**, Dr.Sagayaraj**,Associate Professor ,**Dr.Nikhil,** Assistant Professor, **Dr.Chandrakala,** Assistant Professor, **Dr.Shuaib Merchant,** Senior Resident, the faculty members in Department of Otorhinolaryngology, Sri Devaraj Urs Medical College, Kolar,

were a constant source of encouragement and inspiration. My heart-felt thanks to all of them.

My heart-felt gratitude to **Dr.M.B.Sanikop**, Principal, Sri Devaraj Urs Medical College, Kolar, for permitting me to use the infrastructure facilities.

I also thank **Dr. S.R. Prasad**, Director of PG Studies ,Sri Devaraj Urs Medical College, Kolar and **Dr V.Lakshmaiah**, Medical Superintendent , R.L. Jalappa Hospital and Research Centre for permitting me to make use of the clinical material used in this dissertation.

I would not be justified if I don't express my gratitude to the patients, non teaching staff of ENT Department and my colleagues **Dr.Saheer, Dr.Winson**, **Dr.Lakshmi, Dr.Samdani, Dr.Kousar, Dr.Philip**, **Dr.Rijo, Dr.Manaswini, Dr.Sheetal, Dr.Arun, Dr.Abhishek,Dr.Harshita,Dr.Shreyas,Dr.Beauty,Dr.Vasumathi**

Lastly, I express my profound thanks and gratitude to my parents and my sister for their immense support and unconditional love.

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List of abbreviations(in alphabetical order)

1	AAO-HNS	American Academy Of Otolaryngology Head and Neck Surgery
2	AJCC	American Joint Committee on Cancer
3	CT	Computerised Tomography
4	EJV	External Jugular Vein
5	FNAC	Fine Needle Aspiration Cytology
6	FDG	Fluro Deoxy Glucose
7	FND	Functional Neck Dissection
8	HNSCC	Head and Neck Squamous Cell Carcinoma
9	IJV	Internal Jugular Vein
10	UICC	International Union Against Cancer
11	MRND	Modified Radical Neck Dissection
12	MRI	Magnetic Resonance Imaging
13	OSCC	Oral Squamous Cell Carcinoma
14	PET	Positron Emission Tomography
15	Level V	Posterior triangle Lymph Node
16	RND	Radical Neck Dissection
17	SND	Selective Neck Dissection
18	SAN	Spinal Accessory Nerve
19	SCM	Sternocleidomastoid
20	Level IV	Supraclavicular Lymph Node
21	SOHND	Supra Omohyoid Neck Dissection
22	TNM	Tumour Node Metastasis

ABSTRACT

Background

Oral Cancers are the most predominant cancers in our region due to the habit of beetle nut chewing.Oral cavity has abundant blood supply and lymphatic drainage.Hence chances of cervical metastasis is very high. It is well accepted in literature that neck lymph node metastasis is an important prognostic factor in oral carcinomas and decreases five year survival by nearly half.There are many studies which have shown that nodal metastases occur most commonly at level I-III in oral cancers.Very few studies available which evaluates the importance of cancer spread to level IV and V in oral squamous cell carcinoma in clinically node positive neck (N_1).

Objectives

To find out the frequency of metastasis to posterior triangle (level V) and lower deep jugular/ supraclavicular(level IV) lymph nodes in patients with oral squamous cell carcinoma having clinically N_1 neck.Also, To determine whether dissection of posterior triangle and lower deep jugular lymph node is mandatory in therapeutic neck dissection as a part of treatment for squamous cell carcinoma of oral cavity with clinically N_1 neck.

Materials and Methods

A total of 30 patients with oral squamous cell carcinoma with clinically N_1 (single ipsilateral lymph node less than 3cms in diameter) neck undergoing surgery for the primary lesion and modified radical neck dissection from December 2010 to June 2012 were included in this study.During neck dissection, the contents of level IV and V were dissected , labelled and

processed separately from the remainder of the major neck dissection specimen for histopathological examination.

Results

The age of the patients ranged from 41- 70 years with M:F=1:6.Majority of the primary tumours were buccal mucosa tumours(24/30).Remaining 6 were tongue tumours.10/24 patients in buccal mucosa cancers while 3/6 patients in tongue cancers showed pathologically positive nodes for metastasis.Level Ib was most commonly involved in buccal mucosa carcinoma with no metastasis occurring to level IV and V in any patients.1 out of 6 patients with tongue carcinoma had metastasis to level IV and level II.No metastasis was seen at level V.

Conclusion

Buccal mucosa Cancers are very common in Kolar district with female preponderance.Metastasis to lower neck nodes in level IV and V in buccal mucosa cancers is very rare.However tongue cancers can metastasize to level IV.In future, it may be feasible in properly selected patients to omit posterior triangle clearance in buccal mucosa cancers with N_1 neck.However, tongue cancers requires full neck dissection.(MRND).

Key Words: Oral Squamous cell carcinoma, Posterior triangle and supraclavicular nodes, Neck dissection

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Introduction

Oral cancer is the sixth most common cancer in the world and is largely preventable .[1] It accounts for approximately 4% of all cancers and 2% of all cancer deaths world-wide.[2] In India it is the commonest malignant neoplasm, accounting for 20-30% of all cancers.Southern India presents the highest oral cancer incidence rates among women worldwide and the highest in India overall .[3]

These very high incidence rates in Indian population reflect the continued prevalence of paan chewing in India, a habit which is equally common in both genders.[4] Besides paan chewing, the effects of tobacco use and alcohol drinking are clear risk factors for oral cancer in India and elsewhere.[5-9] Among Indian men, the attributable oral cancer risk due to smoking, alcohol and paan chewing is over 80% and among women in India, paan chewing alone explains almost all (over 90%) the oral cancer risk.[7,10,11,12]

More than 90-95% of oral cancers are SCC or one of its variants.[13] Malignancy within oral cavity is potentially devastating due to the associated morbidity.Therefore early detection and appropriate treatment of cancers remain the most effective weapon against cancers of the oral cavity. A critical prognostic factor in head and neck cancer is spread of disease to regional lymph node. In the early 1800s, it was believed that once head and neck cancer had spread to the cervical lymph nodes, complete removal of the disease was impossible .

It was Crile in 1906 , who described a systematic operative procedure for removal of cervical lymphatics termed ‘ Radical neck dissection ’ which was standardised by Hayes Martin (Father of modern head and neck surgery) and his assosciates.[14,15]

As described by Crile in 1906, Radical neck dissection (RND) required complete removal of lymph nodes from level I to V along with sternocleidomastoid (SCM) muscle, internal jugular vein (IJV) and spinal accessory nerve (SAN). By sacrificing the SAN, patients suffered from the "eleventh nerve syndrome" or "Shoulder syndrome" characterized by shoulder droop, winged scapula, weak abduction, inability to shrug and dull ache with pain localized to shoulder.[18-22] Earlier efforts to treat this problem involved rehabilitation of the functionally impaired extremity, the results of which were not very encouraging. This led to modifications to the Classic RND. [16]

Pioneers like Suarez from Argentina, Ballantyne from North America and Bocca from Italy, began to explore surgical alternatives that would be oncologically sound but preserve important functional and anatomical structures in the neck. These variations in the surgical procedures were categorised as Modified radical neck dissection(MRND)/Functional neck dissection(FND).[17]

The basis of modified radical neck dissection was that the whole lymphatic system of the neck lies within fascial compartments which can be removed without sacrificing the non-lymphatic structures.By 1980's, several concepts played an important role in the emergence of selective neck dissection which preserves the SAN, SCM and IJV and resects only those nodal levels most likely to be involved with tumour, based on location of the primary tumour as lymph node metastasis in neck has a predictable pattern. However selective neck dissection(SND) is used only in N_0 neck and its use in N_1 neck is still under evaluation.

In spite of nerve sparing neck dissections (MRND/SND), some degree of morbidity still persists due to devascularization / neuropraxia during surgical manipulation of SAN.These nerve injuries are seen mainly in posterior triangle dissection in neck / supraspinal accessory lymph node clearance. [18-22]

In our centre, previously a study was done to assess spinal accessory nerve function in various types of nerve sparing neck dissections. Those patients who underwent Functional neck dissection showed the most severe disturbance on electromyography at 3 weeks. Of the 28 shoulders (27 patients) in this group, 11 had severely abnormal electromyogram (39.3%). At three months, electromyography showed improvement in 12 patients (42.9%) . The supraomohyoid neck dissection group was found to have the least damage to the spinal accessory nerve as demonstrated by post operative electromyogram. Of the 11 shoulders in this group two (18.2%) had severely abnormal electromyograms in the early post operative period. On repeat electromyograms at 3 months all showed improvement with nine patients (82%) showing normal electromyograms and 2 patients (18%) showing slightly abnormal electromyograms.

In our country, most of the patients who undergo MRND / SND are manual labourers.Hence the integrity of the spinal accessory nerve is all the more important as the shoulder dysfunction caused by the damage to the nerve will directly affect the day to day earnings of the patient.

As per the literature , there is predictable pattern of cervical lymphatic spread in SCC oral cavity. [23-28]

Lateral cancers of oral cavity (Buccal mucosa) frequently metastasize to Level I or II while midline cancers (Tongue, floor of mouth, oropharynx) drains bilaterally.[23-28] Prevalence of nodal metastasis to level V in buccal cancers is very low and may be seen only in presence of nodal disease at level I-III.[24-34] Skip leisons involving levels II-IV seen only in tongue tumours.[37,38,39]

Considering the predictable pattern of lymphatic spread in SCC oral cavity and increased morbidity to the spinal accessory nerve involved with dissection of level V lymph nodes in concordance with studies in literature, [23-34] this study is done to investigate the occurance of metastasis mainly to level IV and V (Supraclavicular and Posterior triangle) nodes in patients with oral squamous cell carcinoma (OSCC) having clinically N_1 neck and thereby to evaluate the usefulness of level IV and V clearance in oral cancers with clinically N_1 neck. If oral cancers with clinically N_1 neck shows very low prevalence of metastasis to level IV and V lymph nodes, the clearance of this area with resultant morbidity may be avoided.

Objectives of the study

1. To find out the frequency of metastasis to posterior triangle lymph nodes and lower deep jugular (supraclavicular) lymph nodes in patients with squamous cell carcinoma of oral cavity having clinically N_1 neck.

2. To determine whether dissection of posterior triangle and lower deep jugular lymph node is mandatory in therapeutic neck dissection as a part of treatment for squamous cell carcinoma of oral cavity with clinically N_1 neck.

Review of literature

Approximately 300 lymph nodes are located in the head and neck and they comprise 30% of the total 800 lymph nodes in the human body. In 1880, Kocher reported the detrimental effect of neck metastasis in patients with head and neck cancer. In 1906, George Washington Crile reported his experience with 132 neck dissections in JAMA: The Journal of the American Medical Association. The advent of functional neck dissections, aimed at reducing morbidity and maintaining function, was made possible with the further advancement of understanding of the lymphatic spread in the 1960s.[16,17,23,24]

Cervical metastasis has a tremendous impact on the prognosis in patients with carcinomas of the head and neck. The presence of neck metastasis is known to reduce survival by 50%.[40] Further, the presence of extra capsular spread halves the chances of cure. Predictive factors of cervical metastasis are primary site, primary tumor size, degree of differentiation of tumor, perineural invasion, perivascular invasion, inflammatory response, and tumor DNA content.[30,41-45]

Advantages of modified neck dissection (MND) over radical neck dissection (RND) are preservation of shoulder functions, better venous drainage and cosmetic results, protection of the internal carotid artery (ICA), and availability of simultaneous bilateral surgeries.[16] MND offers the same survival rate and disease-free survival benefits as classic RND.

History of the Procedure

1906: Crile developed the en bloc cervical lymphadenectomy known as the RND. In his classic series, spinal accessory and hypoglossal nerves were preserved.

1945: Dargent and Papillon proposed the preservation of the spinal accessory nerve (SAN) in clinically node-negative necks.

1950: Martin popularized the RND without preserving the spinal accessory nerve.

1963: Suarez demonstrated, based on his necropsy studies, that a complete cervical lymphadenectomy could be accomplished while sparing the sternocleidomastoid (SCM) muscle, the internal jugular vein (IJV) and the SAN.

1967: Bocca and Pignataro popularized functional/modified radical neck dissections.

1969-1981: Roy and Beahrs, Carenfelt, and Eliasson advocated the possibility of preservation of SAN in clinically node-positive necks as well.[46]

1972: Lindberg's classic study of carcinomas of various upper aerodigestive tracts indicated consistent patterns of lymphatic drainage.[23]

1986-1994: Byers, Medina, and Spiro reported their satisfactory results with selective neck dissection (SND).[47]

Surgical Anatomy of Neck[48,49]

Traditional nomenclature of the surface anatomy of the neck separates it into anterior and posterior triangles.

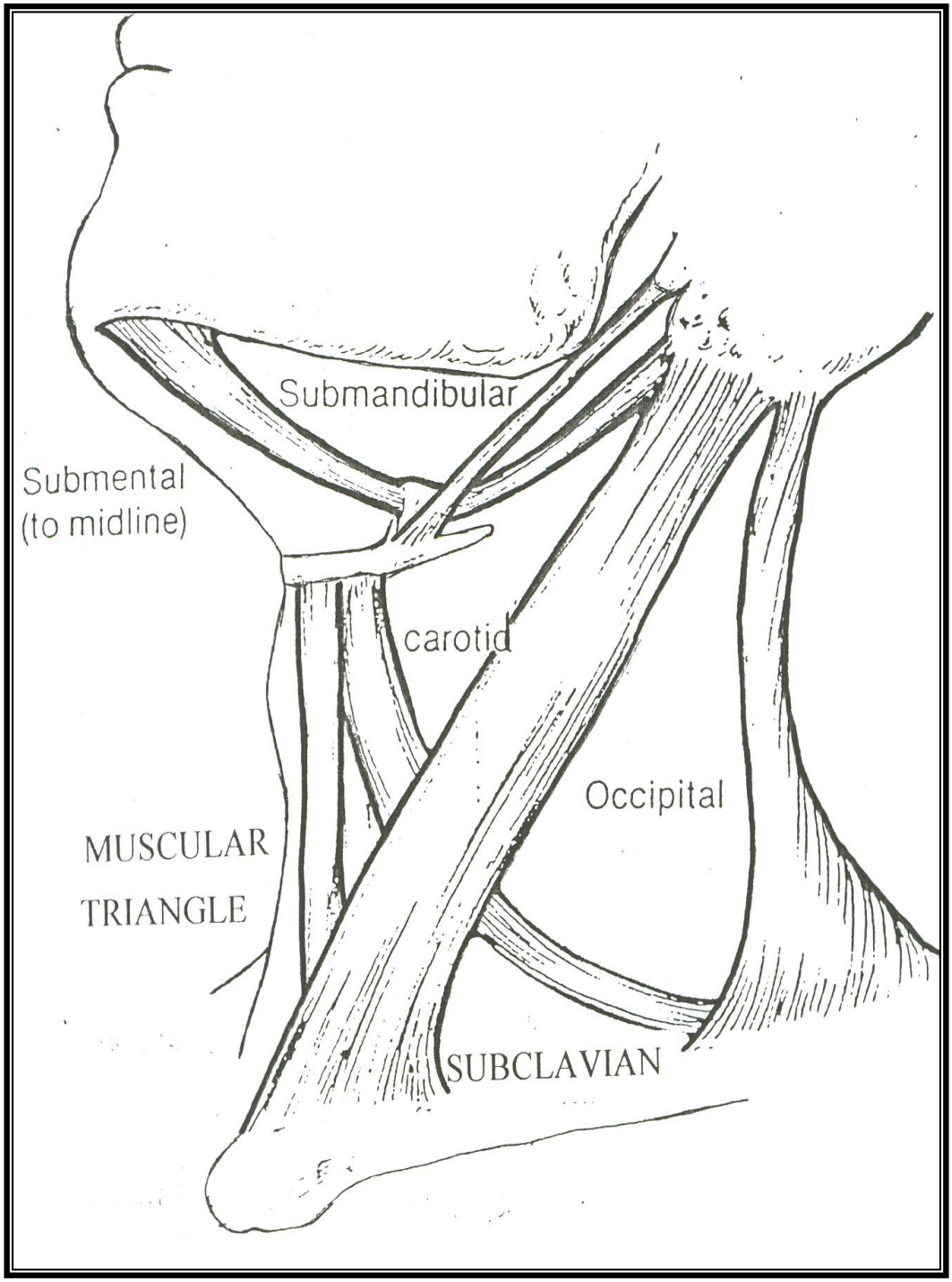


Fig 1 a : Triangles of Neck

Anterior Triangle of the neck

Boundaries

Posteriorly : Posterior border of sternocleidomastoid

Superiorly : Inferior border of mandible and imaginary line joining angle of mandible to mastoid tip

Anteriorly : Midline of neck

As per anatomy textbooks, posterior boundary of anterior triangle of neck is anterior border of sternocleidomastoid (SCM) but in practise during dissection , posterior limit of anterior triangle of neck is considered to be posterior border of sternocleidomastoid, since carotid sheath lies deep to sternocleidomastoid.

Subdivisions of the Anterior Triangle

1.Submental triangle

2.Submandibular (Digastric) triangle

3.Carotid triangle

4.Muscular triangle

Submental (Suprahyoid) Triangle

Lies above the hyoid bone between the two anterior bellies of the digastrics muscles as they approach the chin.The floor is formed by the mylohyoid muscle.Base is formed by arch of hyoid bone and apex is formed by genoid tubercle of mandible.

