A Dissertation on

ROLE OF CYTOLOGICAL EVALUATION IN CERVICAL LYMPHADENOPATHY

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BONAFIDE CERTIFICATE

Certified that this dissertation is the bonafide work of **Dr.KESHAVARAJAN.G** on "**ROLE OF CYTOLOGICAL EVALUATION IN CERVICAL LYMPHADENOPATHY**" during his M.S. (General Surgery) course from May 2010 to April 2013 at the Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai - 600003.

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CONTENTS

I INTRODUCTION

A neck mass in an adult, when present for longer than a week is pathological until proven otherwise. Enlarged lymph nodes are by far the most common neck masses encountered. In our country, tubercular lymphadenitis is not uncommon but even so, a large percentage of all persistent adult neck masses in adults turn out to be malignant.

Lymphadenopathy is one of the first sign of malignancy in a patient. FNAC not only confirms the presence of metastatic disease, but also gives clues regarding the nature and origin of the primary tumour. The number of lymph nodes involved, the size of the lymph nodes or the lymph node metastasis, or the regional lymph node basin involved also has been shown to have prognostic value. In patients with enlarged lymph nodes and previously documented malignancy, FNAC can obviate further surgery performed merely to confirm the presence of metastasis. However, regional lymphadenopathy is not always due to metastatic tumour, and not every nodule represents a lymph node. Cysts (congenital or acquired), abscesses, subcutaneous benign and malignant tumours may also raise the question of lymph node metastasis, especially in patients with a known tumour.

A positive evidence of tuberculosis can obviate the need for further evaluation and leads to early instillation of definite therapy at the

secondary or primary care centre itself. Early treatment leads to better prognosis, as organism load and virulence are minimal; with a good host response. The disease spread and community burden are significantly reduced.

Avoiding false-positive diagnosis is of obvious importance since therapeutic and surgical decisions are taken on cytology results.

Moreover; the procedure is very simple, cost effective, and free from complications, well tolerated by the patient, can be done on an out-patient basis and repeatable when necessary.

India is imminently suited to use this procedure.

This study will address the neck nodes occurring in the adult population. They are usually metastatic nodes, lymphomas or tuberculosis. The metastatic are generally from the upper aero digestive tract, thyroid and salivary glands or may present as occult primaries. Occasionally a neck metastasis from a distant site springs from the gastrointestinal tract, kidney or the lung. Other primary sites below the clavicle, which may appear in the neck, are the cervix, ovary, testis and sometimes even the bladder.

II Aims and Objectives

- To study the pattern of cervical lymph node enlargement.
- To evaluate the diagnostic accuracy of FNAC in cervical lymphadenopathy with an emphasis on discordant cases between the cytology and the histopathology

III REVIEW OF LITERATURE

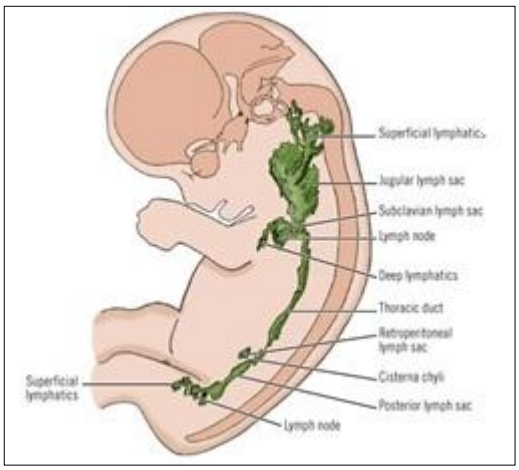
HISTORY

Antonio Pacchioni 1705	"Glandulae" (glands) secrete lymph
Henri Francois LeDran (1685-1770)	First description of spread of cancer along lymphatics
Johann Friedrich Meckel 1772	Described lymphovenous connections
Thomas Pole (1754-1829)	Described techniques (injection and corrosion studies) for lymphatic system dissection
Kocher 1880	Proposed removing nodal metastases
George Crile 1906	Described the classic radical neck dissection (RND)
Blair and Martin 1933 and 1941	popularized the RND
Pietrantoni 1953	recommended sparing the spinal accessory nerves
Bocca and Pignataro 1967	described the “functional neck dissection” (FND)
Bocca 1975	established oncologic safety of the FND compared to the RND
Medina, Robbins, and Byers 1989, 1991, and 1994	Proposed classifications of neck dissections

EMBRYOLOGY

During the 5th week of gestation, two paired and two unpaired endothelial sacs arise as outgrowths from the venous channels. These sacs form the primordia of the lymphatic system.

The first primordial lymph sacs to appear are the paired jugular sacs in the neck. They are located bilaterally at the junction of the subclavian and internal jugular (precardinal) veins. Soon thereafter, extensions from these sacs are visible in the upper limbs. The next sac to appear is unpaired and located at the mesenteric root in the retroperitoneal space. Later the unpaired cisterna chyli develops dorsal to the mesenteric sac. The final paired sacs, two posterior (iliac) sacs, appear at the junction of the sciatic and femoral veins. In short, it may be said that embryologically the lymph system originates and terminates in the venous system.



By the end of the ninth week, these six lymphatic sacs are linked together by multiple endothelial channels to form a complicated network of lymphatic vessels. During early fetal development mesenchymal cells invade these sacs, converting them into groups of lymph nodes. True lymph nodes, however, do not appear until the system of vessels is well established.

The earliest nodes appear in the places occupied by the primary sacs and confluences of capillary plexuses. At first, the nodes are represented by unencapsulated lymphoid tissue located within the meshwork of lymphatic channels. Later, the lymphoid mass separates into smaller portions allowing the inward growth of blood vessels and the lymphatic network. Each mass, together with portions of the surrounding network, becomes enclosed by a capsule of connective tissue. Original lymphoid tissue transforms into the medullary cords and cortical nodules of the node; the enclosed lymphatic capillaries form the peripheral lymph sinus. Cervical lymph nodes appear around the 9th week. Later, several other groups of lymph nodes are formed in various areas of the body.

HISTOLOGY

Nodes vary greatly in size, ranging from 1-2 mm to 3-4 cm in diameter. Each node is covered by a capsule of dense connective tissue

which sends trabecular extensions to the centre of the lymph node. The nodal parenchyma is divided into two regions: cortex and medulla.

The cortex is the outer and more densely staining part of the lymph node. The cortex contains lymph nodules or follicles (aggregations of lymphocytes) which contain lighter staining germinal centres. According to Roth and Reith, the germinal centre is a "morphological indication of lymphatic tissue response which ultimately leads to lymphocyte, plasma cell, and antibody formation." The germinal centre may be the site of genesis of the immune system.

The innermost part of the lymph node is the medulla. The lymphoid tissue of the medulla is organized into medullary cords and medullary sinuses. The medullary cords consist of reticular fibres and cells that develop around tiny blood vessels. Accordingly, small lymphocytes, macrophages, and mature plasma cells can be found in association with medullary cords. The medullary sinuses converge in the vicinity of efferent lymphatic vessels and serve to drain the lymph node. Stellate cells found within the sinuses form a web like series of microscopic baffles, allowing interaction with macrophages in the wall of the sinus. This interaction may create a trap for cells passing through the lumen of the sinus.

Lymph capillaries are very thin. They unite to form lymphatic vessels. Lymph capillaries are lined by endothelium and are slightly larger than blood capillaries. They are unique, however, in that they lack a continuous basal lamina and are permeable only in one direction. The edges of adjacent endothelial cells overlap significantly, providing an intercellular cleft with one or two tiny points of closer apposition and adherence.

Extracellular bundles of filaments extend outward from the endothelium between collagen bundles of the surrounding connective tissues. These bundles are believed to play a role in keeping the lumen of the vessel open. Furthermore, it is presumed that as interstitial fluid increases around the lymphatic capillary, the "anchoring" filaments open the clefts, allowing the inward flow of intercellular fluid and even large molecules. As a result, relatively large products of metabolism can enter the lymph vessel, thereafter being pushed by the contraction of surrounding muscles and interstitial pressures.

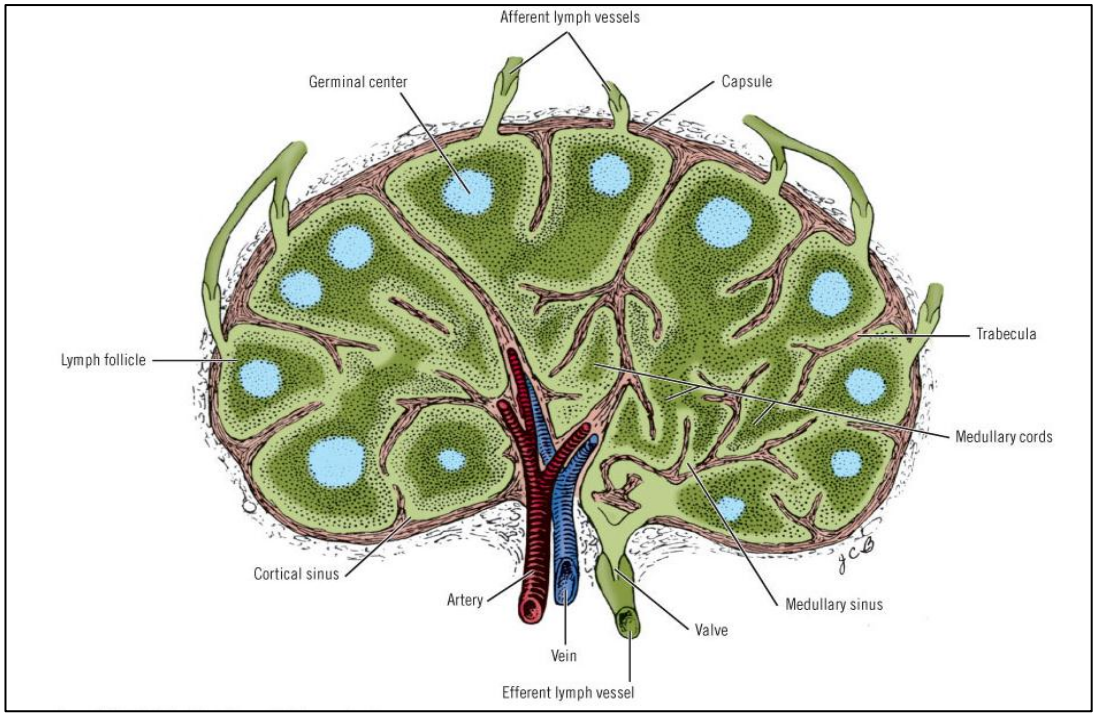
The pathway of lymph starts in interstitial tissue spaces where lymph accumulates, perhaps secondary to the slight predominance of capillary filtration and reabsorption. Lymph passes from lymph capillaries to lymphatic vessels by propulsion and contraction. The lymphatic vessels carry the fluid to the lymph nodes by way of the nodal

sinuses. Efferent vessels carry the lymph to the next node in the chain, and eventually the fluid flows to lymph trunks. The trunks pass the lymph into the thoracic and right lymphatic duct, where it reaches the venous circulation.

If some lymph vessels are damaged or blocked, new vessels form readily. The system drains broadly into the venous system. It is well understood that the thoracic duct and the right lymphatic duct open into their respective brachiocephalic veins, but those who have studied these vessels report openings of lymph vessels into the inferior vena cava, renal, suprarenal, azygos, and iliac veins.

Lymph capillaries and lymphatic vessels have one-way valves which open upon contraction of the vascular wall. These valves permit the passage and circulation of lymph fluid (3 to 5 liters daily) into larger vessels and, ultimately, to the thoracic ducts. The valves are bicuspid and prevent backflow.

Lymphatic vessels always follow minute arteries and veins. They resemble veins in structure but have thinner walls, more valves, and contain lymph nodes at various intervals along their length.



PHYSIOLOGY

The lymph nodes are responsible for filtering lymph and producing antibodies by responding to antigens.

The lymphatic and blood vascular systems are fellow travellers, with multiple interactions in health and disease. There are two principal pathways by which malignant cells spread via the lymphatic system:

- Permeation of minute lymphatic vessels, which ultimately leads to growth and spread to regional lymph nodes
- Lymphatic metastasis by tumor cell emboli, which may bypass a lymph node or become entrapped in the lymph node

The lymph nodes may act as temporary filters, in which metastatic malignant cells are trapped, propelled into vessels, or destroyed.