Contents: Submental lymph node drains the floor of mouth

Submental vein which joins to form the anterior jugular vein

Submandibular (submaxillary/digastric) Triangle

Boundaries

Above : Inferior border of mandible and imaginary line joining angle of mandible to mastoid tip

Below : Anterior and Posterior bellies of digastric muscle

Floor : Anteriorly myelohyoid muscle

Posteriorly Hyoglossus, stylohyoid

Roof : skin, superficial fascia enclosing platysma and fat, mandibular and cervical branches of facial nerve

Contents : Submandibular salivary gland and duct, facial artery and vein, hypoglossal nerve, lingual artery and nerve, submandibular lymph node

Carotid triangle

Boundaries

Superiorly : Posterior belly of digastric muscle

Posteriorly : Posterior border of sternocleidomastoid

Anteroinferiorly : Superior belly of omohyoid

Roof : Skin, superficial fascia, investing layer of deep cervical fascia

Floor : Thyrohyoid muscle, hyoglossus and the middle and inferior Constrictors of pharynx

Contents : Carotid sheath,external carotid artery, sympathetic trunk

Muscular Triangle

Boundaries : Superior belly of omohyoid

Anterior border of sternocleidomastoid

Midline of the neck

Contents : Infrahyoid muscles

Posterior Triangle of the Neck

Boundaries

Anteriorly : Posterior border of sternocleidomastoid

Posteriorly : Anterior border of trapezius

Inferiorly : Middle third of clavicle

Roof : Investing layer of deep cervical fascia, superficial fascia containing platysma, external jugular vein, great auricular nerve

Floor : prevertebral layer of deep cervical fascia covering the following muscles Semispinalis capitis, splenius capitis, levator scapulae, scaleneus anticus medius and posterior

Subdivisions – posterior triangle subdivided into 2 triangles by inferior belly of omohyoid

Above : Occipital Triangle

Below : Supraclavicular Triangle

Contents : Spinal accessory nerve, branches of cervical plexus, brachial plexus, transverse cervical artery and vein, occipital artery, thoracic duct,supraclavicular nerves, occipital and supraclavicular lymph node

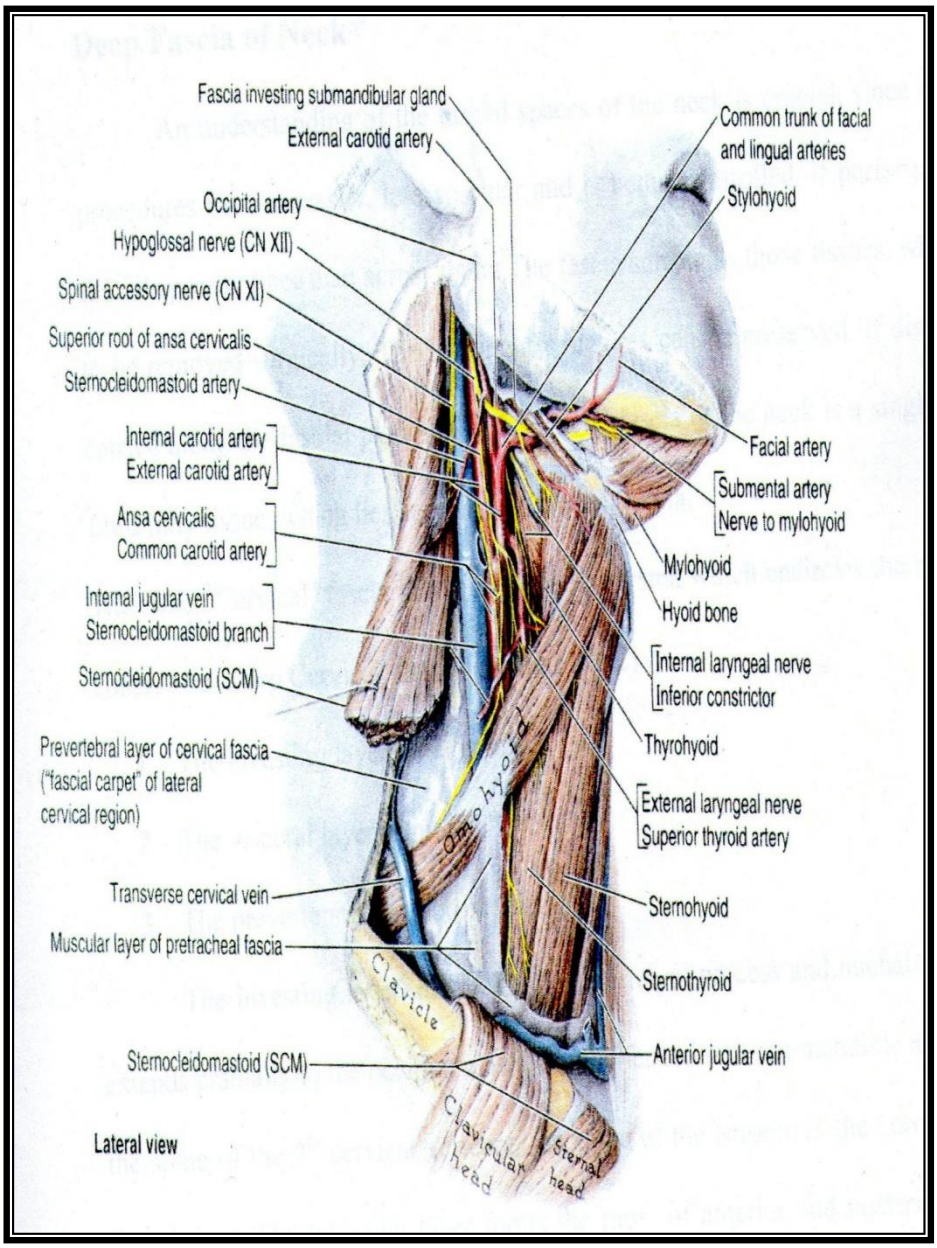


Fig 1 b : Anatomy of the Neck with divided Sternocleidomastoid Muscle showing vital structures

Fascial neck spaces[49]

An understanding of the fascial spaces of the neck is crucial, since operative procedure becomes easier, less vascular and is better controlled, if performed along fascial spaces rather than through them.Removal of the fascia is crucial part of neck dissection since it surrounds those tissues which need to be removed surgically and by dissecting along the fascia , important structures within the head and neck can be preserved .

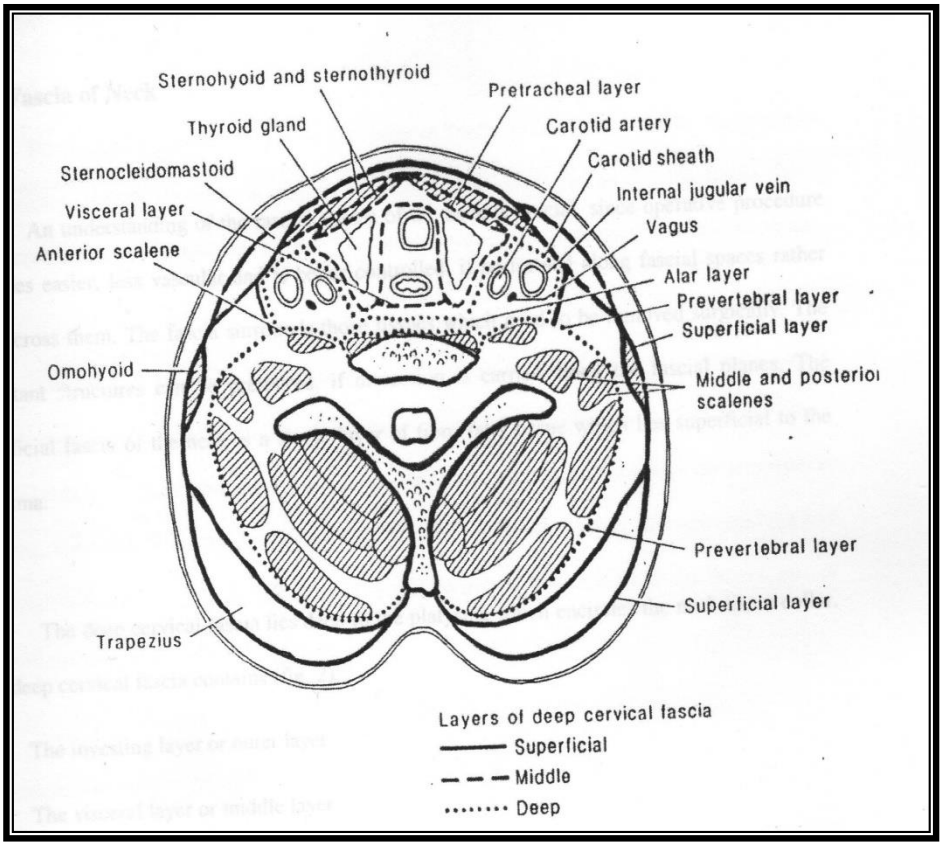


Fig 2: Deep fascia of the neck

The superficial fascia of the neck is a single layer of fibro fatty tissue, which lies superficial to the platysma. The deep cervical fascia lies deep to the platysma and occupies important spaces between muscles, blood vessels, lymph nodes and the viscera in the neck.

Three layers of deep cervical fascia includes

1.The investing or outer layer

2.The visceral or middle layer

3.The internal layer

The investing layer of fascia invests the whole of the neck and spilts to surround the trapezius muscle posteriorly and the sternocleidomastoid muscle laterally.Above it is attached to the superior nuchal line , the mastoid process and the mandible and below to the spine of the 7^{th} cervical vertebra, the spine of acromion, the clavicle and the manubrium.It forms the roof of the posterior and anterior triangles.The fascia splits to envelop parotid and submandibular glands and forms the carotid sheath which sorrounds both the internal and external carotid arteries and the common carotid artery along with internal jugular vein and vagus nerve .

The visceral or middle layer of fascia sorrounds the middle compartment of the neck to include the pharynx, larynx , oesophagus and trachea and allows these structures to move upon each other.It includes pre-tracheal fascia which envelops the thyroid and parathyroid glands.

The internal layer also called the prevertebral fascia surrounds the deep muscles of the neck.It is crucial to understand the anatomy of this layer as it provides the floor to the posterior triangle and has important relations with some important nerves in the neck.The cervical sympathetic trunk lies superficial to the prevertebral fascia under the carotid sheath, the branches of the cervical plexus lie deep to the fascia and both the phrenic nerve and brachial plexus lie deep to this layer.

Sternocleidomastoid Muscle

The sternocleidomastoid muscles originate from two heads, the sternal head is tendinous and arises from the superolateral part of manubrium sterni.The clavicular head is musculotendinous and arises from medial one thirds of the superior surface of the clavicle.The two heads blend below the middle of the neck.It gets inserted by a thick tendon into the lateral surface of the mastoid process and by a thick aponeurosis into the lateral half of the superior nuchal line.Part of the muscle is inserted into skin of the neck.It is supplied by spinal accessory nerve.Branches from the ventral rami of C_2, C_3 are sensory (propioceptive).

In neck dissection it is advisable to retain the muscle wherever possible to provide protection to carotid artery .But long term follow up has shown that after 6 months the muscle gets atrophied as fascia covering the muscle is removed which hampers the blood supply.

Internal Jugular Vein

It is a direct continuation of the sigmoid sinus.It begins at the jugular foramen and ends behind the sternal end of the clavicle by joining the subclavian vein to form the brachiocephalic vein.The tributaries include

1.Common facial vein

2.Lingual vein

3.Pharyngeal vein

4.Superior thyroid vein

5.Middle thyroid vein

6.Occipital vein

The thoracic duct opens into the angle between the internal jugular vein and subclavian vein on the left side.Internal jugular vein is closely assosciated with the lymph nodes all along its course.

Spinal Accessory Nerve

The accessory nerve has two roots:spinal and cranial. The cranial root is accessory to the vagus and is distributed through the branches of vagus nerve.The spinal root has a more independent course.

The cranial root arises from the lower part of the nucleus ambiguous.It fuses with the vagus just below the inferior ganglion and is distributed through the branches of the vagus to the muscles of the palate, the pharynx and the larynx.

The spinal accessory nerve is special visceral efferent, arises from long spinal nucleus between the segments C_1 to C_5. This supplies the sternocleidomastoid and trapezius muscles.It emerges in the form of row of filaments attached to the cord which unite to form a single trunk.This trunk enters the cranium through the foramen magnum.Within the cranium, the nerve runs upwards and laterally, reaches the jugular foramen. The nerve leaves the skull through the middle compartment of the jugular foramen.

In its extracranial course, the nerve descends vertically between the internal jugular vein and internal carotid artery.It reaches a point midway between the mandible and the mastoid process.Then it runs downwards and backwards superficial to the internal jugular vein and deep to the sternocleidomastoid.Here it

is crossed by the occipital artery, accompanied by sternomastoid branch of occipital artery and surrounded by lymph nodes.

The nerve pierces the anterior border of sternocleidomastoid at the junction of its upper one-fourth with the lower three fourth and communicates with spinal nerves C_2 and C_3 within the muscle.

The nerve enters the posterior triangle of the neck by emerging through the posterior border of sternocleidomastoid at the junction of upper $1/3^{rd}$ and lower $2/3^{rd}$ of SCM.In the triangle it runs downwards and backwards, embedded in the fascial roof of the triangle.Here it lies over the levator scapulae muscle.The nerve leaves the posterior triangle by passing deep to the anterior border of the trapezius about 4cms, above the clavicle. On the deep surface of the trapezius the nerve communicates with spinal nerves C_3 and C_4 and ends by supplying the trapezius.

Sites of identification of the spinal accessory nerve during neck dissection

1.At the upper part of neck , deep to sternomastoid where it pierces the posterior border of SCM dividing it into upper $1/3^{rd}$ and lower $2/3^{rd}$

2.Within 2cm above the Erb's point (Emergence of greater auricular nerve at the posterior border of sternocleidomastoid muscle)

3.About 4cms above the clavicle where it enters into the anterior border of trapezius muscle.

Anatomy of Cervical Lymphatic System[49]

Head and Neck lymphatics

The lymphatic drainage of the head and neck is conventionally divided into three systems[21]

1.Waldeyer's Internal Ring

2.Waldeyer's External Ring (Superficial lymph-node system)

3.Deep System (cervical lymph nodes proper)

Waldeyer's Internal Ring

Within the pharynx at the skull base, there is a circular collection of lymphoid tissue aggregates which plays an important part in early immunological development.They consist of a collection of lymphoid tissue and were described by Waldeyer (who was Professor of Anatomy in Berlin) in 1884 .The ring includes the adenoid, the tubal tonsil, palatine tonsil, lingual tonsil and aggregates of lymphoid tissue on the posterior pharyngeal wall.Tumours arising in this area have a high propensity for lymphatic spread.

Superficial lymph-node system(Waldeyer's External ring)

The lymphatic drainage of head and neck is divided into superficial and deep system.The passage of lymph usually is lateralized and follows sequential spread from superficial to deep.The superficial system which drains the superficial tissues of the head and neck consists of two circles of nodes one in the head and the other in the neck.In the head , the nodes are situated around the skull base and

are known as the occipital , post auricular, parotid or pre auricular and then buccal or facial nodes.They are in continuity with the superficial nodes in the upper neck consisting of superficial cervical, submandibular and submental nodes along with the anterior cervical nodes.These latter are situated along the external jugular vein and the anterior jugular veins respectively.This superficial system receives drainage from the skin and underlying tissues of the scalp, eyelids and face along with waldeyer's internal ring, nasal sinuses and oral cavity.

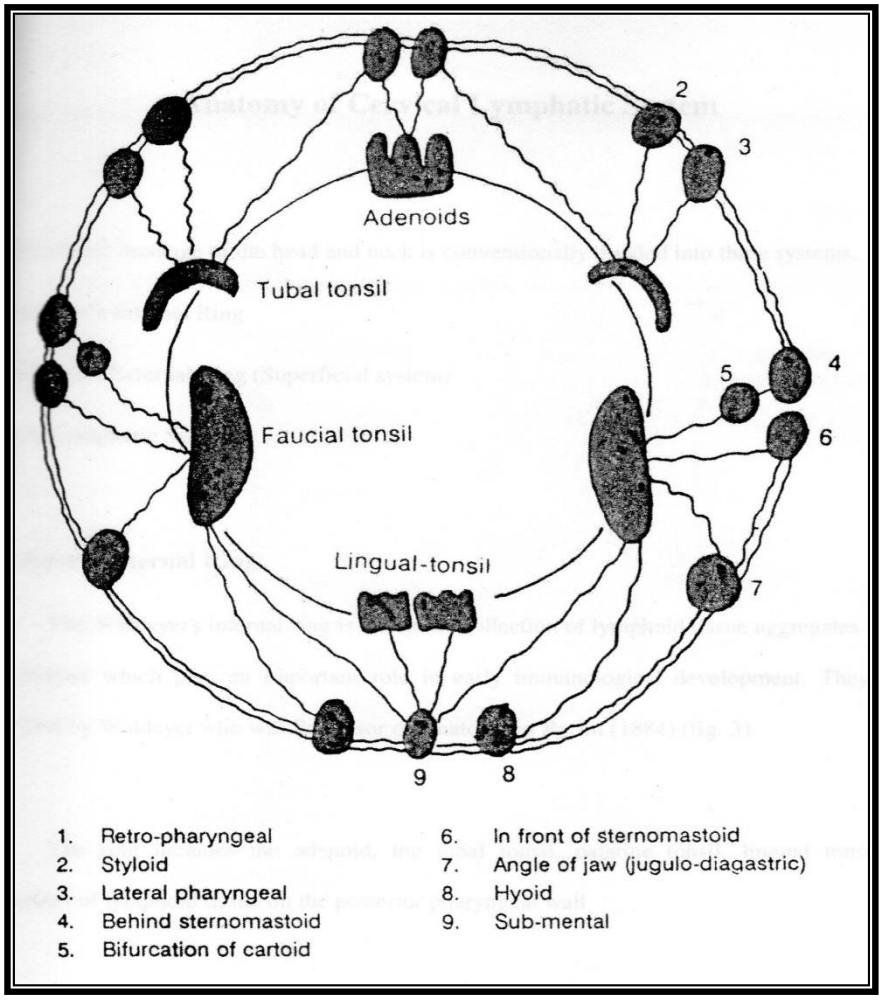


Fig 3. shows waldeyer internal ring

Deep System (cervical lymph nodes proper)

The deep cervical lymph nodes proper consist of the junctional nodes,the upper, middle and lower nodal groups which are situated along the internal jugular vein, the spinal accessory group which accompanies the accessory nerve in the posterior triangle , the nuchal nodes, the visceral nodes in the midlineof the neck and nodes in the upper mediastinum.The junctional nodes represent the confluence of nodes at the junction of the posterior part of the submandibular triangle with the retropharyngeal nodes where they meet at the junction of the upper and middle deep cervical nodes. The passage of lymph within these systems follows a sequential pattern from superficial to deep and from the upper to lower parts of the neck.This lower confluent forms a jugular trunk which on right side ends at the junction of the jugular vein and the brachiocephalic vein whereas on the left side the trunk will join the thoracic duct

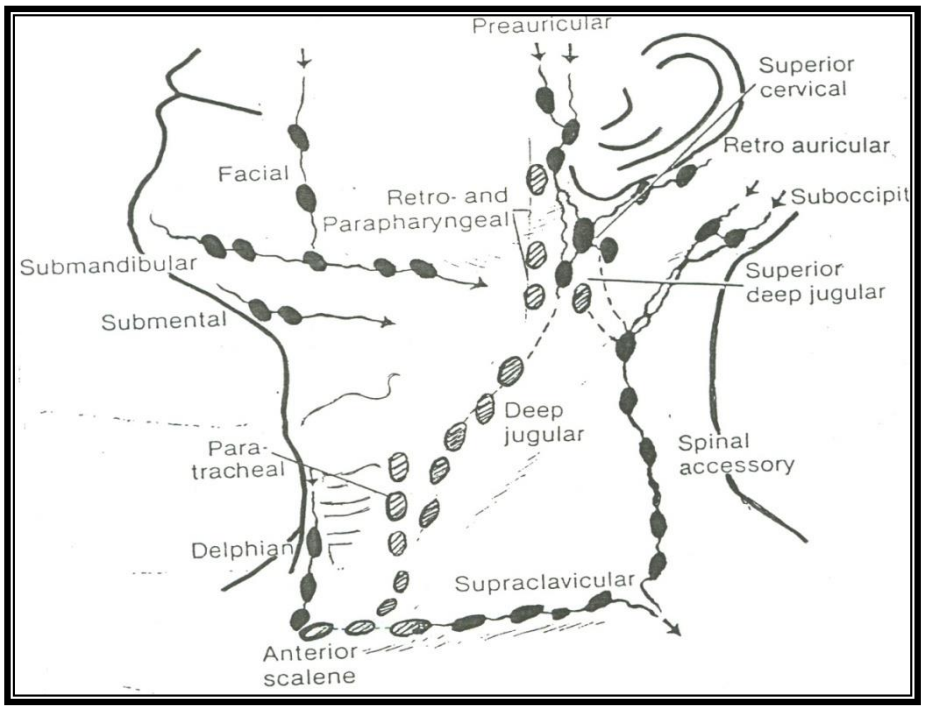


Fig 4 : Deep Lymphatic System

Sloan Kettering Memorial Cancer Centre (1981) devised a classification of neck nodes based on the metastatic spread of tumors originating from the head and neck.They have classified nodes into 5 levels.Som (1987) described level VI and level VII lymph node groups.

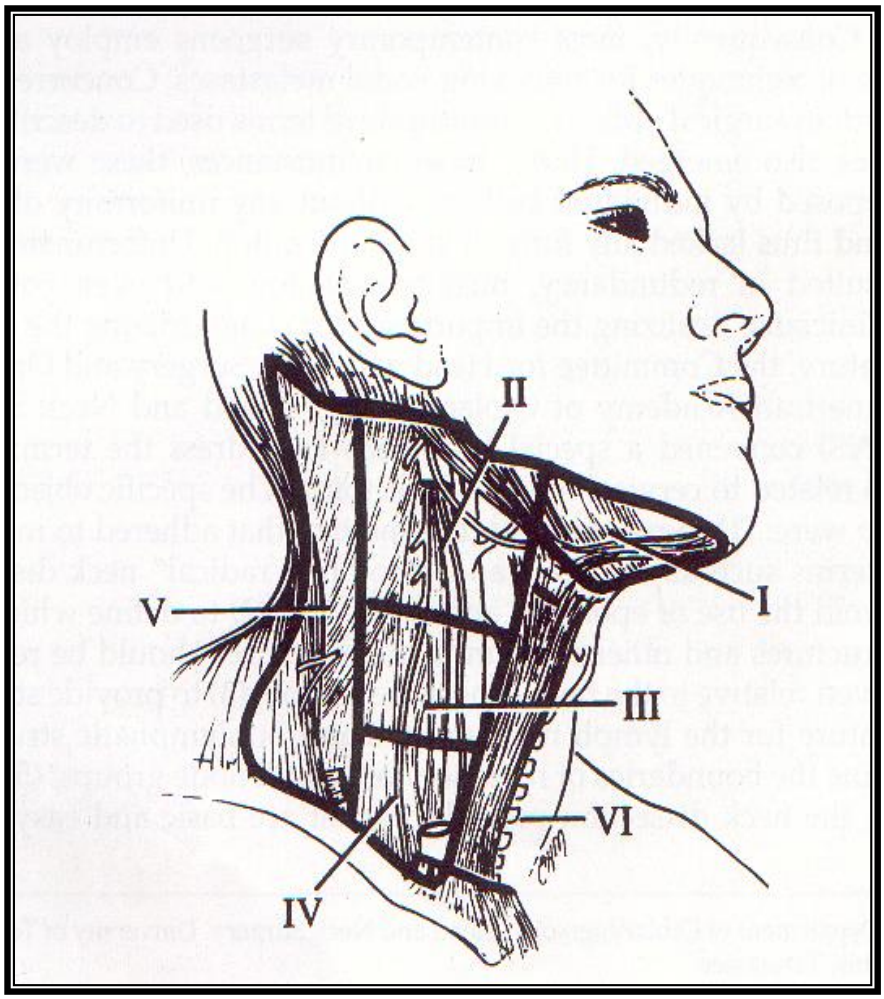


Fig.5-Level I, submental and submandibular group; Level II, upper jugular group;Level III, middle jugular group; Level IV, lower jugular group; Level V, posterior triangle group; Level VI, anterior compartment.

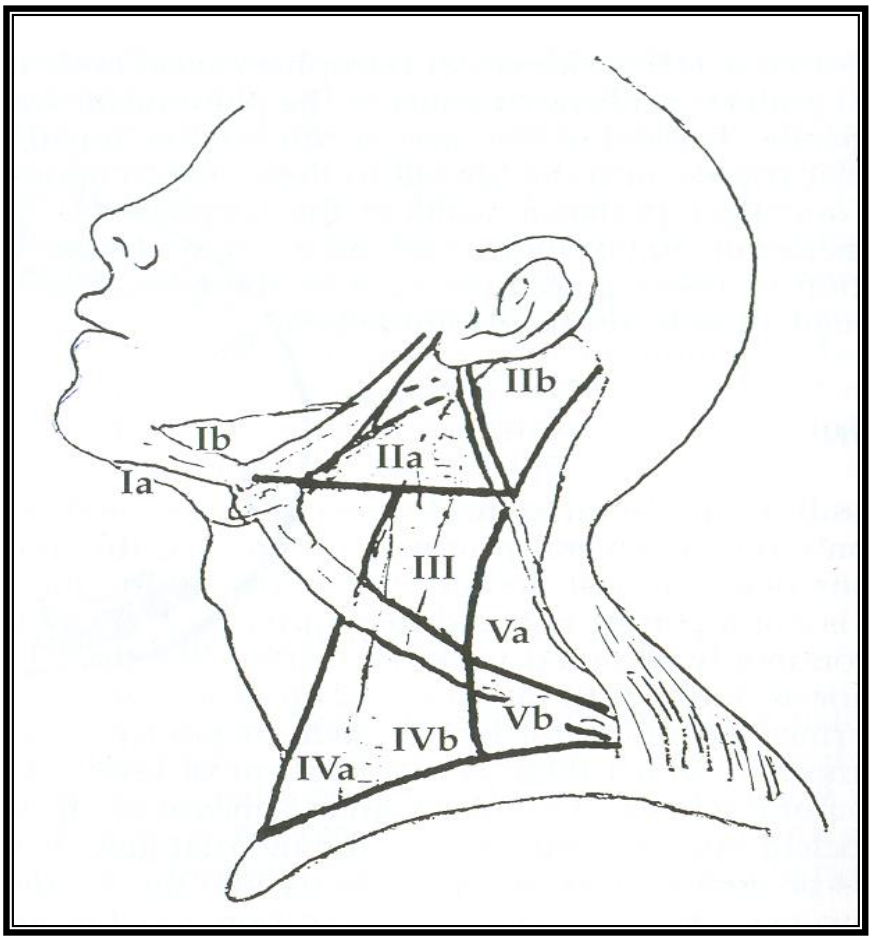


Fig. 6—The boundaries dividing levels I, II, and V into Sublevels A and B

Level IA: Submental Group

Lymph nodes within the triangular boundary of the anterior belly of the digastric muscles and the hyoid bone.

Level IB: Submandibular Group

Lymph nodes within the boundaries of the anterior and posterior bellies of the digastrics muscles, the stylohyoid muscle, and the body of the mandible.. The submandibular gland is included in the specimen when the lymph nodes within this triangle are removed.

Levels IIA & IIB: Upper Jugular Group

Lymph nodes located around the upper third of the internal jugular vein and adjacent spinal accessory nerve extending from the level of the skull base (above) to the level of the inferior border of the hyoid bone (below). The anterior (medial) boundary is the lateral border ofthe sternohyoid muscle and the stylohyoid muscle and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle. Sublevel IIA nodes are located anterior(medial) to the vertical plane defined by the spinal accessory nerve.Sublevel IIB nodes are located posterior (lateral) to the vertical plane defined by the spinal accessory nerve.

Level III: Middle Jugular Group

Lymph nodes located around the middle third of the internal jugular vein extending from the inferior border of the hyoid bone (above) to the inferior border of the cricoid cartilage (below). The anterior (medial) boundary is the lateral border of the sternohyoid muscle, and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle. Included in this group is the jugulo-omohyoid node, which lies immediately above the superior belly of the omohyoid muscle as it crosses the internal jugular vein.

Level IV: Lower Jugular Group

Lymph nodes located around the lower third of the internal jugular vein extending from the inferior border of the cricoid cartilage (above) to the clavicle (below). The anterior (medial) boundary is the lateral border of the sternohyoid muscle, and the posterior (lateral) boundary is the posterior border of the sternocleidomastoid muscle.

Levels VA & VB: Posterior Triangle Group

This group is comprised predominantly of the lymph nodes located along the lower half of the spinal accessory nerve and the transverse cervical artery. The supraclavicular nodes are also included in the posterior triangle group. Sublevel VA includes the spinal accessory nodes, and Sublevel VB includes the nodes following the transverse cervical vessels and the supraclavicular nodes.

Level VI: Anterior (Central) Compartment Group

Lymph nodes in this compartment include the pre- and paratracheal nodes, the precricoid (Delphian) node, and the perithyroidal nodes, including the lymph nodes along the recurrent laryngeal nerves. The superior boundary is the hyoid bone, the inferior boundary is the suprasternal notch, and the lateral boundaries are the common carotid arteries.

Level VII

The lymph nodes situated below the suprasternal notch in the upper anterior mediastinum are called level VII nodes.

Clinical Staging[50]

Although the presence or absence of cervical metastasis is the single most important factor in determining prognosis of head and neck cancer, the extent of the cervical metastasis is also important.Staging of the cervical metastasis is important both for reporting disease and for management and prognosis of patient.

The present TNM classification of regional nodes has evolved from the previous UICC (International Union Against Cancer) and AJCC (American Joint Committee version 2002).The TNM classification is based mainly upon the size of the node.It does not take into account the level of the node.

TNM Classification of Regional Nodes

N_x	Regional lymph nodes cannot be assessed
N_0	No Regional lymph nodes metastasis (No clinically palpable lymph Nodes)
N_1	Metastasis in a single ipsilateral lymph node 3cm or less in its greatest dimension
N_{2a}	Metastasis in a single ipsilateral lymph node more than 3cm but less than 6cm in its greatest dimension
N_{2b}	Metastasis in multiple ipsilateral lymph nodes any node less than 6cm in its greatest dimension
N_{2c}	Metastasis in bilateral or contralateral lymph nodes less than 6cm in its greatest dimension
N_3	Metastasis in a lymph node more than 6cm in its greatest Dimension

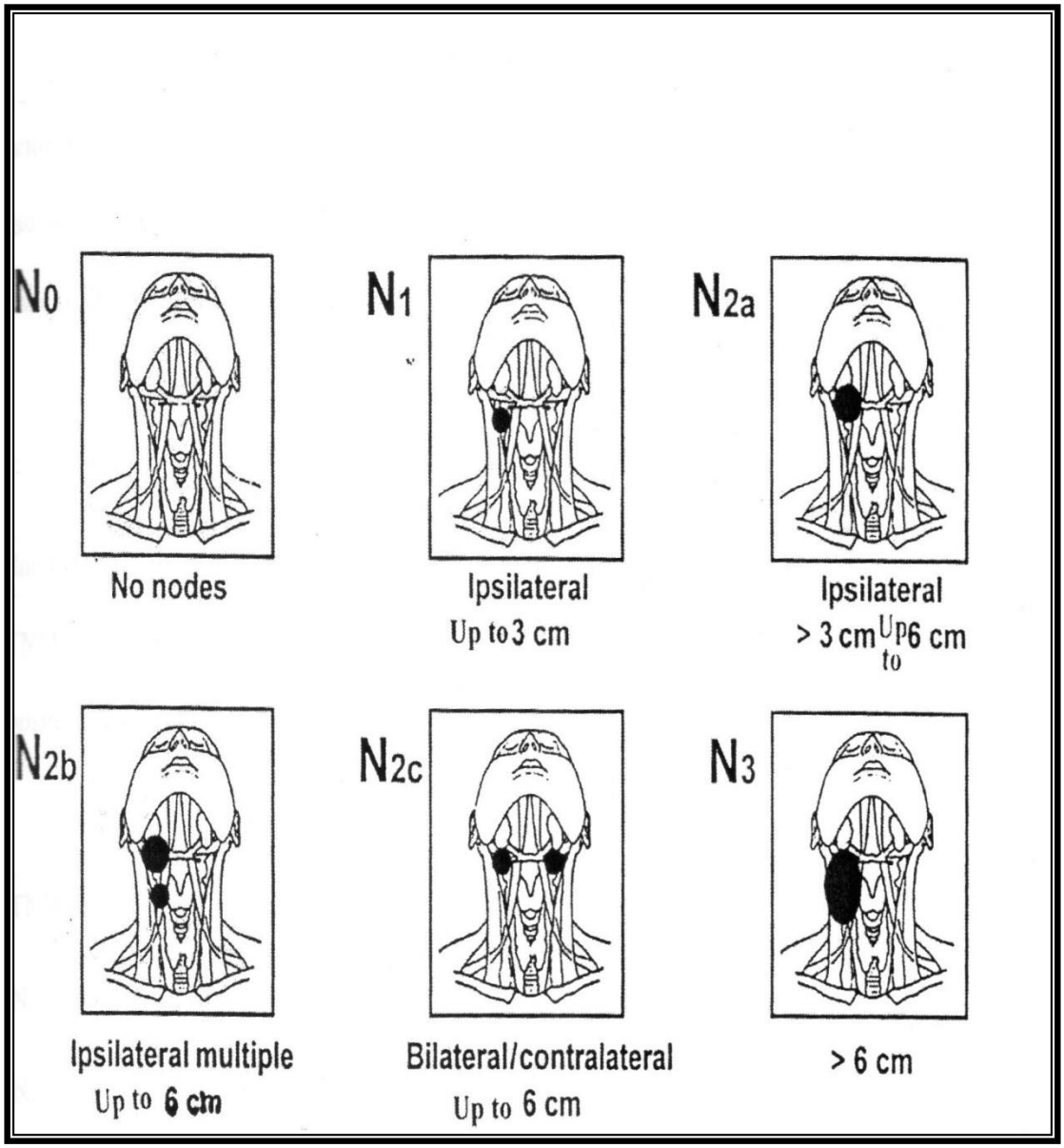


Fig 7 : TNM Classification of Regional Lymph Nodes

Pattern of cervical lymph node metastases

The patterns of nodal metastasis have been well described by Lindberg from the MD Anderson Cancer Center and Shah from Memorial Sloan-Kettering Cancer Center.[23,27] Generally, cervical lymph node metastases progress in an orderly fashion. Rarely, the metastatic disease may skip one area and go to the next level of nodes. As there is a progression of disease from level I to level V, there is decreasing survival and worsening outcome. Lymph node metastases at level IV and V are generally considered to have the worst prognosis, a high incidence of local recurrence, and a high incidence of distant metastasis.

The incidence of nodal metastasis to the neck depends on the characteristics of the primary tumor, the location of the primary tumor, size, T stage and histological differentiation(endophytic versus exophytic) infiltrating margins.The depth of the primary tumor is considered to be the most important prognostic factor. [41-45]

As one moves from the anterior to the posterior sites of the oral cavity and oropharynx, there is an increasing incidence of metastasis to the neck nodes. Lesions of the tonsil and base of the tongue have a very high incidence of nodal metastasis, whereas tumors of the hypopharynx universally have metastatic disease in the neck nodes. In the oral cavity, the tongue has the highest incidence of nodal metastasis, whereas the hard palate and the lip rarely present primarily with metastatic disease.

The first step in the metastatic spread is breach of the basement membrane at the primary tumour.This occurs through hydrolytic enzymes secreted by tumour like urokinase, plasminogen activator, collagenase and stromelysins.[51] The enzymes degrade the basement membrane proteins such as collagen IV , laminin and proteoglycans which allow the spread of tumour cells.

The tumour cells disseminate as emboli within the lymphatic system.The tumour emboli are carried through the afferent lymphatic vessels to the first echelon lymph nodes.The tumour cells localise first in the sub capsular sinus then progressively group to replace cortex and medulla.Eventually tumour invades the capsule of the node heralding extra capsular spread. The extracapsular spread may occur in much smaller lymph nodes where tumour emboli lodge in the capsular lymphatic sinuses .[52]

As the first echelon lymph nodes are replaced by metastatic tumour, afferent lymph flow is deflected, carrying tumour cells to fresh second and third echelon nodes.Increasing obstruction in the lymphatics and intranodal sinuses eventually may lead to reversal of lymphatic flow and retrograde spread occurs to unpredictable nodal groups.

The following chart describes the lymph node levels and the nodes that are at greatest risk of harbouring metastases from different primary sites.[49]

Lymph node group	Primary site
Level I A	Floor of mouth, tip of tongue, anterior part of mandibular ridge, lower lip
Level IB	Oral cavity, anterior nasal cavity, soft tissue of the mid face, submandibular gland
Level II	Oral cavity, anterior nasal cavity, Nasopharynx, Oropharynx, Hypopharynx, Supraglottic larynx, Parotid
Level III	Oral cavity especially tongue, Oropharynx, Hypopharynx, Supraglottic larynx, thyroid
Level IV	Hypopharynx, thyroid, Larynx, Cervical Oesophagus
Level V	Nasopharynx, Oropharynx,Cutaneous structures of the posterior scalp and neck
Level VI	Thyroid gland, Glottic and Supraglottic larynx, Apex of Pyriform fossa, Cervical Oesophagus

Evaluation of Cervical lymph Nodes

A proper evaluation of cervical lymph nodes is important as it influences the choice of treatment modality, staging of the disease and functional outcome.The assessment of cervical lymph nodes depends on history, clinical examination and radiology.[53]

History should include symptoms of upper aero digestive dysfunction.Social history should contain a detailed history regarding alcohol and tobacco consumption.Clinical examination remains the most important method of assessing regional lymph nodes.Physical examination should include careful inspection of the mucosal surface of oral cavity, oropharynx, indirect laryngoscopy, posterior rhinoscopy and palpation of the neck.

The neck palpation should be from behind the patient using both hands for palpation.Each side of the neck should be palpated separately.The sequential examination starts first from submental and submandibular triangles.Then the neck anterior to sternocliedomastoid is palpated from above downward, till clavicle, along the supraclavicular fossa and upwards along the anterior border of trapezius.In addition the parotid region , the posterior auricular region, the facial nodes should also be examined.Some nodes in the neck are difficult to palpate.The retropharyngeal and parapharyngeal nodes are almost impossible to detect unless they are very large.The patients with short neck are more difficult to examine for staging.Area deep to sternomastoid should be given special attention and must be palpated by insinuating the fingers below the muscle.

The structures in the neck, which may be mistaken for enlarged lymph nodes , are the transverse process of the atlas, the carotid bifurcation and the

submandibular salivary gland.In addition , the lymph nodes may be enlarged due to infection causing reactive hyperplasia rather than a metastatic deposit.

The clinical examination of the neck has a variable reliability.Ali and co-workers, in their review of 266 specimens from radical neck dissections found a false positive rate of 20% and false negative rate of 21%.[54,55]

Clinically the lymph nodes bigger than 1cm in areas like submandibular and submental become palpable where as lymph nodes in other deeper parts of the neck are palpable when they attain a size of 1.5cm.

Imaging of Neck Metastasis [56-60]

Ultrasonography is more sensitive than clinical examination in detecting metastatic nodes.Malignant nodes show a heterogenous appearance with a solid and cystic image, round shape, clustering and speckled calcifications on ultrasonography.This will demonstrate the relationship of metastatic nodes to major vessels in the neck.

Fine needle aspiration cytology (FNAC) is helpful in the assessment of palpable node in the evaluation of a patient with an unknown primary tumour.The nature of histology may help in the search for primary tumour.

Ultrasound guided FNAC is gaining popularity because the borderline lymph nodes cannot be reliably scored on ultrasound, CT or MR imaging.Ultrasound guided FNAC proved to be a quick(10-20 min) and safe method although some reports of seedling of tumour cells along the needle tract are present.This is a rare finding and has never occurred with thin aspiration needle.

Aspiration can be obtained from the lymph nodes as small as 5mm. It has been shown that US-FNAC has a very high specificity (100%) and sensitivity (73%). The specificity and sensitivity of US-FNAC is better than CT OR MR imaging.The sensitivity of ultrasound guided FNAC can be enhanced by P^{53} mutational assays. Another technique to increase the accuracy of ultrasound guided FNAC is to select the sentinel node for aspiration .The sentinel node is the first site for metastasis.The technique involves injecting around the primary tumour site with TC-99m labeled sulphur colloid.The localization of the sentinel node is performed by planner scintigraphy and gamma camera.Toulidine dye technique is more easy to perform and also effective but not as sensitive as radioisotope study.

Computerized tomography scan is more accurate than clinical examination in detecting metastatic lymph nodes.It is particularly important in the necks that are difficult to examine for restaging and for inaccessible areas such as retropharyngeal space.The rapid advances in imaging technology have enhanced the ability to identify the metastatic disease in head and neck.CT and MRI have significantly improved the accuracy of detecting occult metastasis.

CT scan criteria to define a node as metastatic node includes :

1. Spherical lymph nodes
2. Peripheral enhancement
3. Central necrosis (Low attenuation areas)
4. Clustering of three or more lymph nodes
5. Scattered calcification
6. Area of Drainage

MRI has similar accuracy rates as CT scan.MRI differentiates nodes from surrounding tissues rather more clearly than CT scan. However, limitations of CT and MRI in the assessment of small lymph node and inability to ascertain with confidence the presence or absence of metastasis in any one lymph node makes CT and MRI not universally acceptable. The metastatic nodes can be demonstrated with radioisotopes like Gallium Citrate, technetium labeled DMSA.These agents do not label normal lymph nodes.But all these investigations suffer from a low sensitivity and specificity and inability to detect nodes less than 2cm in size by which time they are usually clinically palpable.

Positron Emission Tomography assesses the metabolic activity of cervical nodes using 18 fluorodeoxyglucose (18 FDG).The role of PET is confined to the detection of the occult primary and in the assessment of residual and recurrent disease following surgery and irradiation.

Single Photon Emission Computed Tomography (SPECT) gives three dimensional isotopic images and can detect tumour more than 4mm in size.Immuno SPECT using TC-99 labelled monoclonal antibodies can detect tumour measuring 2mm.These techniques depend on the uptake of radionuclide into tumour, which is often related to high blood flow, which explains overlap in the detection of inflammatory disease.Although the expense of PET prohibits wide spread usage, these techniques will be used to detect occult recurrences, occult primaries or distant metastasis.

Neck dissection classification[61,62]

Currently several types of cervical lymph node dissections are in vogue in the surgical management of head and neck malignancy. It is highly essential to adopt a common nomenclature for the nodal groups in the neck and the surgical procedures followed in their removal. The classification of neck dissections recommended by the American Academy of Otolaryngologists [30] primarily takes into account the nodal groups of the neck that are removed and secondarily the anatomic structures that are preserved. Commonly preserved anatomical structures include the spinal accessory nerve and the internal jugular vein. When the various types of neck dissections are analyzed using the above point of view, three types of neck dissections can be described.