It is known that lymph nodes can effectively arrest the passage of particulate matter and blood cells, and entrap and destroy bacteria. Some viruses, however, can proliferate rapidly within the lymph node and thereafter easily disseminate throughout the body. Similarly, lymph nodes may fail to entrap other kinds of cells carried in the lymph. For example, a large percentage of cancer cells may transit in lymphatic vessels without being arrested at the node.

When malignant cells are entrapped within the node they may proliferate rapidly, greatly increasing the size of the node. Non-tender, hard, compacted masses of nodes usually contain metastatic carcinoma or very aggressive intrinsic neoplasms. The particular location of the lymph gland enlargement often provides very definite clues to the origin of the primary lesion.

ANATOMY

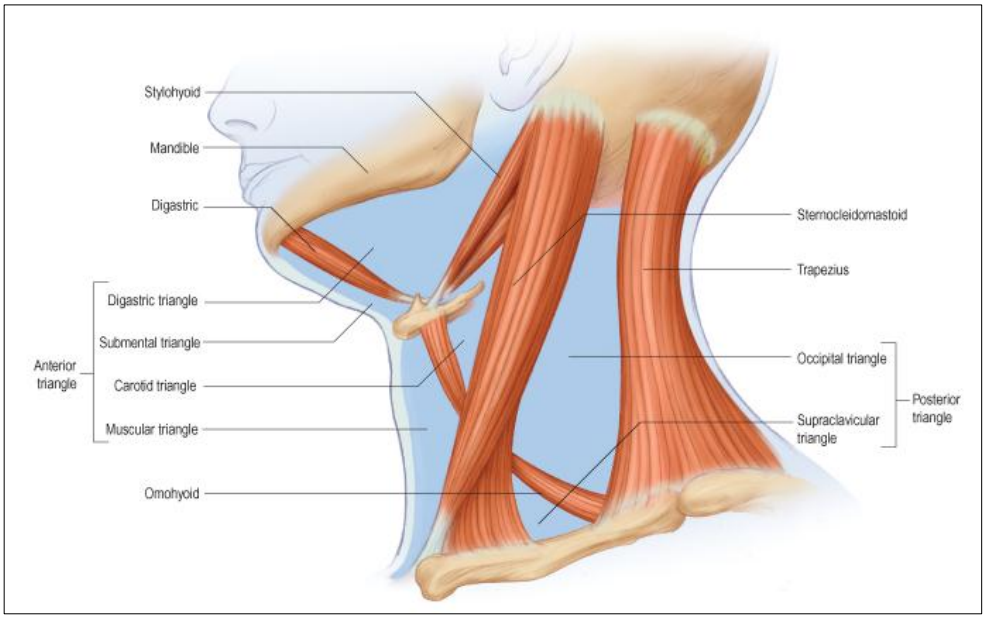
There are a total of 800 lymph nodes in the body, 300 of which are located in the head and neck region. The cervical lymphatic system consists of interconnected groups or chains of nodes that parallel the

major neurovascular structures in the head and neck. All the structures in the head and neck have specific and predictable draining nodes associated with them.

TRIANGLES OF NECK

The sternocleidomastoid muscle divides each side of the neck into 2 major triangles:

1. Anterior triangle
    - Digastric triangle
    - Submental triangle
    - Carotid triangle
    - Muscular triangle
2. Posterior triangle
    - Occipital triangle
    - Supraclavicular triangle



DIGASTRIC TRIANGLE

The digastric triangle is bordered above by the base of the mandible and its projection to the mastoid process, posteroinferiorly by the posterior belly of digastric and by stylohyoid, and anteroinferiorly by the anterior belly of digastric. It is covered by the skin, superficial fascia, platysma and deep fascia, which contain branches of the facial and transverse cutaneous cervical nerves. Its floor is formed by mylohyoid and hyoglossus. The anterior region of the digastric triangle contains the submandibular gland, which has the facial vein superficial to it and the facial artery deep to it. The submental and mylohyoid arteries and nerves lie on mylohyoid. The submandibular lymph nodes are variably related to the submandibular gland.

SUBMENTAL TRIANGLE

The single submental triangle is demarcated by the anterior bellies of both the digastric muscles. The apex is formed by the chin. Base is formed by the body of the hyoid bone and the floor by both the mylohyoid muscles. It contains lymph nodes and small veins which unite to form the anterior jugular vein.

MUSCULAR TRIANGLE

The muscular triangle is bounded anteriorly by the mid line of the neck from the hyoid bone to the sternum, inferoposteriorly by the anterior margin of sternocleidomastoid muscle and posterosuperiorly by the superior belly of omohyoid muscle. The triangle contains sternohyoid, omohyoid, sternothyroid and thyrohyoid.

CAROTID TRIANGLE

The carotid triangle is limited posteriorly by sternocleidomastoid muscle, anteroinferiorly by the superior belly of omohyoid muscle and superiorly by stylohyoid muscle and the posterior belly of digastric muscle. The hyoid bone forms its anterior angle and adjacent floor and can be located on simple inspection, verified by palpation. Parts of thyrohyoid, hyoglossus and inferior and middle pharyngeal constrictor muscles form its floor. The carotid triangle contains the upper part of the common carotid artery and its division into external and internal carotid arteries. Overlapped by the anterior margin of sternocleidomastoid, the external carotid artery is first anteromedial, then anterior to the internal carotid artery. Branches of the external carotid artery are encountered in the carotid triangle. Thus the superior thyroid artery runs anteroinferiorly, the lingual artery anteriorly with a characteristic upward loop, the facial artery anterosuperiorly, the occipital artery posterosuperiorly and the

ascending pharyngeal artery medial to the internal carotid artery. Arterial pulsation greets the examining finger. The superior thyroid, facial, lingual, ascending pharyngeal and sometimes the occipital, veins, correspond to the branches of the external carotid artery, and all drain into the internal jugular vein. The hypoglossal nerve crosses the external and internal carotid arteries. It curves round the origin of the lower sternocleidomastoid branch of the occipital artery, and at this point the superior root of the ansa cervicalis leaves it to descend anteriorly in the carotid sheath. The internal laryngeal nerve and, below it, the external laryngeal nerve, lie medial to the external carotid artery below the hyoid bone. Many structures in this region, such as all or part of the internal jugular vein, associated deep cervical lymph nodes, and the vagus nerve, may be variably obscured by sternocleidomastoid.