They are radical and modified radical, selective and extended radical types. The newer classification evolved has managed to remove certain types of selective neck dissection thereby reducing the confusions involved.

It was also pointed out by the American Academy of Otolaryngologists in 2001, regardless of what name a neck dissection is given, the operative record should reflect accurately what was done during surgery in terms of the nodal groups that were removed and the important neural and vascular structures that were removed or preserved. The surgeon also must orient the surgical specimen for the pathologist and identify the different lymph node groups it contains. This will help the pathologist in generating a meaningful report.

Classification of neck dissections [62]

1991 Classification	2001 Classification
Radical neck dissection	Radical neck dissection
Modified radical neck dissection	Modified radical neck dissection
Selective neck dissection a. Supraomohyoid b. Lateral c. Posterolateral d. Anterior	Selective neck dissection a. SND (I-III/IV) b. SND (II-IV) c. SND (II-V, post auricular, suboccipital) d. SND (Level VI)
Extended neck dissection	Extended neck dissection

Radical neck dissection [49]

This surgical procedure is defined as en bloc removal of lymph node bearing tissues of one side of the neck from the inferior border of the mandible and line joining angle of mandible to mastoid tip and from the lateral border of the strap muscles to the anterior border of trapezius muscle to the clavicle. Included in this specimen are the spinal accessory nerve, internal jugular vein, sternomastoid muscle, submandibular salivary gland, and omohyoid muscle.

It was Crile in 1906 who first described the procedure of systematic removal of lymphatics of the neck.[14] He also firmly believed that removing the internal jugular vein was essential because of its intimate relationship to the lymph nodes of the neck. He preserved the spinal accessory and ansa hypoglossal nerves

Hayes Martin in 1950 said that the concept of cervical lymphadenectomy for cancer was inadequate unless the entire node bearing tissues of one side of the neck was removed. He also believed that this was not possible unless the spinal accessory nerve, internal jugular vein and sternomastoid muscle are included in the specimen. He also said that normal lymphatic flow is interrupted by metastasis in a node, causing further tumor dissemination to occur in any direction and a less radical operation would disseminate and stimulate the growth of tumor mass.Removal of sternomastoid muscle facilitates access to internal jugular vein and the removal of jugular chain of nodes.[15]

Indications

1.Radical neck dissection is indicated in patients with clinically obvious lymph node metastasis

2. Large cervical nodal metastasis

3. Cervical metastasis involving multiple nodal areas of neck

4. Should be performed only in patients with malignant tumors of head and neck

5.Extracapsular spread in a lymph node

Radical neck dissection is not indicated in patients with no palpable lymph nodes.

Modified radical neck dissection

This category of neck dissection procedures includes the various modifications that have been incorporated into the procedure of radical neck dissection with the intention to reduce the morbidity by preserving one or more of the following structures: the spinal accessory nerve, internal jugular vein and sternomastoid muscle. Earler 3 types of modified neck dissections were described.

Modified radical neck dissection with preservation of SAN

This surgery involves en bloc removal of lymph node bearing tissues of one side of the neck from the inferior border of the mandible to the clavicle and from the lateral border of strap muscles to the anterior border of trapezius. The spinal

accessory nerve is preserved. The internal jugular vein and sternomastoid muscle is included in the specimen.

Advantages

1.Preservation of spinal accessory nerve prevents frozen shoulder development

2.Causes less cosmetic deformity even when performed bilaterally

3.It has been shown that spinal accessory nerve in majority of cases is not in proximity to the grossly involved nodes and hence its preservation does not compromise the oncologic safety of the surgery

Indications

1. Used in surgical treatment of neck in patients with clinically obvious nodal metastasis

2. In patients with multiple nodal involvement in various nodal levels

3.Spinal accessory nerve should not lie close to the involved node

Modified radical neck dissection with preservation of spinal accessory nerve and internal jugular vein

This surgery involves the dissection of node bearing tissues of one side of the neck en bloc preserving the spinal accessory nerve and the internal jugular vein. Usually this procedure is decided on the table when during the course of neck dissection the metastatic tumor in the neck is found to be adherent to the sternomastoid muscle but away from the accessory nerve and the internal jugular

vein.This scenario occurs occasionally in patients with hypopharyngeal/ laryngeal tumors with metastasis under the middle third of sternomastoid muscle.

Modified radical neck dissection with preservation of spinal accessory nerve, internal jugular vein and sternomastoid muscle (Functional neck dissection)

This surgery involves en bloc removal of lymph node bearing tissues of one side of neck, including lymph node levels I – V preserving the spinal accessory nerve, internal jugular vein and sternomastoid muscle. It should be borne in mind that the muscular and vascular aponeurosis of the neck delimits compartments filled with fibroadipose tissue. The lymphatic system of the neck contained within these compartments can be excised in an anatomic block by stripping the fascia off muscles and vessels. Except the vagus nerve which runs within the carotid sheath, the nerves of the neck don't follow the aponeurotic compartment distribution. The phrenic nerve and brachial plexus are partially within a compartment. The hypoglossal and spinal accessory nerves run across compartments. Unless these nerves are directly involved by tumor, they can be dissected free and preserved.

Indications

1.This surgery is the treatment of choice even in N0 neck patients with squamous cell carcinoma of the upper aero digestive tract, especially when the primary is in the supraglottic larynx or Hypopharynx.

2.This surgery is indicated in the treatment of N1 neck when the Metastatic nodes are mobile and are no greater than 2.5 – 3 cms.

3.This surgery is indicated in patients with well differentiated carcinoma of thyroid who have palpable nodal metastasis in the posterior triangle of neck.

The present classification does not subclassify MRND into types.It is just mentioned as MRND and the non lymphatic structures preserved are mentioned.

Selective neck dissection

This involves removal of only the nodal groups that carry the highest risk of containing metastasis according to the location of the primary, preserving the spinal accessory, internal jugular vein and sternomastoid muscle.

Selective neck dissection of level I – III

This is also known as Supraomohyoid neck dissection (SOHND). If the selective dissection covers even level IV nodes then it is known as "Extended Supraomohyoid neck dissection". The nodes removed are those contained in the submental and submandibular triangles (level I), Upper jugular region (level II), the midjugular level (level III). The posterior limit of dissection is marked by the cutaneous branches of cervical plexus and the posterior border of sternomastoid muscle. The inferior limit is the omohyoid muscle as it crosses the internal jugular vein.

Indications

1.This procedure is commonly used in the management of neck in patients with oral or oropharyngeal malignancies.

2.In patients with midline oropharyngeal tumors then bilateral neck dissection should be carried out as nodes of both sides are at risk in these patients.

Selective neck dissection levels II – IV

This dissection is also known as "lateral neck dissection". It involves removal of the upper (level II), middle (level III) and lower (level IV) jugular groups of nodes. The superior limit of dissection is the digastric muscle and the mastoid tip. The inferior limit is the clavicle. The antero medial limit is the lateral border of sternohyoid muscle. The posterior limit of dissection is marked by the cutaneous branches of cervical plexus and the posterior border of sternomastoid muscle.

Indications

1.This procedure in indicated in the treatment of neck in patients with squamous cell carcinoma of the larynx, oropharynx and Hypopharynx.

2. For tumors of the supraglottis and posterior pharyngeal wall the dissection is often bilateral

Selective neck dissection level VI

This procedure is also known as anterior neck dissection or central compartment dissection. This procedure involves removal of prelaryngeal, pretracheal as well as paratracheal nodes on both sides.

Indications

1.This procedure is used to treat patients with cancer of midline structures of the anterior inferior aspect of the neck and thoracic inlet.

2.Cancers involving thyroid gland

3.Cancers involving glottic / subglottic regions of larynx

Extended neck dissections

This surgical procedure includes removal of any lymph node groups / structures that are not routinely removed in neck dissection.This could be skin of neck, carotid artery, levator scapulae muscle, vagus, hypoglossal nerves.Nodal structures could be retropharyngeal, paratracheal , upper mediastinal and facial lymph node.

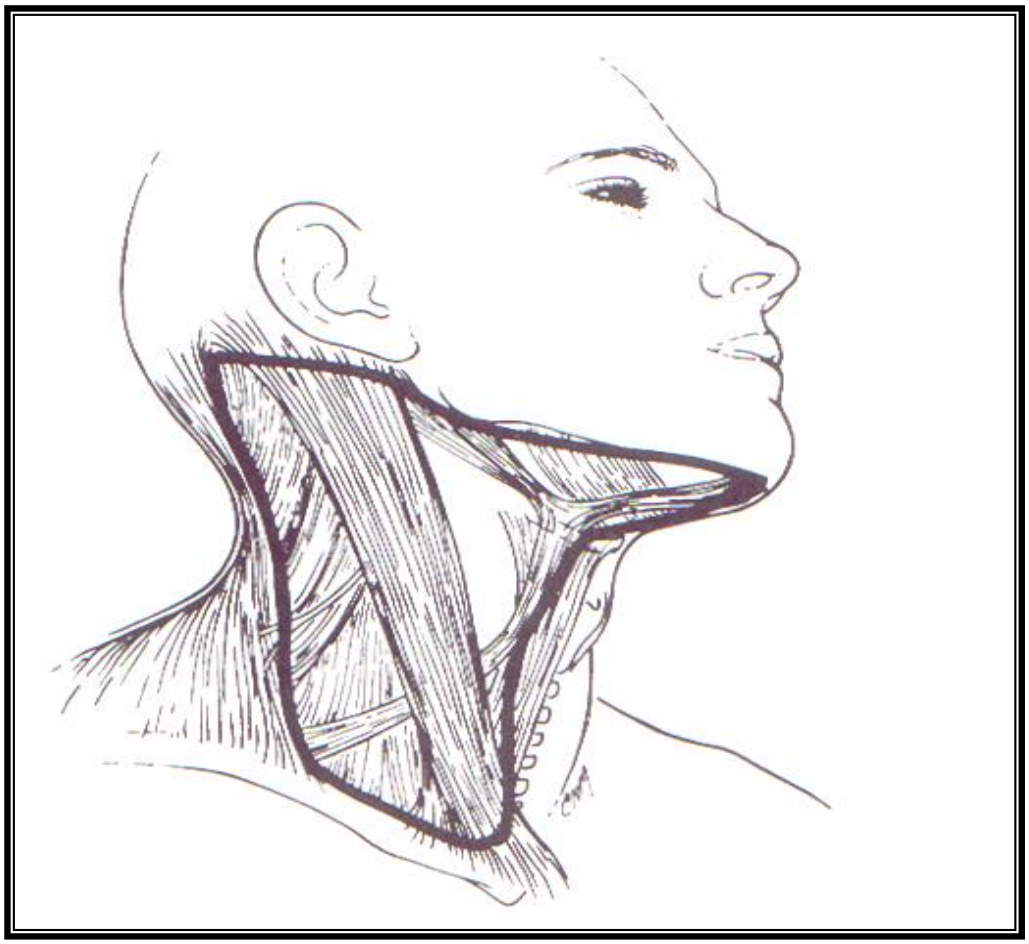


Figure 8: The Extent of Clearance in Functional Neck Dissection

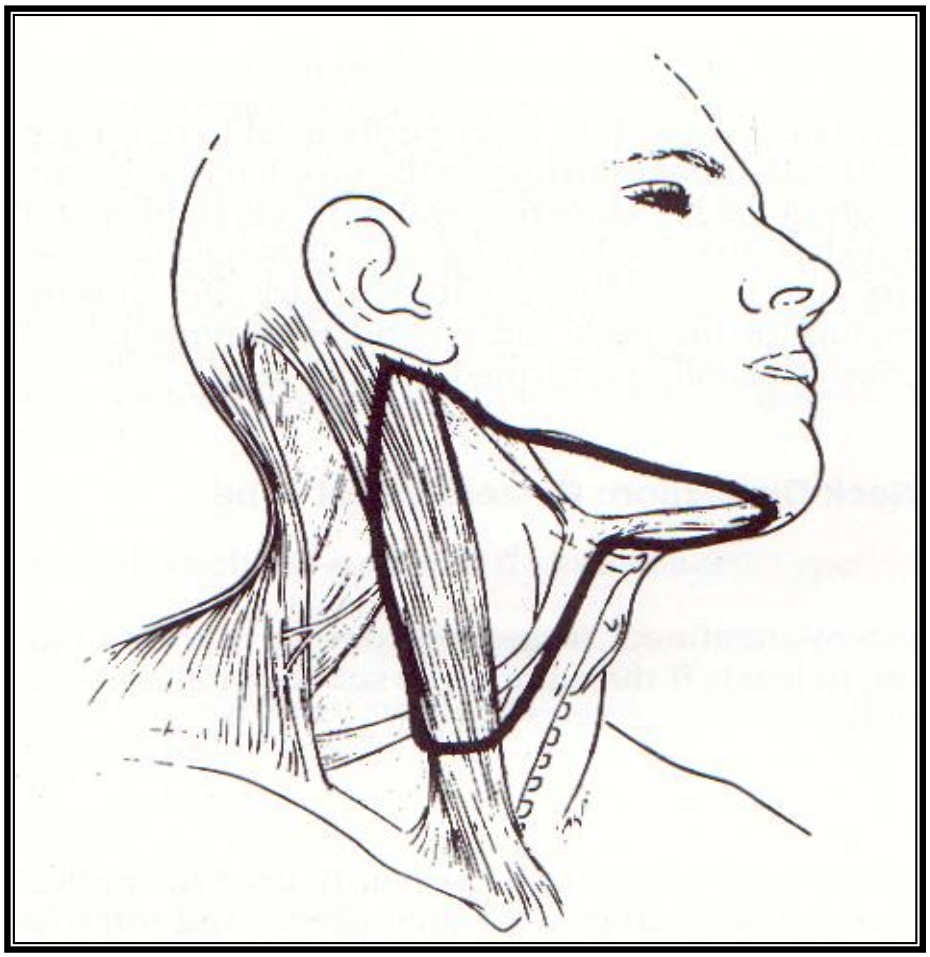


Fig 9 : The Extent of Clearance in Supraomohyoid Neck Dissection

Problems with neck dissection

1.In radical neck dissection procedures the spinal accessory nerve is removed. This causes denervation of the trapezius muscle. This muscle is one of the most important shoulder abductors. This destabilizes the scapula causing it to flare. The patient will not be able to abduct the shoulder above 90 degrees. The classic feature is the shoulder syndrome characterized by pain, weakness and deformity of shoulder girdle. The shoulder dysfunction is not only due to dysfunction of spinal accessory nerve, but also can occur secondary to glenohumeral stiffness caused by weakness of the scapulo humeral girdle muscles and post operative immobility.

2.Cosmetic neck deformity

3.Infection

4.Air leaks – This can cause flap necrosis. When these leaks are associated with tracheal wound it is sinister. Suction drain should be inserted to prevent this complication

5.Bleeding

6.Chylous fistula

7.Facial / cerebral oedema – due to ligation of internal jugular vein. This is more pronounced when internal jugular veins on both sides are ligated.

8.Blindness – very rare. Occurs after bilateral radical neck dissection. Possible causes include intraoperative hypotension associated with severe venous distention. Bilateral occipital lobe infarcts have also been implicated as possible factors

9.Apnea – Some patients become apnoeic due to loss / diminished ventilatory responses due to carotid body denervation after bilateral neck dissection.

10.Jugular vein thrombosis

11.Jugular vein blow out – Common in patients following post operative radiotherapy

Functional Neck Dissection [49]

Bocca of Italy was one of the first surgeons to report on functional neck dissections and his technique was first described in 1966.Alando J Ballantyne of the Anderson hospital, Houston , Texas has been doing functional neck dissection for over 25 years.His technique is performed fromed anterior approach while Bocca's technique uses an approach both anterior and posterior to the sternocleidomastoid muscle.

The functional neck dissection consists of the enbloc removal of the lymph node bearing tissues on one side of the neck including lymph nodes levels I to V preserving the spinal accessory nerve, the internal jugular vein and the sternocleidomastoid muscle.

The most commonly used incision is the Y type Crile's incision or the Schoebinger's incision with a lazy S on the vertical limb to reduce scar tissue contracture.The incision begins over the mastoid tip curving to the hyoid bone and then up again to the symphysis menti.The vertical limb / lazy " S " shaped incision begins perpendicular to the skin tension lines.The other type of neck incision for neck dissection is shown in the figure.The skin incision is taken and the upper flap elevated in sub platysmal plane.The marginal mandibular nerve is preserved while elevating upper flap.

The anterior and posterior flaps are elevated and the neck is exposed with access to the four corners of consternation.This includes

1.Lower end of internal jugular vein

2.Junction of clavicle with trapezius muscle

3.Upper end of internal jugular vein

4.Submandibular triangle

The investing layer of deep cervical fascia is opened over sternocleidomastoid muscle.The investing layer is reflected medially and the muscle laterally.

Dissection of lower end of internal jugular vein

Chaissaignac's triangle is defined as a triangle between where the longus colli and scaleneus anterior attach to the tubercle of C_5 (Chaissaignac's or carotid tubercle) with the subclavian artery as base.The triangle contains scalene nodes, jugular lymoh duct, transverse cervical trunk and vertebral vein.It is here that cervical lymphatics terminate and occult disease may lurk in the scalene nodes.These nodes are removed.Any chylous leak
(recognised as milky fluid) should be over sewn with fine silk.Sometimes the leash of lymphatics is found instead of single duct.In such a situation the whole area is over sewn taking large bites with a fine silk.This incites a vigorous inflammatory reaction.

Dissection of supraclavicular region

Dissection is started from the bottom end of the trapezius muscle behind the omohyoid muscle.The omohyoid muscle is divided and retracted in an upward direction.Transverse cervical aretery and vein encountered at omohyoid tendon level medial to the omohyoid muscle, fascia over the fat lateral to internal jugular vein should be incised and then prevertebral fascia may be xposed by sharp or blunt dissection (with a swab in an upward direction). Here phrenic nerve is

identified as it runs over scaleneus anterior from lateral to medial direction.The prevertebral fascia protects the phrenic nerve and brachial plexus. The fat in the supraclavicular area should be removed without excessive traction since the subclavian vein can be pulled up.Once the supraclavicular dissection has been completed towards the anterior border of trapezius, the operation continues in an upward direction to dissect the posterior triangle.

Dissection of posterior triangle

The posterior triangle dissection continues till the mastoid tip along the anterior border of trapezius .Spinal accessory nerve runs in the roof of posterior triangle and can be damaged early in the dissection.Everything that is important lies below i.e. caudal to the accessory nerve.

The spinal accessory nerve is identified by the following methods

1.Erb's point : Nerve lies 1cm above the Erb's point i.e. the point where the greater auricular nerve winds around the posterior border of sternocleidomastoid

2.The spinal accessory nerve exits the lateral border of sternocliedomastoid muscle at the junction of its upper third with lower two thirds.The nerve has sinusoidal course before arriving at the lower anterior border of trapezius.

3.The nerve will usually cross the imaginary line drawn laterally from the thyroid notch as the nerve runs from 1cm above the Erb's point to the lower posterior corner of the posterior triangle

4.Dissection along the anterior border of trapezius until the nerve is encountered.This is more difficult because the nerve may be confused with branches of cervical plexus.

The spinal accessory nerve is followed through sternocleidomastoid muscle.A tunnel is formed so that nerve can be followed and dissected free of the muscle up to level II and upto the point where it lies on top of the internal jugular vein.

Along with spinal accessory nerve, it is important to preserve the branches to the trapezius from the C_3 and C_4 cervical nerve.These branches of C_3 and C_4 arise deep within the sternocleidomastoid muscle, pass laterally beneath the fascia covering the floor of the posterior triangle to supply trapezius muscle.In order to preserve the nerves, it is necessary to preserve the fascia on the floor of posterior triangle.

The specimen is mobilised from the mastoid tip.The division of retromandibular portion of the parotid gland is completed.The hypoglossal nerve is preserved as it runs sharply to cross the external carotid artery.

The branches of cervical plexus are cut distal to the branch for phrenic nerve.Anteriorly low down, dissection is completed taking the specimen with omohyoid upto the junction with hyoid bone (omohyoid tunnel) .The carotid sheath is opened and dissected from lower end of internal jugular vein till the upper end of vein.

Dissection of Submandibular triangle

The fibro fatty tissue is dissected from submental triangle.The submandibular gland is dissected, the facial artery and vein ligated and cut.The submandibular salivary gland is resected and cut preserving lingual nerve and hypoglossal nerve.

This completes the dissection of four corners of consternation preserving the internal jugular vein, spinal accessory nerve and sternocleidomastoid muscle.Following the washing of the wound , two large drains are placed through the posterior flap and securely tied .Drains should not cross the carotid sheath .Finally a check is made for any chylous leak, any bleeding from the venae Nervi hypoglossi comitantes.The wound is closed in two layers.

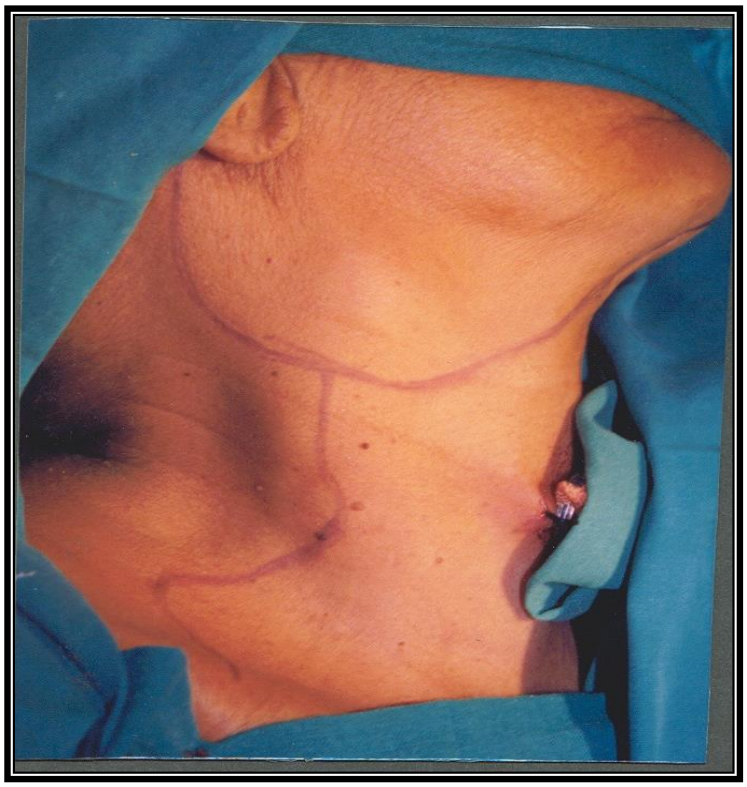


Fig 10: An incision for functional neck dissection

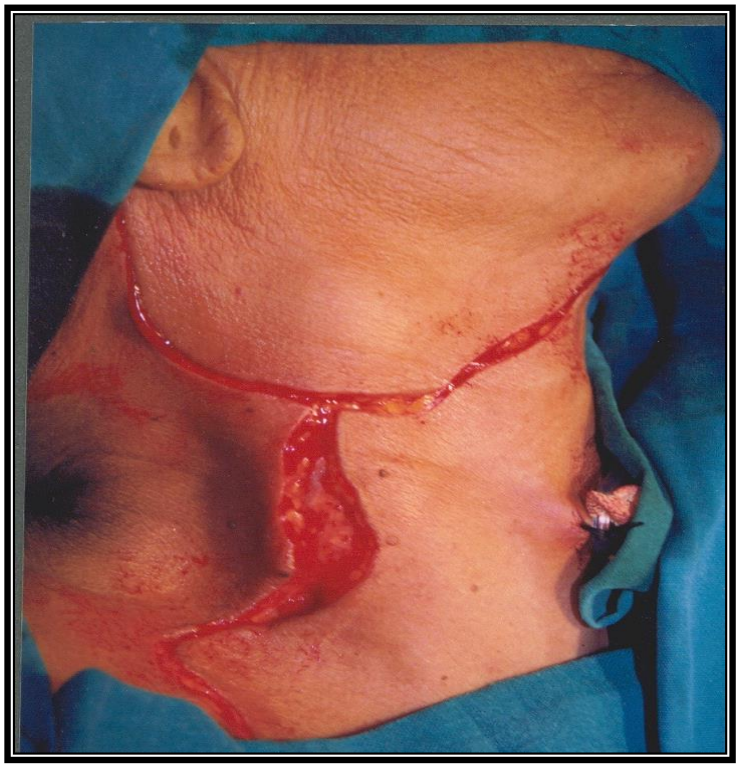


Fig 11: The same incision deepened till platysma.

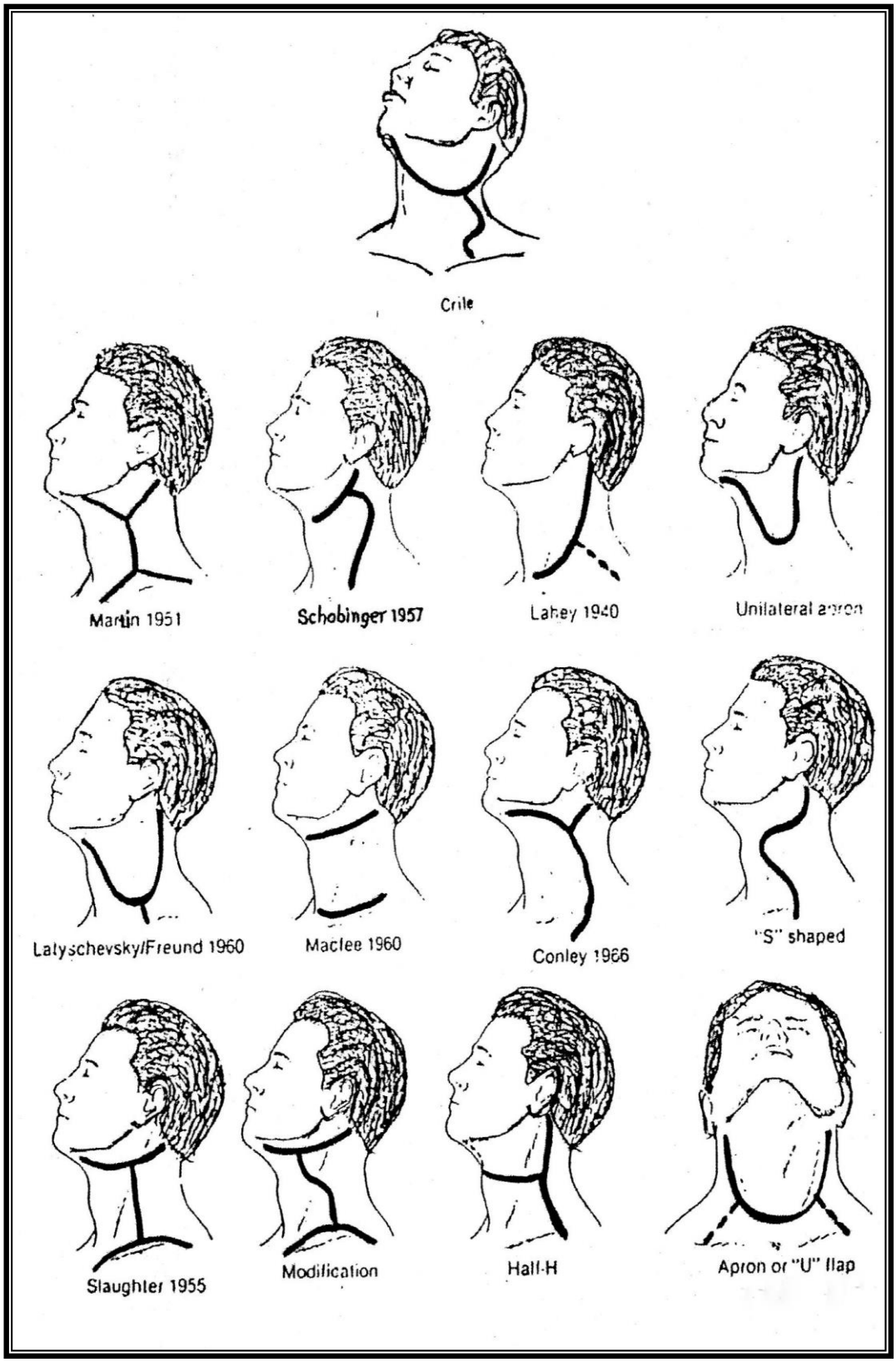


Fig 12: Types of Incisions for Neck Dissection

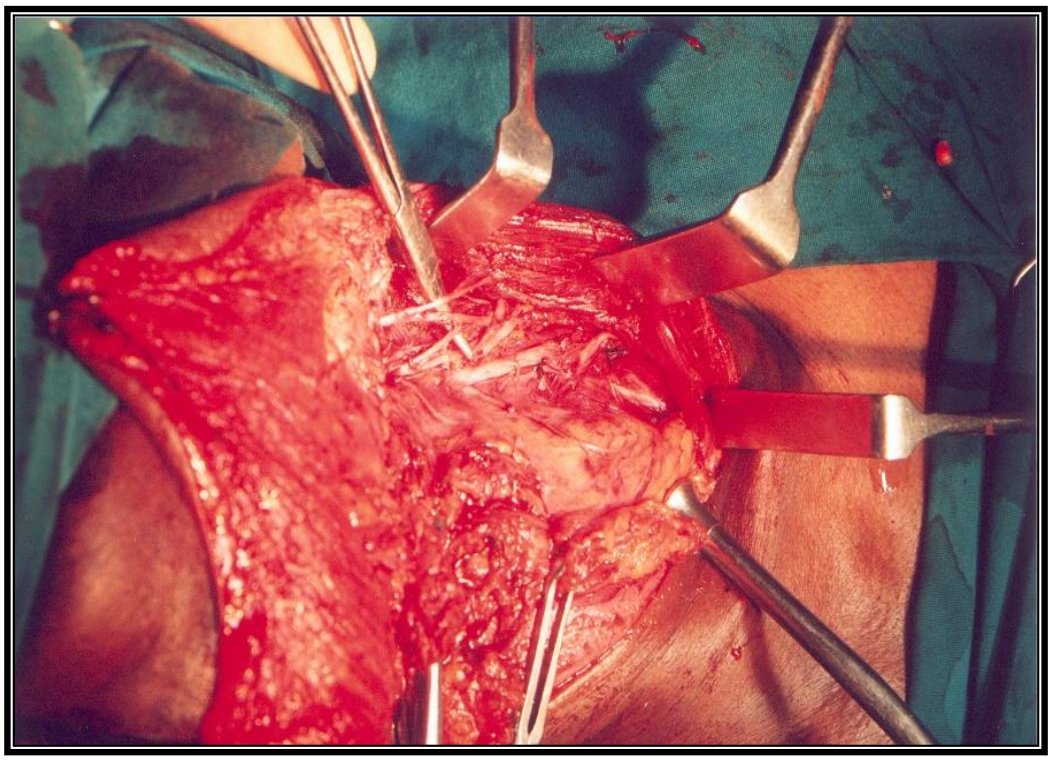


Fig 13: FND showing Marginal mandibular nerve, Cervical plexus, SAN

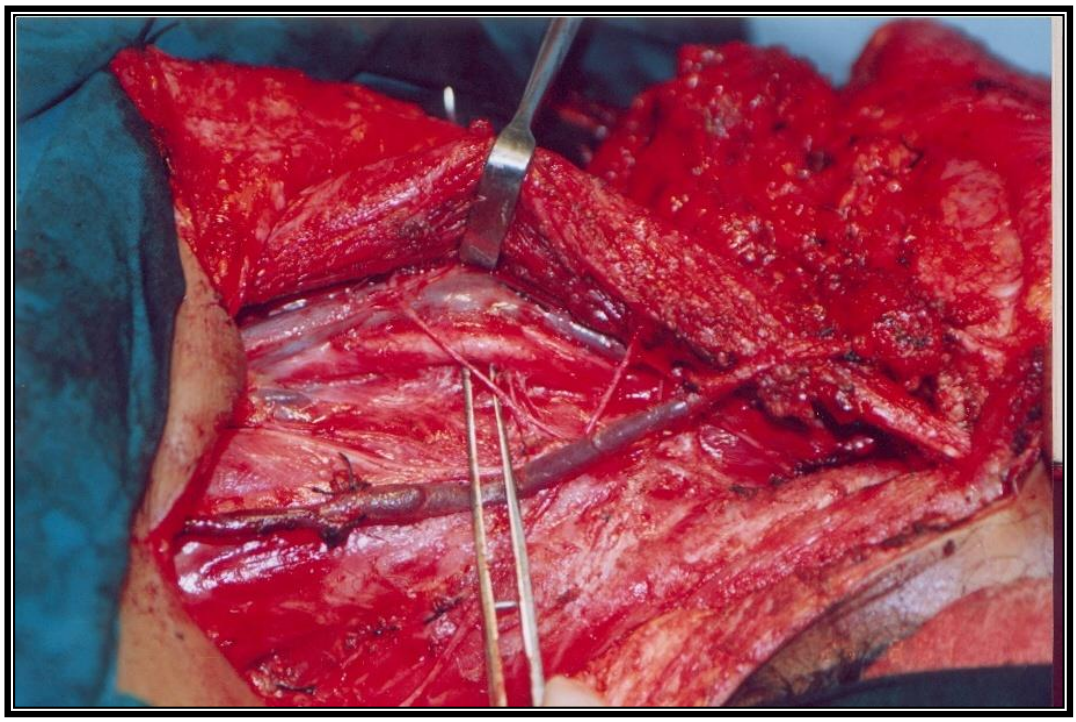


Fig 14: FND showing SAN, EJV

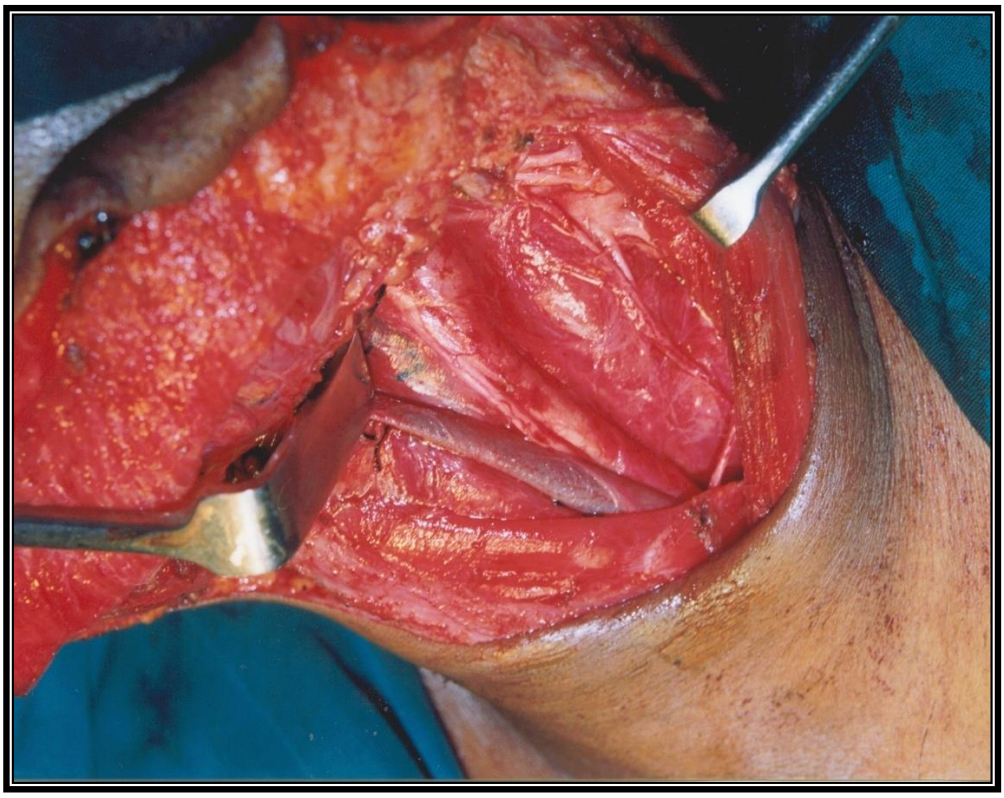


Fig 15: FND showing SAN, Carotid Artery, IJV, Vagus nerve

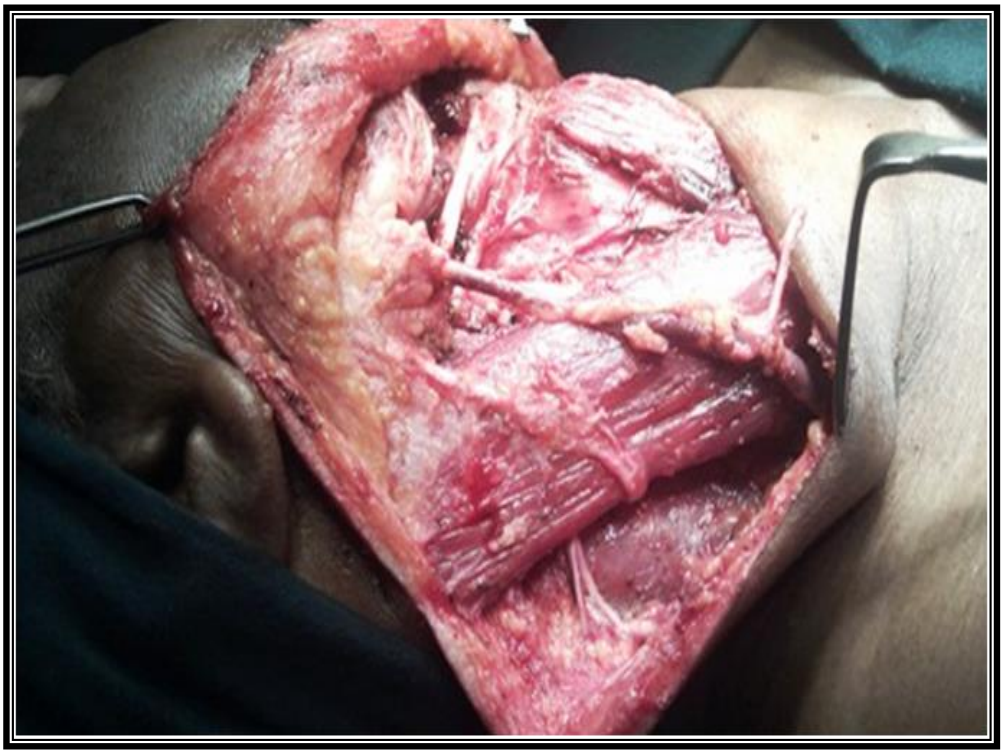


Fig 16 : FND showing Great auricular nerve,Spinal accessory nerve, External jugular vein