POSTERIOR TRIANGLE OF THE NECK

The posterior triangle is delimited anteriorly by sternocleidomastoid, posteriorly by the anterior edge of trapezius, and inferiorly by the middle third of the clavicle. The apex is formed by the attachments of sternocleidomastoid and trapezius to the occiput and is often blunted. The roof of the posterior triangle is formed by the investing layer of the deep cervical fascia. The floor of the triangle is formed by the prevertebral fascia

overlying splenius capitis, levator scapulae and the scalene muscles. It is crossed, 1inch above the clavicle, by the inferior belly of omohyoid muscle, which subdivides it into occipital and supraclavicular triangles. Collectively these contain the cervical and brachial plexuses, the subclavian artery and the spinal accessory nerve. The spinal accessory nerve pierces sternocleidomastoid and crosses levator scapulae obliquely downwards and backwards to reach the deep surface of trapezius. The muscles forming the floor of the posterior triangle constitute the anterior and lateral groups of the prevertebral musculature. Lymph nodes lie along the posterior border of sternocleidomastoid from the mastoid process to the root of the neck

The regional lymphatic drainage of the neck is divided into seven levels.

The system developed by Memorial Sloan-Kettering Cancer Centre, is ease and creates uniformity in describing regional nodal involvement in cancer of the head and neck. These levels allow for a standardized format for radiologists, surgeons, pathologists, and radiation oncologists to communicate concerning specific sites within the neck and does not represent regions isolated by fascial planes.

The levels are defined as the following:

Level I—the submental and submandibular nodes

Level Ia—the submental nodes; medial to the anterior belly

of the digastric muscle bilaterally, symphysis of mandible superiorly, and hyoid inferiorly

Level Ib—the submandibular nodes and gland; posterior to the anterior belly of digastric, anterior to the posterior belly of digastric and inferior to the body of the mandible

Level II—upper jugular chain nodes

Level IIa—jugulodigastric nodes; deep to sternocleidomastoid (SCM) muscle, anterior to the posterior border of the muscle, posterior to the posterior aspect of the posterior belly of digastric, superior to the level of the hyoid, inferior to spinal accessory nerve (CN XI)

Level IIb—submuscular recess; superior to spinal accessory nerve to the level of the skull base

Level III—middle jugular chain nodes; inferior to the hyoid, superior to the level of the hyoid, deep to SCM from posterior border of the muscle to the strap muscles medially

Level IV—lower jugular chain nodes; inferior to the level of the cricoid, superior to the clavicle, deep to SCM from posterior border of the muscle to the strap muscles medially

Level V—posterior triangle nodes

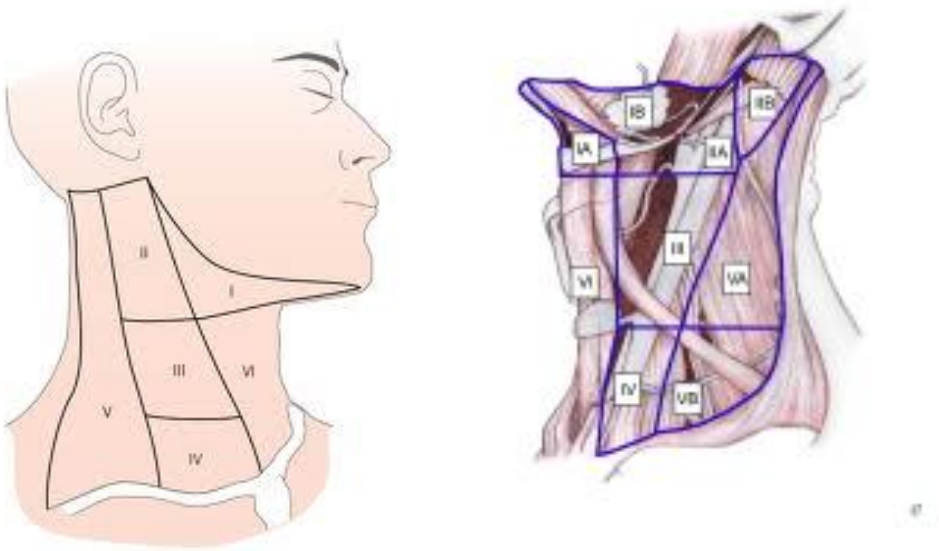
Level Va—lateral to the posterior aspect of the SCM, inferior and medial to splenius capitis and trapezius,

superior to the spinal accessory nerve

Level Vb—lateral to the posterior aspect of SCM, medial to trapezius, inferior to the spinal accessory nerve, superior to the clavicle

Level VI—anterior compartment nodes; inferior to the hyoid, superior to suprasternal notch, medial to the lateral extent of the strap muscles bilaterally

Level VII—paratracheal nodes; inferior to the suprasternal notch in the upper mediastinum



Level IA: Submental Nodes

These are lymph nodes located within the triangular boundary of the anterior belly of the two digastric muscles and the hyoid bone.

Cancers arising from anterior tongue, the floor of the mouth, anterior mandibular alveolar ridge and lower lip metastasise to these nodes.

Level IB: Submandibular Nodes

These are lymph nodes located within the boundaries of the anterior and posterior bellies of the digastric muscles, and the body of the mandible. Radiographically, the vertical plane at the posterior aspect of the submandibular gland demarcates the posterior aspect of level IB from level IIA. The group includes the pre- and post-glandular nodes, and the pre- and post-vascular nodes.

The submandibular gland is excised en block when the lymph nodes within this triangle are resected. Cancers arising from the soft tissue structures of the mid face, oral cavity, anterior nasal cavity, and submandibular gland metastasise to these nodes.