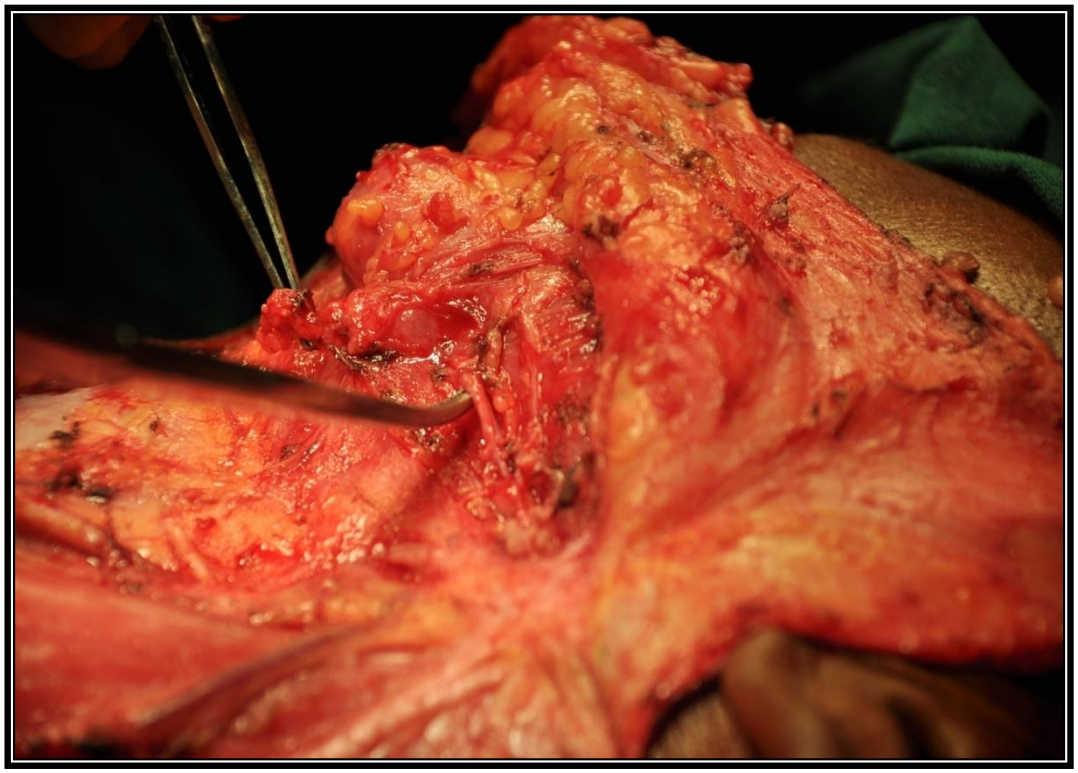


Fig 17: Submandibular fossa dissection

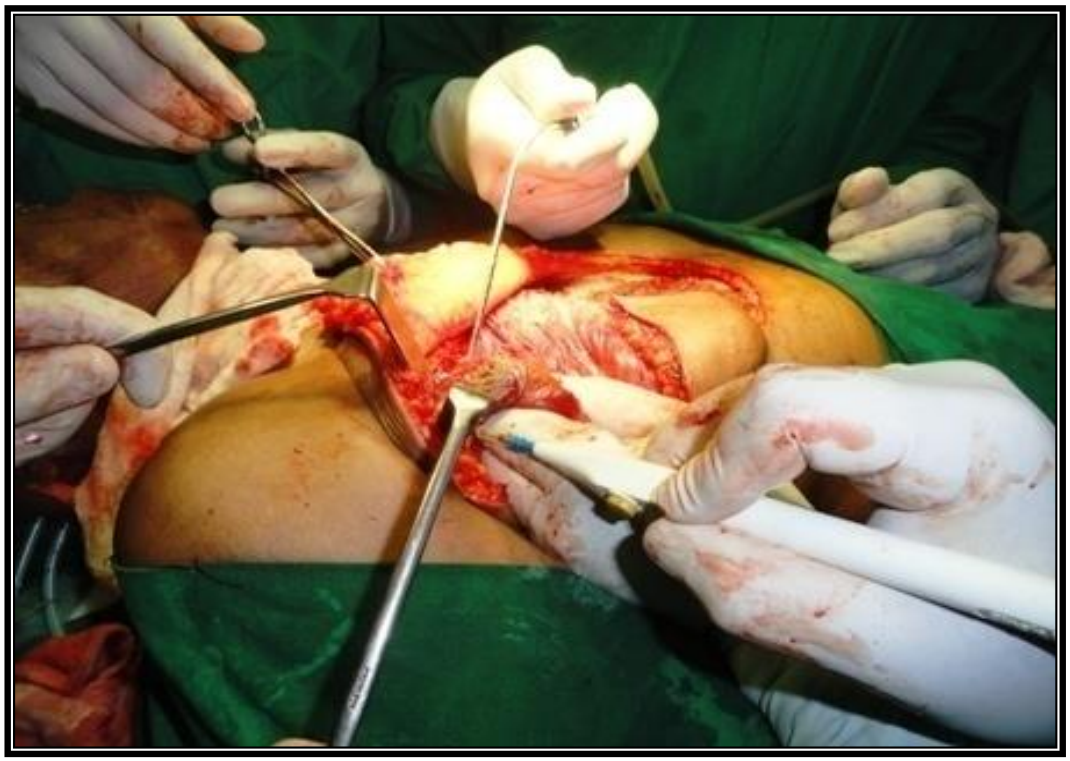


Fig 18 : Harvesting PMMC flap

Fig 19 : Harvesting Forehead flap

Fig 20: : FND - Skin closure with suction drains in situ

Treatment of Cervical Metastases[49]

The presence of cervical lymph node metastases has an adverse effect on survival.At the same time, careful and effective treatment can provide a cure in a significant number of patients with node positive neck.In the untreated neck, the patterns of spread are often predictable.Once patient has had previous radiotherapy or surgery or infection, drainage patterns are often altered.Hence, although the neck may be clinically negative (N_0) all five levels in the neck should be treated by surgery or radiotherapy.In patients with palpable neck disease (N_1 , N_2 , N_3) non-palpable spread may be present anywhere in the neck and correct approach for such patients is to completely encompass the disease.This usually involves surgery although radiotherapy may have a place for small N_1 (less than 2cm) necks.

Treatment of N_0 Neck

The evaluation and treatment of N_0 Neck remains controversial.The problem is whether to treat the neck electively or not.The controversy extends into when and how the N_0 neck should be treated.

The treatment option for N_0 neck includes

1.Elective surgery

2.Elective radiotherapy

3.Elective neck dissection

4.Adopt a policy of wait and watch

In patients with a greater than 20-25% chance of sub clinical neck disease, where vigilant follow up is not possible, where clinical evaluation of the neck has proved difficult, where the neck is being entered for access for reconstruction or where imaging of the neck suggests possible nodal spread, there elective treatment with surgery or external beam radiotherapy should be considered.[49]

A further option in the treatment of N_0 neck is to consider elective neck dissection.But false positive result is inevitable in the presence of inflammatory neck nodes and false negatives do occur.

It is perfectly reasonable to adopt a policy of " wait and watch " in low risk necks.But in patients with high risks " wait and watch " policy will have detrimental effect.This does not justify its routine use.

Sentinel lymph node biopsy has a role in management of N_0 neck.We harvest sentinel lymph node and subject it to histopathological examination .If it shows micrometastases, we do a selective neck dissection.If negative, we can wait and watch.

Treatment of N_1 neck

In palpable neck disease all five levels may be involved and the minimum operation that should be performed is a modified radical neck dissection.As extra nodal spread may be uncommon in this group, conservation or functional neck dissection is considered.

The role of radiotherapy in the treatment of N_1 disease is controversial.It is less efficient than surgery for N_1 neck and is a less preferred option unless the primary site is also being treated with radiotherapy.

Treatment of N_{2a} and N_{2b} neck

This group represents the advanced neck disease and should be treated with radical neck dissection. There are proponents who suggest that in many cases, the accessory nerve can be preserved and modified radical neck dissection (Type 1) can be performed, as it is often not infiltrated except in extra capsular spread.Depending upon pathological findings postoperative radiotherapy may be administered.A few authorities argue that when hypoglossal nerve is being preserved in radical neck dissection when it is equally close to disease, the sacrifice of accessory nerve is often not justified.

Treatment of N_{2c} neck

Cases with bilateral neck nodes occur in about 5% of head and neck cancers.[26] The common primary sites involved are the tongue base, the supraglottic larynx and the hypopharynx.The prognosis depends upon the size, number of nodes and by the presence or absence of extracapsular spread.The decision to treat will be helped by the location and size of the primary site.

Supraglottic tumors with bilateral nodes are often eminently treatable with a laryngectomy and the appropriate neck dissections but patients with extensive tongue base tumours with bilateral cervical lymphadenopathy will usually be inoperable at presentation.

It is mandatory to save atleast one internal jugular vein(usually contralateral) while performing bilateral neck dissection.

Treatment of N_3 neck

Cases with massive nodes (N_3) occur in about 5% of head and neck cancers.[21] The decision of treatment depends on the staging of the disease, the presence or absence of fixation and the structures to which the node is fixed.Surgery in operable cases is either RND or extended RND

Fixation to the mandible , sternocleidomastoid muscle, prevertebral fascia or muscles may not represent as much of a problem as fixation to the brachial plexus or carotid artery.Some of the patients are helped by extended radical neck dissection.Fixation to the skull base and the brachial plexus is almost certainly a contraindication to surgical treatment.If the carotid artery is involved assessment regarding whether the cure may be achieved by its resection without a significant risk of hemiplegia.This may be done preoperatively by measuring the cross-cerebral flow and pressure in the carotid stump.Unless the carotid pressure stump exceeds 70mm Hg, resection of carotid artery by a vein graft carries high risk of morbidity (33% hemiplegia) and mortality (12%).[49]

For those patients who are inoperable, palliative treatment like radical radiotherapy, with or without adjuvant chemotherapy , pain relief and supporting nursing is all that is required.

Studies showing low incidence of metastasis to lower neck nodes in oral cancers with N_0 and N_1 neck

In a study by Davidson et al, which included more than 1000 comprehensive neck dissections in patients with squamous cell carcinoma of the head and neck (HNSCC), the highest prevalence of level V metastasis was observed with hypopharynx and oropharynx primary tumours (7% and 6% respectively) and the least at oral cavity carcinoma (1%).According to Davidson, obvious involvement of level IV must exist to dissect level V.[29]

Shah et al in his study of 516 radical neck dissections performed electively for oral cavity tumours, found metastasis in level IV lymph nodes in 3% and also reported the absence of metastasis in level V in patients with cancers of buccal mucosa, retromolar trigone and tongue and 6% involvement in alveolar lesion.He observed that all occurances of level V lymph node metastasis were associated with positive lymph nodes at multiple neck levels.[27]

Similar observations were reported in few other studies which showed low incidence of level V metastasis in buccal alveolar cancers.[24-34]

In another study comprising 277 patients with oral tongue carcinoma, a high incidence (15.8%) of either level III or IV metastasis as the only manifestation of disease in the neck without disease in levels I and II was reported.[38] This study justifies the inclusion of level IV in the dissection for the patients with oral tongue cancer in view of known lymphatic drainage of the tongue and higher incidence of skip metastasis.[35,36,37,38,39]

MATERIALS AND METHODS

STUDY DESIGN : Prospective

SOURCE OF DATA : Patients having oral squamous cell carcinoma with clinically N_1 neck (single ipsilateral lymph node less than 3cms in diameter) undergoing modified radical neck dissection in R.L. Jalappa hospital and research centre between December 2010 and June 2012 were enrolled in the study

INCLUSION CRITERIA

Patients with histologically proven oral squamous cell carcinoma with clinically single ipsilateral lymph node less than 3cms in greatest diameter(N_1)

EXCLUSION CRITERIA

1.Patients with no palpable lymph nodes(N_0 neck) with oral squamous cell cancers.

2.Oral squamous cell cancer patients treated by other methods such as radiotherapy or chemotherapy

3.Patients with oral cancer with advanced cervical lymph node metastasis (N_2, N_3)

4.Patients with non squamous malignancies of oral cavity

5.Patients unfit for surgery (neck dissection)

6.Patients not willing for surgical treatment

METHOD OF COLLECTION OF DATA

1) 30 patients were enrolled for the study

2) Study period : December 2010 and June 2012

3) Written informed consent taken for inclusion in the study, surgical excision of primary tumour, modified radical neck dissection and histopathological examination

4) Following surgical excision of the primary lesion along with simultaneous neck dissection (modified radical), contents of posterior triangle and lower deep jugular lymph nodes along with other dissected lymph nodes was sent for histopathology after marking the various lymph node levels

5) Pathological assessment of metastatic nodes

Lymph nodes were identified by visual inspection and palpation and were dissected out from the fixed gross specimen in each of the five anatomic levels.All nodes were measured and processed routinely. Histological assessment was made on a single hilar section with examination of step serial sections in selected nodes.

6) Metastasis to posterior triangle and lower deep jugular lymph nodes and their size were documented

7) In addition documentation of other criteria in the primary tumor which affect lymph node metastasis like T stage, histological grade and presence of other positive lymph nodes was done.The data was analysed using descriptive statistics like proportions and comparison done using Chi square tests.

OBSERVATIONS AND RESULTS

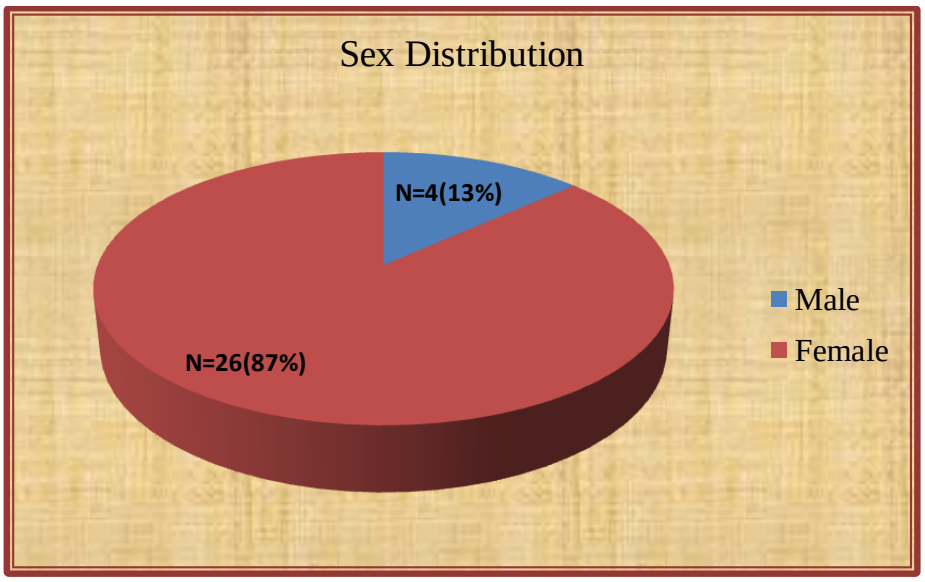
Sex Distribution

Of the 30 patients included in our study, 4 were male (13%) and 26 were females (87%).

Table 1: Sex Distribution

Sex	Male	Female
Number	4	26

Graph 1 : Pie Diagram Showing Sex Distribution



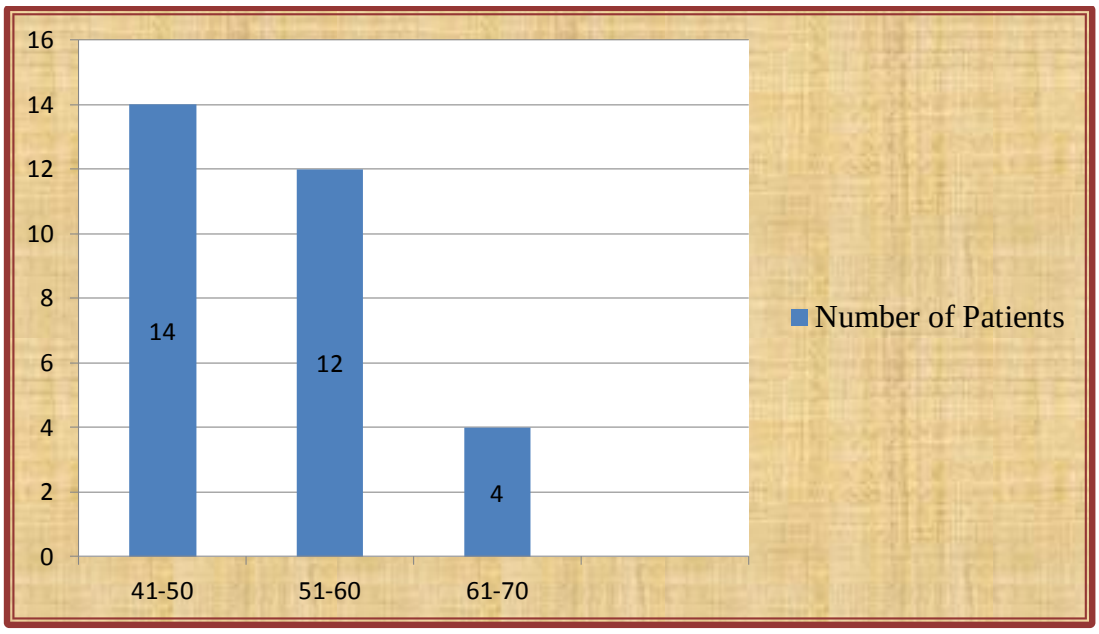
Age Distibution

The age of the study group patients ranged from 41- 70 years with a mean age of 53 years.The age distribution is shown in bar diagram (Graph 2).

Table 2: Age Distribution

Age in Years	41-50	51-60	61-70
Number of Patients	14	12	4

Graph 2 : Bar Diagram Showing Age Distribution



Age in Years

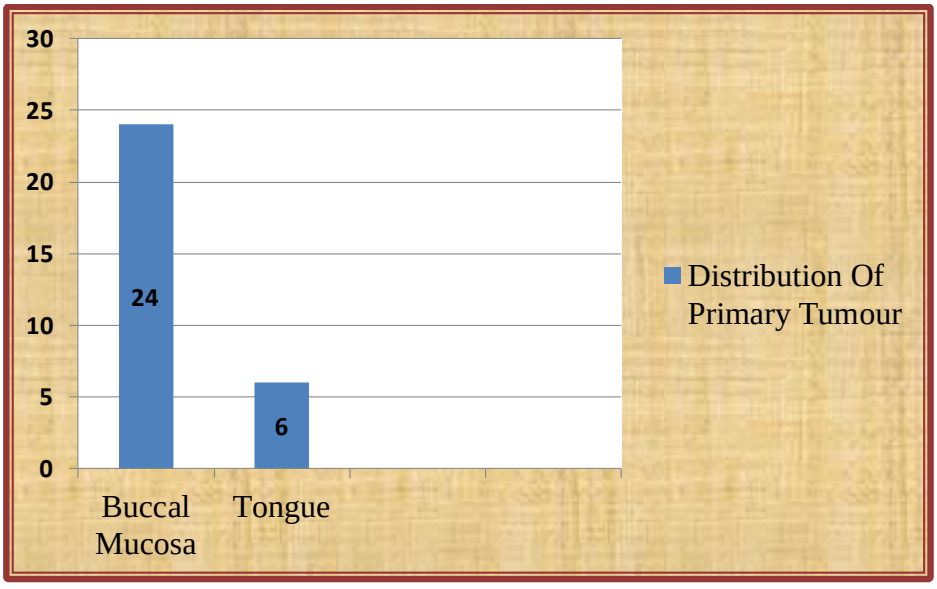
Site of Primary Tumour

In our study, the majority of primary tumours were buccal mucosa tumours (24).We had 6 anterior 2/3rd tongue tumours.Distribution of primary tumour is shown in Graph 3.