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Levels II: Upper Jugular Nodes

These are lymph nodes located along the upper third of the internal jugular vein and adjacent to spinal accessory nerve extending from the the skull base (above) to the inferior border of the hyoid bone (below). The medial (anterior) boundary is the lateral border of the stylohyoid muscle and the sternohyoid muscle. Radiologically, posterior aspect of the submandibular gland is the anterior limit. The lateral (posterior) boundary is the posterior border of the sternocleidomastoid muscle. The

malignancies from oral cavity, oropharynx, nasal cavity, nasopharynx, larynx, hypopharynx and the parotid gland metastases to level II nodes. The spinal accessory nerve divides the level into a sublevel IIA located medial (anterior) and sublevel IIB nodes located posterior (lateral). In case of oral cavity, larynx and hypopharynx cancers if level IIa is not involved it may not be necessary to dissect IIb nodes.

Level III: Middle Jugular Nodes

These are lymph nodes located around the middle third of the internal jugular vein. They extend from the inferior border of the hyoid bone above, to the inferior border of the cricoid cartilage below. The medial (anterior) boundary is the lateral border of the sternohyoid muscle, and the lateral (posterior) boundary is the posterior border of the sternocleidomastoid muscle. Malignancies arising from the nasopharynx, oral cavity, oropharynx, hypo pharynx, and larynx metastases to these nodes. This group includes the jugulo-omohyoid node, which lies just above the superior belly of the omohyoid muscle when it crosses the internal jugular vein.

Level IV: Lower Jugular Nodes

These are lymph nodes located around the lower third of the internal jugular vein. They extend from the inferior border of the cricoid cartilage above, to the clavicle below. The medial (anterior) boundary is the lateral border of the sternohyoid muscle. The posterior border of the

sternocleidomastoid muscle is the posterior boundary. These nodes have high risk of harbouring metastases from malignancies arising from the, cervical oesophagus, hypopharynx, and larynx. Metastasis in Level IVa nodes has increased risk of secondaries in Level VI and Level IVb nodes increases risk in Level V. The Virchow's node is located in Level IV.

Levels VA & VB: Posterior Triangle Nodes

These are lymph nodes predominantly located along the lower half of the spinal accessory nerve and the transverse cervical artery. Superiorly, apex is formed by the convergence of the sternocleidomastoid and the trapezius muscles. Clavicle forms the inferior boundary. The medial (anterior) boundary is the posterior border of the sternocleidomastoid muscle. The lateral (posterior) boundary is formed by the anterior border of the trapezius muscle. The supraclavicular nodes are also included in the posterior triangle group. A horizontal plane along the inferior border of the arch of the cricoid cartilage separates Sublevel VA from Sublevel VB.

Sublevel VA harbour metastases from cancers of nasopharynx and oropharynx. Thyroid gland cancers metastasise to sublevel VB.

Level VI: Anterior (Central) Compartment Nodes

Level VI lymph nodes include the precricoid (Delphian) node, the pre- and paratracheal nodes, and the perithyroidal nodes, including the

lymph nodes along the recurrent laryngeal nerves. They are bound superiorly by the hyoid bone, inferiorly by the suprasternal notch. The common carotid arteries on both sides form the lateral borders. Cancers arising from the thyroid gland, piriform sinus, subglottic larynx, and cervical oesophagus metastasise to level VI.

METASTATIC LYMPH NODES

An enlarged cervical lymph node is often the first clinical manifestation of head and neck cancers. Cervical lymphadenopathy is the presenting symptom in 47% of patients with cancer of the nasopharynx, 25% of patients with cancer of the oral cavity and oropharynx, and 23% of the patients with thyroid cancer. The primary tumour may not be detectable in some cases.

Painless swelling is the usual presentation. In late stages patient may complain of pain due to involvement of nerves and surrounding structures. Associated symptoms of primary are usually present.

The precise location of the gland can give clue to the site of primary tumour. Upper deep cervical nodes are involved when the primary lies in head, face and interior of the mouth. The middle and lower deep cervical nodes are involved when the primary is in the larynx or thyroid. Supraclavicular lymph node enlargement indicates thoracic or

abdominal disease. When Virchow's glands are enlarged it is called Troisier's sign.

The lymph nodes are irregular in shape and of varying sizes. The nodes are usually hard to feel. As the nodes are tethered their mobility becomes restricted. In early stage the nodes can be moved sidewards but not vertically. Later on nodes become absolutely fixed to the surrounding structures. Gradually the skin may be involved and is pulled towards the mass.

When the primary growth is not detected, the secondarily involved lymph node should be excised. When the primary growth is operable, the primary growth is adequately excised along with excision of the involved nodes. Excisions are always a form of neck dissections.

Staging of the Neck Nodes

- **NX** - Regional lymph nodes cannot be assessed
- **N0** - No regional lymph node metastasis
- **N1** - Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension
- **N2** - Metastasis in a single ipsilateral lymph node, more than

3 cm but not more than 6 cm in greatest dimension; or in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension; or in

bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension

  - **N2a** - Metastasis in single ipsilateral lymph node more than 3 cm but not more than 6 cm in greatest dimension
  - **N2b** - Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension
  - **N2c** - Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
- **N3** - Metastasis in a lymph node more than 6 cm in greatest dimension

THE LYMPHOMAS

Hodgkin's Disease

Hodgkin’s disease is characterized by the presence of multinucleated Reed-Sternberg (RS) cells or one of their variants. As opposed to Non-Hodgkin’s Lymphoma, in which a monoclonal population of malignant lymphocytes usually predominates, in Hodgkin’s disease the malignant cells are a minority population outnumbered by inflammatory cells.

Patients with Hodgkin’s disease typically present with non-tender lymphadenopathy. The cervical nodes are most commonly involved;

other regions, which include the axillary, inguinal, mediastinal, and retroperitoneal nodes are less frequently affected at presentation. The presence or absence of B symptoms should be elucidated from the patient's history. B symptoms include any one of the following: unexplained fever with temperature over 38°C, night sweats significant enough to require changing bed clothes, or weight loss of more than 10% of body weight over 6 months. Although classic for Hodgkin’s disease, the Pel-Ebstein fever, with progressively shortening intervals between fevers, is a relatively rare phenomenon.