Table 3 : Distribution of Primary Tumour

Site of Primary	Buccal Mucosa	Tongue
Number of patients (n=30)	24 (80%)	6(20%)

Graph 3 :Bar Diagram Showing Distribution of Primary Tumour



Site of Primary Tumour

Fig 21 : Buccal Mucosa Carcinoma

Fig 22 : Carcinoma Anterior two third tongue

"TNM " Staging Of Primary Tumour

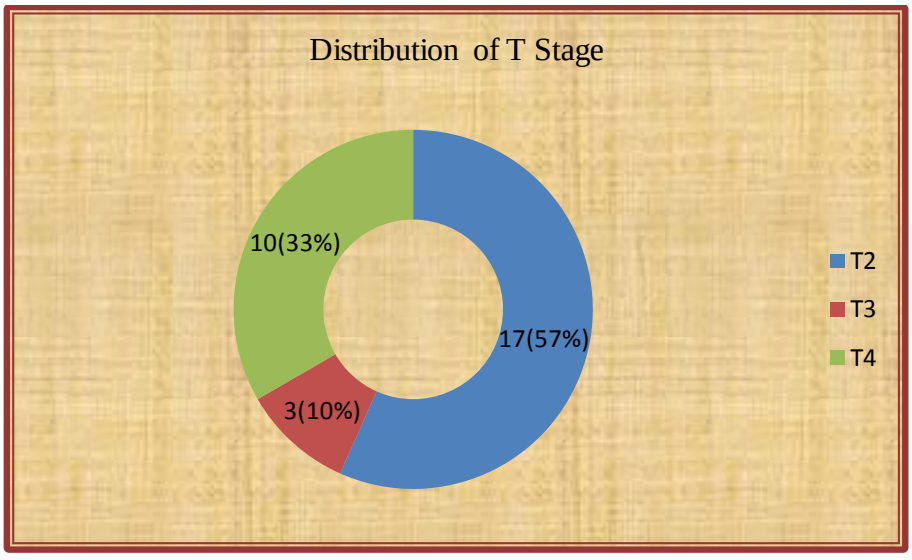
"T" Stage of our series

The primary tumour staging included 17 T_2 lesions (57%), 3 T_3 lesions(10%), 10 T_4 lesions(33%)

Table 4 : Distribution Of "T" Stage

T Stage	T_2	T_3	T_4
Number of Patients	17(57%)	3(10%)	10(33%)

Graph 4 : Distribution Of T Stage



"N" Stage of our series

All patients in our study selected were having N_1 neck

Clinical Staging of Our Series

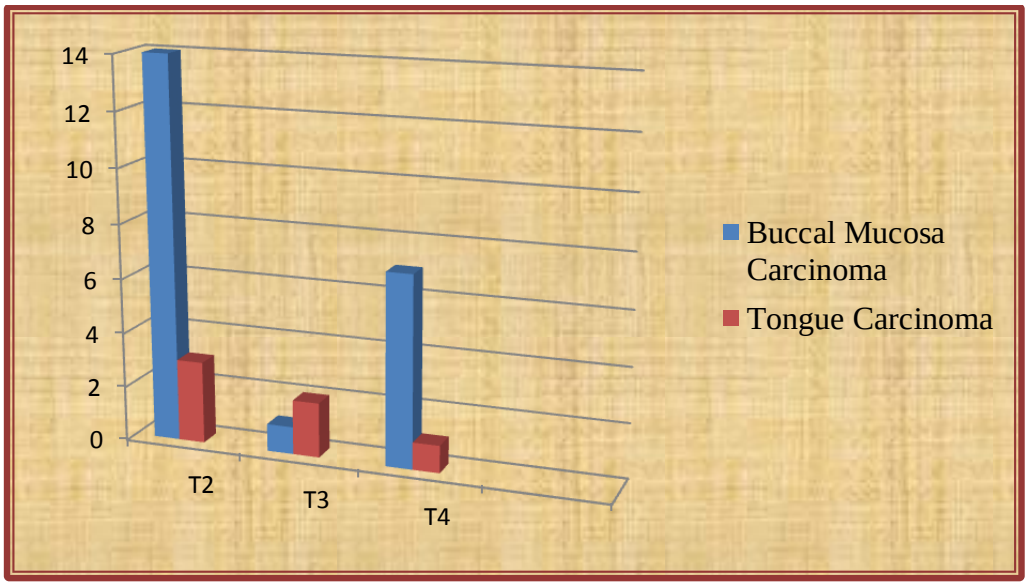
In our study, in patients with buccal mucosa carcinoma, fourteen patients had T_2 disease , nine patients had T_4 and one patient had T_3 disease.

In patients with carcinoma lateral border tongue, three patients had T_2 disease, two patients had T_3 and one patient had T_4 disease.

Table 5 : Site of Primary Tumour and Clinical Staging

Clinical Staging	Site of Primary Tumour	
	Buccal Mucosa (n=24)	Tongue (n=6)
T_2	14	3
T_3	1	2
T_4	9	1

Graph 5 : Bar Diagram Showing Distribution of Clinical Staging of the Study Group



Type of Surgery Done

In buccal mucosa carcinoma, out of 24 patients, 16 patients underwent wide excision with hemimandibulectomy .In these 16 cases, 2 patients had reconstruction with double flap(DP+ PMMC) while rest 14 cases with island pectoralis major myocutaneous (PMMC) flap.Out of remaining 8 patients, 2 patients underwent marginal mandibulectomy.In all these 8 patients , reconstruction was done using nasolabial flap in 1 patient, buccal pad of fat in 2 patients, masseter flap in 1 patient and forehead flap in 4 patients. In carcinoma anterior 2/3rd tongue, all 6 patients underwent hemiglossectomy with simultaneous modified radical neck dissection.

Table 6: Surgery done

	Treatment of the primary tumour	Number of cases
Buccal mucosa carcinoma	Wide Excision	24
Tongue Carcinoma	Hemi glossectomy	6
Neck Dissection	MRND (Functional neck dissection)	28
	MRND (Sternomastoid sacrificed)	2
Reconstruction in Buccal mucosa carcinoma	Nasolabial flap	1
	PMMC + DP	2
	Buccal pad of fat	2
	Masseter flap	1
	Forehead flap	4
	Island PMMC	14
Hemimandibulectomy		16
Marginal Mandibulectmy		2

Histopathologic grading of tumour

Histopathologic examination of the tumour specimens in our study revealed squamous cell carcinoma in 26 patients and verrucous variant of squamous cell carcinoma in 4 patients.Majority of our patients belonged to well differentiated squamous cell carcinoma (19 out of 30).

Table 7: Pathologic distribution of primary tumour

Pathologic type of tumour	Site of primary tumour	
	Buccal Mucosa(n=24)	Anterior 2/3rd Tongue(n=6)
Well Differentiated	15	4
Moderately Differentiated	5	2
Verrucous carcinoma	4	-

Graph 6: Bar diagram showing Histopathologic Distribution

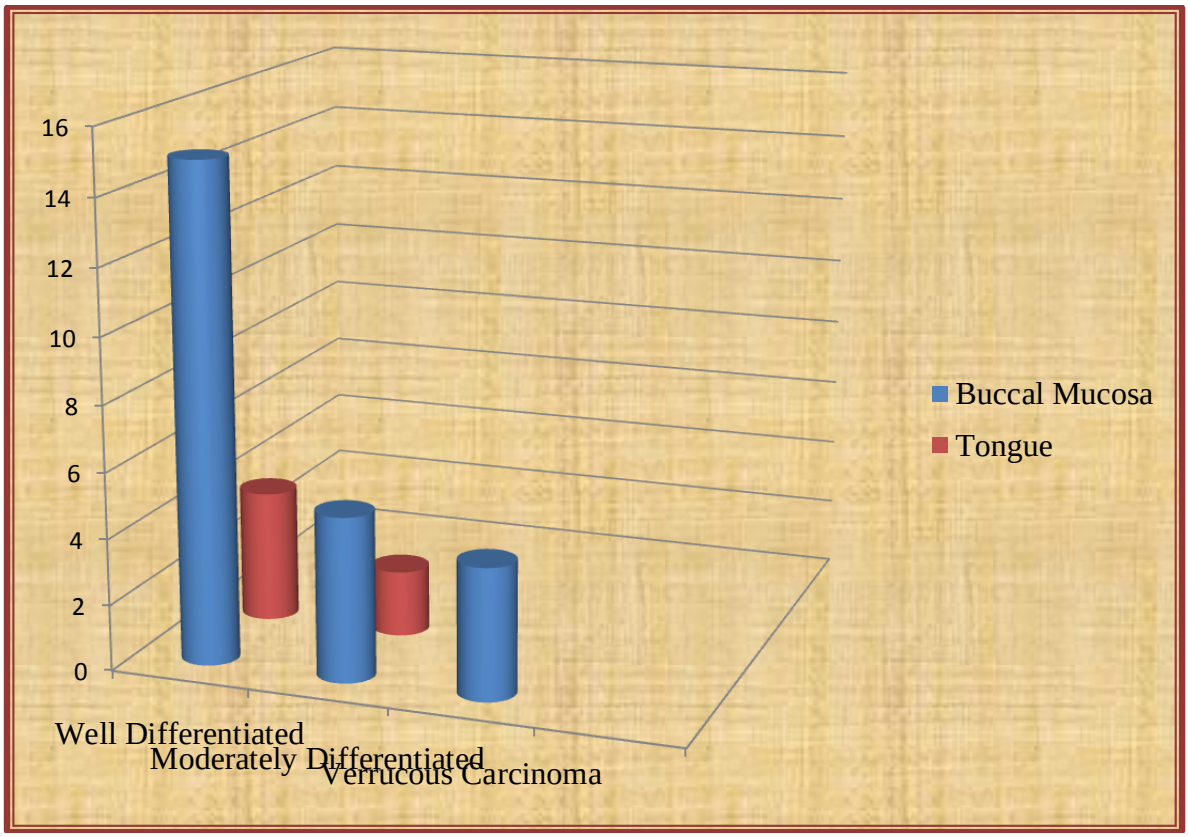


Fig 23 : Showing Specimen of Level IV and Level V Lymph Nodes sent for histopathology

Level IV Lymph Node - Long thread tied

Level V Lymph Node - Short thread tied

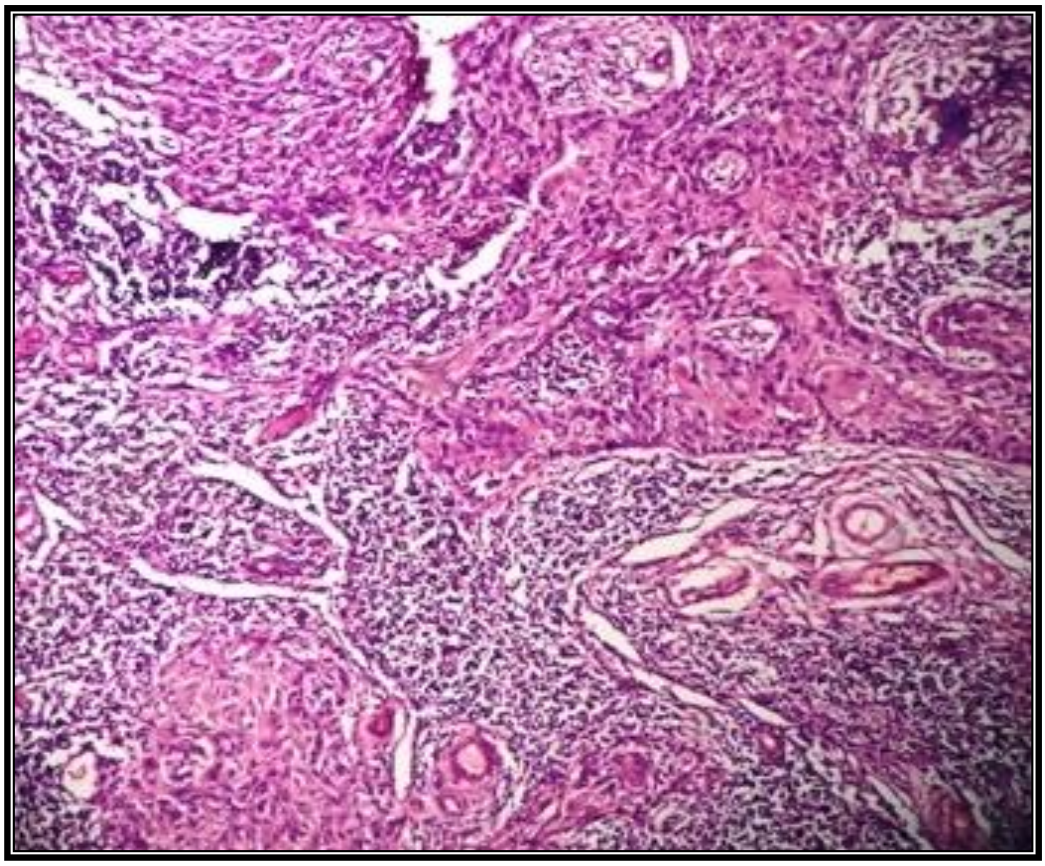


Fig 24 : Showing Squamous cell carcinoma deposits in lymph Node

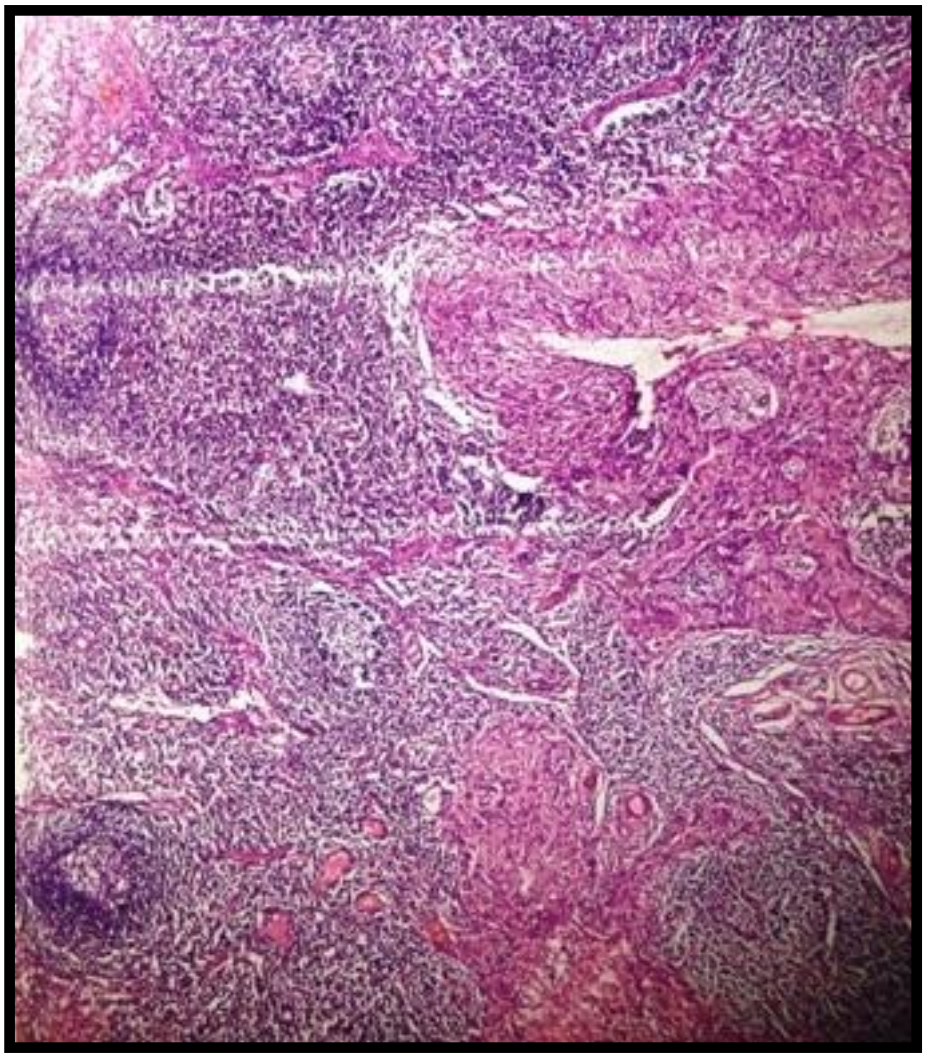


Fig 25 : Well differentiated Squamous Cell Carcinoma showing well formed keratin pearls and increase in nuclear size showing the malignant change in squamous cell lining of mucous membrane(Haematoxylin and eosin, x40)

Pattern of Metastasis to Neck Nodes

Total Number of lymph nodes examined included 327.

Out of 30 N_1 Necks, only 13 necks had lymph node metastasis, rest were found to be false positive (reactive) nodes. Among 13 pathologically proven metastatic cases, 10 patients with buccal mucosa carcinoma had lymph nodes showing squamous cell deposits at level I and II.None of the patients had metastasis to level IV or level V in buccal mucosa carcinoma.

Out of 3 pathologically proven metastasis, in tongue carcinoma, 1 patient had metastasis to level IV.Metastases to level V did not occur in any patient.

Table 8 : Pattern of metastasis to neck nodes

Neck Level	Site of primary showing metastatis to neck nodes	
	Buccal Mucosa *n=10/24	Tongue *n=3/6
Ia	2	1
Ib	9	3
IIa	2	3
IIb	1	2
III	1	0
IV	0	1
V	0	0
Total Metastatic Nodes	15	10

*n = number of patients showing lymph node metastasis out of the total number of patients for each primary site

Graph 7 : Pattern of metastasis

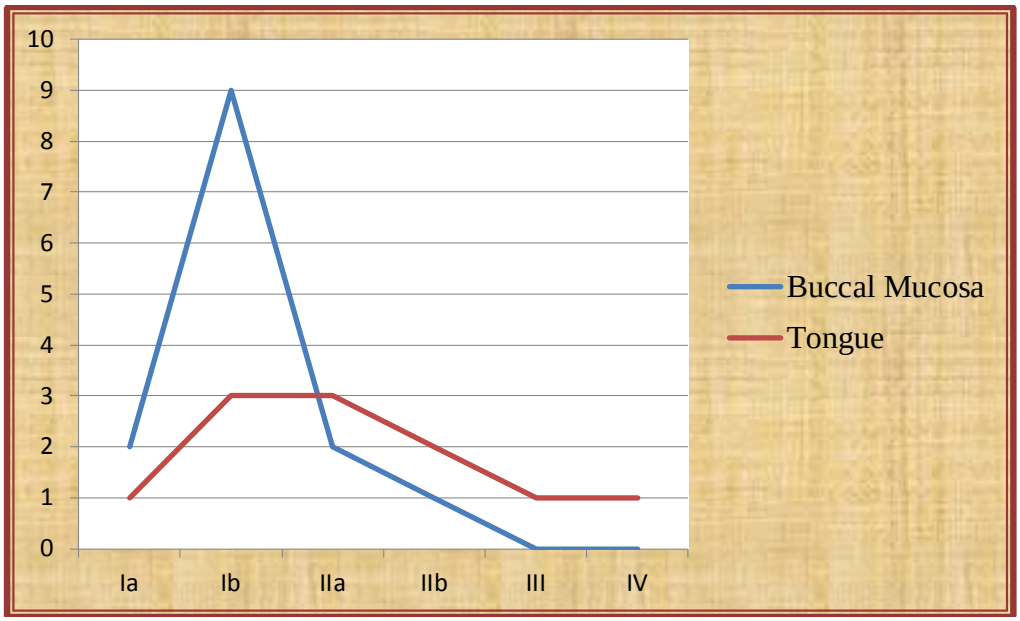
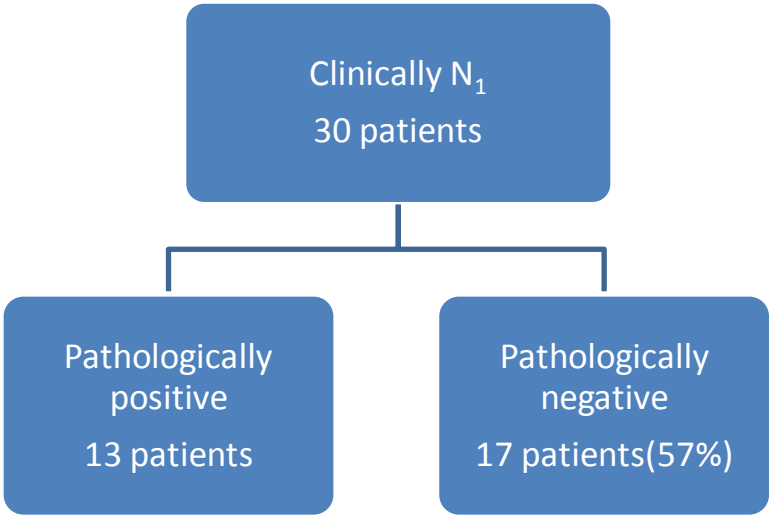


Table 9 : Showing False positive rates

Clinical Examination	Percentage
False positive	57%
False Negative	0%

In our study, we found high false positive rates (Clinically positive nodes, pathologically negative for tumour).The probable cause may be inflammatory lymphadenopathy owing to poor orodental hygiene.False negative were nil in this study as N_0 cases were excluded from the study.

Graph 8 : Showing Metastatic nodes and False Positive nodes in N_1 neck



In buccal mucosa carcinoma, level I was positive in 2 T_2 lesions ,1 T_3 and 5 T_4 lesions while level II was positive in 2 T_2 , 1 T_3 , 3 T_4 cases and level III in 1 T_4 case.This shows level I being commonly involved in the study.None of the patients had metastasis to nodal levels IV and V in any "T" stage in our study.

In tongue carcinoma, level II and level IV was involved in 1 T_3 stage .Level I and II was involved in 2 T_2 stage patients..No metastasis at level V was seen in any patient.

Table 10 : showing Pathological stage and nodal metastasis

Pathological Staging	Site of Primary Tumour									
	Buccal Mucosa *n=10/24					Tongue *n=3/6				
	I	II	III	IV	V	I	II	III	IV	V
T_2	2	2	-	-	-	2	5	-	-	-
T_3	1	1	-	-	-	-	2	-	1	-
T_4	5	3	1	-	-	0	-	-	-	-

*n= number of patients showing lymph node metastasis out of the total number of patients for each primary site

Post op Follow up

Within 6 months from the date of surgery, 3 patients had recurrence.Out of 3 recurrences , 1 patient had local recurrence while 2 patients (T_3 tongue tumour and T_4 buccal mucosa cancer) had regional recurrence at nodal level II.1 patient (Regional recurrence in buccal mucosa cancer patient) was salvaged by radical neck dissection out of 3 recurrences while 2 patients died of disease.