The physical examination should include an evaluation of all lymph node bearing areas, including Waldeyer's tonsillar ring, and palpation for liver or splenic enlargement. Initial workup should include a complete blood cell count with a differential count, liver function tests, and a chest radiograph. A bone marrow biopsy is useful to determine the extent of the disease. Excisional biopsy of the largest node that is likely to provide the diagnosis should be performed. Careful selection of the biopsy site is important because some areas, particularly the inguinal region, frequently contain non diagnostic inflammatory nodes.

Ann Arbor staging system for Hodgkin's disease

Stage	Criteria
I	Involvement of a single lymph node region (I) or a single extralymphatic organ or site (IE)
II	Involvement of two or more lymph node regions on the same side of the diaphragm (II) or of an extralymphatic organ and its adjoining lymph node site (IIE)
III	Involvement of lymph node sites on both sides of the diaphragm (III) or localized involvement of an extra-lymphatic site (IIIE), spleen (IIIS), or both (IIISE)
IV	Diffuse or disseminated involvement of one or more extralymphatic organs with or without associated lymph node involvement
A	Asymptomatic
B	Fever, night sweats, or weight loss of more than 10%

Other clinical staging tools include computed tomography (CT), nuclear medicine scans, and bipedal lymphangiography. CT is used to detect mediastinal and abdominal lymphatic enlargement; however, nodes containing Hodgkin's disease often are not enlarged. Gallium scans have been useful in detecting residual disease. The prognosis of patients with Hodgkin's disease depends on the histologic subtype and stage of disease at presentation. The Rye modification of the Lukes-Butler classification of Hodgkin's disease identifies four histologic subtypes: lymphocyte predominant, nodular sclerosis, mixed cellularity, and lymphocyte

depleted. These subtypes are determined by the specific variant of Reed Sternberg cell, the ratio of these cells to the normal population, and the degree of sclerosis.

The Ann Arbor staging system is used for staging Hodgkin's disease based on the extent of disease. Clinical staging includes all data from the history and physical examination and nonoperative diagnostic studies. The Ann Arbor stages are subclassified to reflect lymphatic disease and involvement of extranodal areas designated by E, for involvement of an extralymphatic site (i.e., stomach or small intestine), or S, for splenic involvement. Disease is further subclassified according to the presence or absence of systemic symptoms of the disease.

Increasing knowledge of the effect of patient characteristics, histologic subtype, and stage of disease have allowed more individualized treatment of patients, with dramatic improvements in survival. Staging laparotomy was first introduced to define disease extent in all presentations of Hodgkin's disease. Subsequently, investigators performed staging by laparotomy to determine which patients had early stage disease that could be treated by local irradiation and which had extensive disease requiring systemic therapy. Both improvements in the accuracy of radiologic diagnostic procedures and more intensive use of chemotherapeutic and radiation treatments earlier in the course of the

disease have decreased the number of patients who require staging laparotomy.

Non-Hodgkin's Lymphoma

Most patients with Non-Hodgkin’s Lymphoma present with superficial adenopathy, most commonly in the cervical lymph nodes. These nodes are generally enlarged and not tender. The Ann Arbor system is used to stage these patients, but it is less helpful in Non-Hodgkin’s Lymphoma than in Hodgkin’s disease because more than half of Non-Hodgkin’s Lymphoma patients present with stage III or IV disease and approximately 20% present with B symptoms. Patients with Non-Hodgkin’s Lymphoma also are more likely to have hematogenous spread versus lymphatic spread as seen in patients with Hodgkin’s disease.

Non-Hodgkin’s Lymphomas do not spread in the orderly manner that Hodgkin’s lymphoma does.

Patients with Non-Hodgkin’s Lymphoma characteristically have a monoclonal proliferation of lymphocytes, with 80% of cases being of B-cell derivation and the remainder originating from T cells. The diagnosis of various subsets of B-cell Non-Hodgkin’s Lymphoma depends on the identification of histopathologic markers using monoclonal antibodies and on cellular morphology; criteria assessed are a diffuse versus

follicular (nodular) pattern of lymph node involvement, small versus large cell type, and cleaved versus noncleaved nuclear morphology. With this information, the lymphoma can be categorized according to the Working Formulation, which is a modification of the Lukes and Collins schema. The Working Formulation has simplified our understanding of the behaviours of these subtypes by placing them into one of three categories, depending on whether patients have a low, intermediate, or high risk of death due to the disease. The T-cell Non-Hodgkin's Lymphomas are much more difficult to identify precisely and to place into prognostic groups. More recently, the proposed European-American classification of lymphoid neoplasms uses morphology, phenotype, and cytogenetics to classify these disorders

Diagnostic Biopsy for Lymphoma

When lymphoma is suspected, proper planning and execution of the biopsy are crucial to enable the pathologist to make a diagnosis. Because preservation of the architecture aids in histologic diagnosis, efforts should be made to avoid traction or cautery. The largest node found on physical examination should be biopsied. If several nodal areas are enlarged, biopsy of the cervical area is preferred to biopsy of an axillary node, which in turn is superior to biopsy of nodes from the inguinal region. In suspected extranodal disease or in the case of matted

nodes, it is important to excise as generous an amount of tissue as possible. Communication with the pathologist is important to guarantee that adequate tissue is sent and that it is delivered in an acceptable fashion. In general, the specimen is sent fresh, is sent in saline, or is wrapped in a saline-soaked sponge. It is important that the specimen be sent directly to the pathologist and that there is an indication that the diagnosis of lymphoma is suspected. Needle biopsies rarely provide an adequate amount of tissue, although they may be helpful in ruling out a carcinoma or sarcoma or in suspected relapse of lymphoma when a tissue diagnosis is needed before treatment.

TUBERCULOSIS

Tuberculous lymphadenitis is a chronic granulomatous inflammation with caseating necrosis of the lymph nodes. In majority of cases human tubercle bacilli enter the body through the tonsil of the corresponding side. From there they move to the cervical nodes, so the upper deep cervical nodes are the most common to be involved. There is no generalised infection, so the cervical nodes involvement is not secondary to tuberculosis anywhere in the body.

It may affect any age but commonly affects young adults. The incidence has diminished since introduction of BCG vaccine. The cervical nodes are the most common affected nodes.

In tuberculosis, the lymph nodes on section show opaque and yellowish areas, which is the result of necrosis and caseation.

Microscopically the characteristic feature is the tuberculous granuloma containing multinucleated giant cells (Langhans cells), surrounded by aggregation of epithelioid cells, activated T cell lymphocytes and fibroblasts.

Stages of Tubercular Lymphadenitis

1- Stage of Lymphadenitis

Common in young adults.

Non tender, discrete, mobile, firm lymph nodes are palpable.

Upper anterior deep cervical nodes are enlarged.

2- Stage of periadenitis

Nodes are matted and move together.

Firm and non-tender.

Matting is pathognomonic of tuberculosis.

3- Stage of cold abscess

It occurs due to caseation necrosis of lymph nodes resulting in fluctuant swelling in the neck. The cold abcess are not warm, not tender, soft, cystic and fluctuant. Swelling is deep to deep fascia.

4- Stage of collar stud abscess

It results when a cold abcess which is deep to deep fascia ruptures through the deep fascia and forms another swelling in subcutaneous plane which is fluctuant.

5- Stage of sinus

It occurs when collar stud abcess ruptures through the skin. It may be multiple. Skin surrounding the sinus shows pigmentation and sometimes bluish in colour.

Treatment for tuberculous lymphadenitis involves administration of anti-tubercular regimens. Surgery is seldom indicated if anti-tuberculous treatment is effective, although limited surgery in conjunction with effective chemotherapy is sometimes appropriate. The emergence of multi-resistant strains of tuberculosis, however, means that once again the

surgeon may have to operate for this condition when no other treatment is effective.

When surgery is undertaken for resistant disease, it must include the excision of all diseased nodes if it is to offer a reasonable chance of eradication of the infection, and healing. This can, however, be a challenging operation when the deep cervical nodes are matted and adherent to the internal jugular vein, the wall of which may form the medial wall of the tuberculous abscess. A dissection similar to the radical neck dissection may be necessary to secure the internal jugular vein above and below the segment of involved vein, which has to be removed en bloc with the specimen. The accessory nerve and the sternocleidomastoid muscle can usually be preserved.

Cold abscess are drained non dependently. Tubercular sinuses are excised along with the tract.

ULTRASONOGRAPHY

Ultrasound has an important role in head and neck imaging. It is does not involve ionising radiation and inexpensive. Fine-needle aspiration cytology (FNAC) or core biopsy can be taken under ultrasound guidance. The superficial nature of the neck structures makes ultrasound assessment easy and reliable.

Ultrasound differentiates pathological nodes (e.g., metastases, lymphoma, tuberculous lymphadenitis) from normal/reactive nodes. Certain criteria are laid down to differentiate benign from malignant nodes. Size of the node measured using minimum axial diameter is the most specific dimension for predicting malignancy. It is recommend a minimum axial diameter of 7 mm for submental/submandibular nodes and 8 mm for other cervical nodes.

Benign nodes tend to have an elliptical shape, while malignant lymph nodes are rounded. In benign nodes hilus is echogenic, which indicates preserved sinusoidal architecture. In malignant nodes, the hilus is absent and they look round.

An enlarged lymph node which is diffusely hypoechoic or pseudocystic is suggestive of lymphoma.

Enlarged lymph nodes with metastatic squamous cell carcinoma deposits have coagulative and cystic necrosis. Cystic degeneration is also seen in tuberculous nodes and papillary thyroid carcinoma metastases. The lymph node metastases from papillary carcinoma have typical small punctate calcifications. The sign is specific and attempt is made to search for primary in thyroid. Ultrasound can show presence of an ill-defined

border or frank invasion of neighbouring structures which in turn indicates poor prognosis.

A colour Doppler can make out the distribution of vessels within a node. Benign nodes have a central hilar flow pattern, whereas malignant nodes have a disorganized peripheral pattern. Necrotic areas are relatively avascular.

These signs aid to arrive at a specific diagnosis. It also helps choose the lymph node for ultrasound-guided FNAC.

CT and MRI

Three-dimensional and multiplanar modeling of the CT data can provide the surgeon with a better appreciation of the anatomy preoperatively, providing a more surgically oriented perspective of the pathology and, in some cases, allowing for production of synthetic prostheses to be prepared preoperatively to fit the patient's anticipated surgical defect. With this information, the head and neck surgeon can have a more informed discussion with the patient regarding potential operative options and prognosis. Staging of nodal disease in the neck traditionally has been based on clinical examination; however, imaging can supplement clinical examination. CT and MRI, uses a threshold size to determine if a node is abnormal. Depending on the reference, this size

varies between 1 and 1.5cm. Morphology of the node is also considered in determining the likelihood of metastasis, including the transverse-to-longitudinal ratio and the attenuation of the node.

Positron Emission Tomography

Positron emission tomography (PET) is a functional nuclear medicine imaging technique. It is used to assess metabolic, biochemical, and physiologic parameters of disease.

Cancer cells differ from normal cells in various biological processes like glucose consumption, amino acid synthesis, DNA synthesis, oxygenation, perfusion, cell membrane synthesis etc. When biological substances involved in these processes are tagged with radiotracers, their change in distribution and localisation in the body becomes valuable. The most commonly used PET radiotracer is $_{18}$F-2-fluoro-2-deoxy-D-glucose (FDG), an analogue of endogenous glucose. Cancer cells have a high mitotic rate, hence their glucose requirement and uptake is high.

In PET-CT, there is a combined evaluation of anatomical and metabolic picture of the imaged region. This proves extremely valuable for diagnosis, staging, estimation of therapeutic response, restaging, and evaluation of recurrence. They are also useful in guiding biopsy,

predicting prognosis, and detecting the nature of indeterminate lesions found by other imaging methods.

PET-CT imaging is very useful in patients with metastatic nodes in neck with unknown primary, when pan-endoscopy and other imaging methods fail to detect primary. Field cancerisation is seen in head and neck cancers. Detection of second primary is also possible with PET-CT imaging.

With these benefits, whole-body PET and PET-CT imaging are frequently used in staging and restaging algorithms of head and neck cancers.

Fine Needle Aspiration cytology

Fine Needle Aspiration cytology (FNAC) is a procedure that involves passing a thin hollow needle through the tissue to be studied, to sample cells for microscopic analysis.