Table 11 : Showing Post op Follow up of patients

	Site of primary tumour	
	Buccal Mucosa (n=24)	Tongue (n=6)
Disease free	17	5
Local Recurrence	1	-
Regional Recurrence	2	-
Locoregional Recurrence	-	-
Died of disease	2	-
Died of other causes	-	-
Lost to follow up	2	1

Discussion

Head and Neck cancers are the most common cancers in India. Among these, oral cavity forms the most common site for squamous cell carcinoma.[13] High prevalence of oral cavity cancers is seen in socially and economically backward group of people owing to the use of tobacco and / areca (betel) nut which produces chronic irritation and inflammation of oral mucosa with continued use over years, eventually leading to potentially malignant lesion.[4-7,11,12] More than half the subjects present with lymph node metastases and histological confirmation of metastatic neck disease is the one of the most important prognostic factor in Head and Neck SCCs.[41-45] The main routes of the cervical lymph node spread are through the first station nodes (levels I and II) and second station nodes including the levels III, IV and V. This indicates predictable pattern of lymphatic spread .Predicting the lymphatic spread can help in choosing the appropriate procedure and may also help in predicting the outcome.[23,24,26,27]In case of lymph node metastases, neck dissection should be performed.[49]Radical neck dissection has been the conventional form of treatment of neck metastases and is associated with high morbidity .[14,15]This led to surgical modifications (MRND) sparing uninvolved non lymphatic structures like spinal accessory nerve, internal jugular vein / sternomastoid .[16,17] Even with careful preservation of the spinal accessory nerve during surgical dissection, the nerve was found vulnerable to injury in the posterior triangle secondary to devascularisation and traction injury to the nerve.[18-22]

In our centre, previously a study was done to assess spinal accessory nerve function in various types of nerve sparing neck dissections. Those patients who underwent Functional neck dissection showed the most severe disturbance on

electromyography at 3 weeks. Of the 28 shoulders (27 patients) in this group, 11 had severely abnormal electromyogram (39.3%). At three months, electromyography showed improvement in 12 patients (42.9%) . The supraomohyoid neck dissection group was found to have the least damage to the spinal accessory nerve as demonstrated by post operative electromyogram. Of the 11 shoulders in this group two (18.2%) had severely abnormal electromyograms in the early post operative period. On repeat electromyograms at 3 months all showed improvement with nine patients (82%) showing normal electromyograms and 2 patients (18%) showing slightly abnormal electromyograms.

Therefore necessity of level V (Posterior triangle) dissection in N_0 and N_1 neck is debatable.

Our study involved 30 patients in the age group ranging from 41-70 years with mean age 53years.Out of 30 patients, four were males(13%) and the majority(i.e. twenty six) were females(87%).This shows that oral cancers are more common among females in this region.This can be attributed to the habit of chewing tobacco, beetle nuts and keeping a cudd in the mouth.

In literature, Southern India presents the highest oral cancer incidence rates among women worldwide and the highest in India overall.[3,10,11,12]These very high incidence rates in Indian population reflect the continued prevalence of pan chewing in India , a habit which is equally common in both genders.[4,10,11,12]

Majority of the patients in our study had malignancy involving buccal mucosa and tongue(80% and 20% respectively).Owing to their addiction to chewing

beetle nuts and tobacco and keeping a cudd, buccal mucosa cancer is by far the most common malignancy in this region.

In our study, seventeen patients (57%) had early malignancy (T_2) and 43% had advanced malignancy T_3 (10%) and T_4 (33%).Out of 30 patients, thirteen patients had metastases on histopathological examination and the rest seventeen cases had reactive lymph nodes on histopathology.This high incidence of false positive cases of lymphadenopathy on clinical examination could be attributed to reactive lymphadenopathy due to poor oral hygiene.There were no false negatives as patients with N_0 neck were excluded from the study.

Clinical Examination	Percentage
False positive	57%
False Positives in few other studies[54,55]	40%

In other studies, The incidence of false-negative neck nodes was lower in well differentiated primary lesions when compared to false positive nodes Micrometastases or metastasis to nodes measuring less than 1.7 cm accounted for misdiagnosed cases.[54,55]

In buccal mucosa carcinoma, out of 24 patients, 16 patients underwent wide excision with hemimandibulectomy.In these 16 patients, 2 patients had reconstruction with double flap(DP+ PMMC) while rest 14 cases with island pectoralis major myocutaneous (PMMC) flap.Out of remaining 8 patients, 2 patients underwent marginal mandibulectomy.In all these 8 patients, reconstruction was done using nasolabial flap in 1 patient, buccal pad of fat in 2 patients, masseter flap in 1 patient and forehead flap in 4 patients.

In carcinoma anterior 2/3rd tongue, all 6 patients underwent hemiglossectomy with simultaneous modified radical neck dissection.

Hemimandibulectomy was done whenever tumour was involving posterior most region of buccal mucosa or involving the bone.Marginal mandibulectomy was done when tumour was reaching lower alveolus without infiltrating bone.Hemiglossectomy was done in 6 patients of tongue cancer as they were well lateralised not extending to midline or base tongue.

In our study , among buccal mucosa tumours with N_1 neck, 10 out of 24(41.6%) patients had metastasis. Among those with pathologically involved nodes (p N_1) , level I cervical node was most commonly involved site followed by level II and III . Level IV or V was not involved in any patient.This is in accord with other studies in literature. [24-34]

In literature, metastasis to level V is not expected if the other nodal levels are not involved.Even if the other levels are involved , risk of occult metastasis to level V is not above 20%.[24-34]

According to a large study by Davidson, the metastasis at level V is least expected and metastasis to level V occurs only when other levels are involved.[29]Jatin Shah in his study found level IV metastasis in 3-6% of oral cancers.[27]Similar observations were found in few other studies.[24,25,26,28,30,31,32,33]

In our study, Among tongue tumours with N_1 neck, three out of six (50%) patients had metastases .Among these 3 patients, there was metastasis at level IIA (2 patients) and level IV (one patient). There was no case with isolated involvement of level IV in the absence of nodal disease at level I or II. Metastases to level V did not occur in any patient.

In literature, metastasis to level IV in oral tongue cancers is reported to be higher(15-17%).[27,37,38] Also there is higher incidence of skip metastasis at level IV.[37-39]

Post op Follow up :

Prognosis depends on tumour primary site, nodal involvement, depth of tumour, and the status of the surgical margins. Also, the cumulative effects of tobacco, betel nut and alcohol decrease the survival rate . TNM system is a good indicator of tumour prognosis. [50] Prognosis is better in early cancers, particularly those that are well-differentiated.

Most of the patients in this study had well differentiated squamous cell carcinoma(60%).This is because majority of the patients had buccal mucosa cancer.10 % showed moderately differentiated squamous cell carcinoma .13.3% showed verrucous carcinoma. Recurrence was associated with moderately differentiated tumours

In our study ,with a mean follow up of 6 months, recurrence occurred in 3 patients (10%).Out of 3 recurrences, 1 patient had local recurrence(3%) while 2 patients (T_3 tongue tumour and T_4 buccal mucosa cancer had regional recurrence (7%) had nodal level II.1 patient (Regional recurrence in buccal mucosa cancer) was salvaged by radical neck dissection out of 3 recurrences while 2 patients died of disease.

In our study, we did not have metastasis to level V in any patients.This low prevalence rate of metastasis is in concordance with other studies in literature.[24-34] In one of our patient with tongue carcinoma, level IV was involved when nodal level II was positive for metastasis showing similar reports as other studies in literature.[35-39]

Table 12: Literature Reports on prevelance of level IV and V lymph node metastasis in N1 neck

Various studies	Buccal Mucosa Cancer	
	Level IV	Level V
Shah et al[27]	3%	0%
Woolgar [24]	0%	0%
Our study	0%	0%

Various studies	Anterior 2/3rd Tongue Cancer	
	Level IV	Level V
Shah et al[27]	15%	7%
Byer et al[38]	15.8%	0%
Nitya et al[37]	15.2%	0%
Our study	16.6%	0%

Considering the above observations and results of our study, metastasis to posterior triangle nodes in oral cancer with N_1 neck was 0% in buccal mucosa and tongue. However, metastasis at level IV in tongue cancers with N_1 neck is higher (16.6%) in our study.It was not an isolated skip metastasis and this patient was also found to have metastasis at level II.

Conclusion

- There is high prevalence of buccal mucosa cancers in Kolar district.
- There is female preponderance in oral malignancy in our study.
- In oral malignancy there is a high incidence of false positive lymph nodes.
- Most common nodal involvement in Buccal mucosa carcinoma was Level Ib(Submandibular lymph node).
- The incidence of Level IV (Supraclavicular) and Level V (Posterior triangle) lymph node metastasis is low in buccal mucosa carcinoma patients with clinically N_1 neck.
- It may be feasible after multi-institutional studies to omit dissection of level IV and V lymph nodes in buccal mucosa cancer patients with clinically N_1 neck if no other sub-clinical lymph nodes are found during surgery in higher levels.Wherever feasible, frozen section of such sub-clinical lymph node in higher levels would be feasible.This will avoid unnecessary injury to spinal accessory nerve in significant number of patients.
- Metastasis to Level IV nodes in tongue carcinoma patients is higher especially when multiple sub-clinical nodes are found in higher levels intraoperatively.Therefore, it is safer to do full neck dissection (MRND) in carcinoma tongue.

Summary

Between December 2010 and June 2012, thirty patients from our centre with histologically proven Oral Squamous cell carcinoma with clinically N_1 neck underwent primary surgery and Modified radical neck dissection .Male female ratio was 1: 6.5.The patients' age ranged from 41-70 years with the average of 53 years.

Among 30 patients, study group comprised 24 buccal mucosa cancers and 6 tongue cancers.

Histopathological examination of the excised specimens showed that most common type of carcinoma was well differentiated squamous cell carcinoma found in 18 patients. Moderately differentiated squamous cell carcinoma and verrucous carcinoma was detected in 7 and 4 patients respectively.

Out of thirty patients, ten cases showed metastases to level IB mainly in buccal mucosa carcinoma while 3 cases in tongue tumour showed metastasis mainly to level IIA.

In buccal mucosa carcinoma, level IV or V was not involved in any patients (0%) while in tongue tumour, one patient had tumour deposit at level IV lymph node when other nodal level (level II) was involved(16.6%).None of the patients had level V node involvement in tongue cancer.However , the number of patients with tongue cancer was less.

From the day of surgery to a post op period of within 6 months , recurrence occurred in 3 patients (10%).Out of 3 recurrences, 1 patient had local recurrence (3%) while 2 patients (T_3 tongue tumour and T_4 buccal mucosa cancer) had regional recurrence (7%) at nodal level II .1 patient (Regional recurrence in buccal mucosa cancer) was salvaged by radical neck dissection out of 3 recurrences while 2 patients died of disease.

Therefore, during neck dissection , it may be oncologically safe to avoid level IV and level V clearance in buccal mucosa Squamous cell carcinoma with N_1 neck.However, tongue tumour seems to have a higher incidence of metastasis to level IV when other nodal levels were involved and it would be safer to clear this level when the primary tumour is in tongue.

In our study, since the sample size is too small, it may be feasible after multi institutional studies with greater number of patients to formulate a definite protocol on posterior triangle and supraclavicular node clearance in oral cancers with clinically N_1 neck.

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PROFORMA

NAME OF THE PATIENT:

AGE: **OCCUPATION:**

ADDRESS: **HOSPITAL NUMBER:**

DATE OF ADMISSION:

HISTORY

History	Yes/No	Since
Pain in the mouth		
Inability to open the mouth		
Ulcer in the mouth		
Change in voice		
Bad smell in the mouth		
Excessive salivation		
Difficulty in swallowing		
Swelling in the neck		
Loss of appetite		
Weight loss		
Generalised weakness		

PAST HISTORY

HTN

DM

PTB

Asthma

Any surgery

FAMILY HISTORY

Contributory

Not contributory

PERSONAL HISTORY

Sleep, bowel & bladder habits:

Appetite:

Smoking:

Beedi /cigarette number/day since

Alcohol: Duration

Frequency

Quantity

Areca/betel quid:

Tobacco chewing:

Pan masala:

GENERAL PHYSICAL EXAMINATION

Built	Nourishment
Pallor	Icterus
Cyanosis	Clubbing
Oedema	Weight
Pulse	Blood pressure

LOCAL EXAMINATION

Oral cavity:

Orodental hygiene:

Trismus:

Nicotine stains:

Premalignant lesions:

Primary lesion

Tongue-anterior 2/3

Floor of mouth

Buccal mucosa

Retromolar trigone

Lower alveolus

Upper alveolus

Hard palate

Lips

Others

Side of growth:

Size of growth: 2 cm or <2 cm in greatest dimension

>2 cm but <4 cm in greatest dimension

>4 cm in greatest dimension

Type of growth:

Ulcerative/Proliferative/Ulceroproliferative

IDL:

NOSE EXAMINATION

Anterior Rhinoscopy

Posterior Rhinoscopy

EAR EXAMINATION

NECK NODES : Number:

Level of node: Size:

Consistency: Tenderness:

Mobility: Skin over nodes:

TNM Stage

SYSTEMIC EXAMINATION

Cardiovascular system:

Respiratory system:

Per Abdomen:

Central Nervous System:

CLINICAL DIAGNOSIS

INVESTIGATIONS

Hb	Platelet Count
TC	BT
DC	CT
ESR	Blood Grouping & Typing
RBS	

Ultrasound neck:

Biopsy:

CXR:

TREATMENT:

Surgery Done:

Type of Neck Dissection:

Reconstruction:

Histopathology Report

1.Of the primary tumour : Well differentiated SCC

Moderately differentiated SCC

Poorly differentiated SCC

2.Total number of nodes:

3.Of the posterior triangle lymph node: Number of nodes

Positive for malignancy

Reactive changes

4.Of the supraclavicular lymph node: Number of nodes

Positive for malignancy

Reactive changes

5.Of the levels I,II,III : Number of nodes

Positive for malignancy

Reactive changes

6.Resected margin of the tumour: Free from tumour

Involved by the tumour

7.Infiltration : To Skin Vascular invasion

Bone Perineural tissue

Muscle Subcutaneous tissue

7.Post operative

Follow up : 1 month – uneventful/complication

3 months- uneventful/complication

6 months- uneventful/complication

KEY TO MASTER CHART

1	BM	Buccal mucosa
2	MRND	Modified Radical Neck Dissection
3	M.M	Marginal mandibulectomy
4	HG	Hemiglossectomy
5	BP	Buccal Pad of Fat
6	DP	Deltopectoral Flap
7	Lt	Left
8	FND	Functional neck dissection
9	HG	Hemiglossectomy
10	HM	Hemimandibulectomy
11	Ant.Tong	Anterior Tongue
12	Rt	Right
13	M	Male
14	PMMC	Pectoralis Major Myocutaneous Flap
15	MF	Masseter Flap
16	NLF	Nasolabial Flap
17	FF	Forehead Flap
18	WE	Wide Excision
19	HPE	Histopathological examination
20.	F	Female
21.	WD	Well differentiated
22.	MD	Moderately differentiated
23.	SCC	Squamous cell carcinoma
24.	Level IV	Supraclavicular
25.	Level V	Posterior triangle
26.	LN	Lymph Node
27.	RR	Regional recurrence
28.	LR	Local recurrence
29.	Ds	Disease

Sl No	Hosp No	Age	Sex	Site of Primary	TNM Staging	Surgery Done	HPE Primary	No of Nodes	level IV & V LN	level I,II,III LN	Follow Up
1	656428	60	F	Lt BM	T2N1MX	WE+MRND+NLF	WD SCC	14	Not found	Found and Reactive	Alive & disease free
2	657293	65	F	Lt BM	T4aN1MX	WE+MRND+HM+PMMC+DP	WD SCC	13	Not found	I- 1, II-1,Rest reactive	Alive & disease free
3	686138	55	F	Rt BM	T4aN1MX	WE+MRND+HM+PMMC	MD SCC	11	Not found	I-1,II-1,Rest reactive	RR at 6months,Later died of Ds
4	691175	44	F	Rt BM	T4aN1MX	WE+MRND+HM+PMMC	WD SCC	4	Not found	I-1,II-1,Rest reactive	Alive & disease free
5	694774	50	M	Lt BM	T2N1MX	WE+MRND+FF	Verrucous ca	6	Not found	Found and Reactive	Alive & disease free
6	702545	50	F	Lt BM	T3N1MX	WE+MRND+HM+PMMC	WD SCC	8	Not found	I-1,II-1,Rest reactive	Alive & disease free
7	705389	45	M	Rt Ant 2/3rd tong	T3N1MX	WE+H	MD SCC	4	Not found	Found and Reactive	Alive & disease free
8	714471	60	F	Rt BM	T4aN1MX	WE+MRND+HM+PMMC	MD SCC	17	Not found	Found and Reactive	Alive & disease free
9	712641	70	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC	WD SCC	6	Not found	Found and Reactive	Alive & disease free
10	714405	50	F	Rt BM	T4aN1MX	WE+MRND+BP	WD SCC	6	Not found	Found and Reactive	Alive & disease free
11	716289	55	F	Rt BM	T4aN1MX	WE+MRND+MM+MF	WD SCC	14	Not found	I-1, Rest reactive	Alive & disease free
12	731559	60	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC	Verrucous ca	14	Not found	Found and Reactive	Alive & disease free
13	7402009	58	F	Lt BM	T4aN1MX	WE+MRND+MM+BP	WD SCC	20	Not found	Found and Reactive	Alive & disease free
14	760347	55	F	Rt BM	T2N1MX	WE+MRND+HM+PMMC	WD SCC	12	Not found	II-1, Rest reactive	Alive & disease free
15	770442	42	F	Rt BM	T4aN1MX	WE+MRND+HM+PMMC	MD SCC	16	Not found	I-1,II-1,III-1,Rest reactive	Alive & disease free
16	769022	58	F	Rt Ant 2/3rd Tong	T2N1MX	WE+HG	WD SCC	9	Not found	II- 1, Rest reactive	Alive & disease free
17	772257	42	F	Rt Ant 2/3rd Tong	T2N1MX	WE+HG	WD SCC	4	Not found	Found and Reactive	Alive & disease free
18	779194	65	F	Rt BM	T2N1MX	WE+MRND+HM+PMMC	WD SCC	9	Not found	I-1,Rest reactive	Alive & disease free
19	780718	55	F	Lt BM	T2N1MX	WE+MRND+FF	WD SCC	10	Not found	Found and Reactive	Alive & disease free
20	784914	48	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC+DP	WD SCC	12	Not found	I- 1, Rest reactive	Alive & disease free
21	785829	45	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC	MD SCC	6	Not found	I-1, Rest reactive	Alive & disease free
22	787765	60	F	Lt BM	T2N1MX	WE+MRND+FF	Verrucous ca	24	Not found	Found and Reactive	Alive & disease free
23	708224	55	F	Rt BM	T2N1MX	WE+MRND+HM+PMMC	Verrucous ca	10	Not found	Found and Reactive	Alive & disease free
24	807391	55	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC	MD SCC	5	Not found	II- 1, Rest reactive	LR at 6months,Later died of Ds
25	811801	48	F	Lt BM	T2N1MX	WE+MRND+HM+PMMC	WD SCC	21	Not found	Found and Reactive	Alive & disease free
26	818868	45	F	Rt BM	T2N1MX	WE+MRND+HM+PMMC	WD SCC	17	Not found	Found and Reactive	Alive & disease free
27	823830	45	M	Rt BM	T4aN1MX	WE+MRND+FF	WD SCC	12	Not found	Found and Reactive	Alive & disease free
28	841826	49	M	Rt Ant 2/3rd Tong	T3N1MX	WE+HG	WD SCC	10	IV - 1	II- 2,IV-1, Rest reactive	RR at 6months, Later salvaged
29	837856	65	F	Rt Ant 2/3rd Tong	T4aN1MX	WE+HG	MD SCC	7	Not found	Found and Reactive	Alive & disease free
30	844938	50	F	Rt Ant 2/3rd Tong	T2N1MX	WE+HG	WD SCC	6	Not found	Found and Reactive	Alive & disease free