Fine needle aspirations can be performed on palpable swellings or impalpable lesions which are image detected. For impalpable lesions, imaging is done to see the nature of the lesion and localize it. Then if aspiration is warranted, needle is passed under image guidance. Needle is

ensured to be in the lesion before aspiration. Ultrasound is the most frequently used, but CT, PET-CT can also be used.

FNAC can be done on an outpatient basis

The skin over the proposed site of aspiration is cleaned. Needle is passed into the swelling, aspirated, smeared and sent for analysis. The needle used for fine needle aspiration cytology has a gauge of 22 to 25 G. Multiple insertions and aspirations may be required to get adequate sample. The site of aspiration is covered with a small bandage. The patient can continue his normal activities post procedure. Usually there are no complications; but some patients may complain of pain, swelling, or bleeding at the prick site.

Local anaesthesia is usually not required. Time required for the procedure is very less.

Comparing FNAC to other modalities of tissue sampling it is

- non-invasive
- no anaesthesia
- less painful
- no scarring
- shorter recovery time
- minimal complications

- quicker method
- repeatable

The risks of FNAC include the theoretic possibility of cancer cells being trailed into unaffected tissue as the needle is removed. FNAC samples only a small number of cells from a swelling, there is a risk of missing abnormal cells. This is very important in cystic neoplasms and micro metastatic nodes. Image guided FNAC reduces these errors.

Skills required to perform a good FNAC are

- Familiarity with general anatomy
- Good knowledge in normal cellular elements from various organs and tissue and how they appear on smears
- Comprehensive knowledge of surgical pathology
- Ability to translate traditional tissue patterns of lesions to their appearance in smears

    - **Adjuvant tools for better diagnosis**

- Cell blocks
- Histochemistry
- Immunohistochemistry
- Electron microscopy

- Flow cytometry
- Immuno electron microscopy
- Molecular pathology -In situ hybridization, PCR etc

Diagnostic Lymph Node Biopsy

Patient is positioned in supine position with head turned away from the side on which the biopsy is to be performed. The region of the proposed incision is infilterated with local anaesthesia. A transverse incision is made over the palpable node selected for biopsy. The incision is deepened through the platysma, retracting the sternocleidomastoid muscle to expose the node. Node is dissected intact with minimal trauma. As dissection progresses, the hilum of the lymph node containing a small artery and vein is identified. Hilum is clamped and ligated.

If a matted group of nodes, extending much farther proximally and distally than previously expected, an adequate portion of the accessible surface of the mass is removed rather than attempting complete removal. In case of matted but still lobulated mass, attempt is made to shell out an entire node. Hemostasis achieved in the residual nodal mass by electrocautary or suture ligature. The incision is closed in layers with fine

interrupted sutures. The lymph node specimen is sent fresh to the laboratory.

Deeper nodes are excised in general anaesthesia and with a protected airway. Care is taken not to damage the internal jugular vein; if need be its anterior tributaries such as facial and thyroid veins, may have to be ligated and divided.

Supraclavicular nodes are often deceptive, and found at operation to be deeper than initially suspected. They may merely be the only accessible part of a huge mass of matted mediastinal nodes, which are compressing the trachea and distorting the anatomy of the great vessels at the root of the neck. The surgeon should dissect with caution in optimum surgical and anaesthetic conditions. Tracheal compression in the superior mediastinum can make a general anaesthetic hazardous, but this is also a hazardous area for a surgeon to operate under local anaesthesia.

NECK DISSECTIONS

A neck dissection is an operation that is done for individuals with cancer of the head and neck to remove the lymph nodes in the neck.

Classification of Neck Dissections

Academy's Committee for Head and Neck Surgery and Oncology publicized standard classification system in 1991

Academy's classification is based on 4 concepts

1) RND is the standard basic procedure for cervical lymphadenectomy against which all other modifications are compared

2) Modifications of the RND which include preservation of any non-lymphatic structures are referred to as modified radical neck dissection (MRND)

3) Any neck dissection that preserves one or more groups or levels of lymph nodes is referred to as a selective neck dissection (SND)

4) An extended neck dissection refers to the removal of additional lymph node groups or non-lymphatic structures relative to the RND

Academy's classification

1) Radical neck dissection (RND)

2) Modified radical neck dissection (MRND)

3) Selective neck dissection (SND)

- Supra-omohyoid type
- Lateral type
- Posterolateral type
- Anterior compartment type

4) Extended radical neck dissection

Radical Neck Dissection (RND)

All lymph nodes in Levels I-V including spinal accessory nerve , sternocleidomastoid muscle, and internal jugular vein are excised.

Indications

Extensive cervical involvement or matted lymph nodes with gross extracapsular spread and invasion into the spinal accessory nerve, sternocleidomastoid muscle, or the internal jugular vein.

Modified Radical Neck Dissection (MRND)

Excision of same lymph node bearing regions as RND with preservation of one or more nonlymphatic structures (spinal accessory nerve, sternocleidomastoid muscle, internal jugular vein).

MRND is analogous to the "functional neck dissection" described by Bocca.

Three types of Modified Radical Neck Dissection (Medina 1989) are commonly referred

• Type I: Preservation of spinal accessory nerve

• Type II: Preservation of spinal accessory nerve and internal jugular vein

• Type III: Preservation of spinal accessory nerve, internal jugular vein, and sternocleidomastoid muscle.

MRND Type I

Indications

- Clinically obvious lymph node metastases
- Sternocleidomastoid muscle not involved by tumor
- Intraoperative decision

MRND Type II

Indications

- Rarely planned
- Intraoperative tumor found adherent to the sternocleidomastoid, but not internal jugular vein and spinal accessory nerve

MRND Type III

- Widely accepted.
- Neck dissection of choice for N0 neck

Advantages of Modified Radical Neck Dissection

– Reduce postsurgical shoulder pain and shoulder dysfunction

– Improve cosmetic outcome

– Reduce likelihood of bilateral IJV resection in cases were contralateral neck is also involved.

Selective Neck Dissections

Selective Neck Dissection is cervical lymphadenectomy with preservation of one or more lymph node groups. Lymphatic spread from mucosal surfaces of the head and neck tumors have predictable routes. The rate of occult metastasis in clinically negative neck is 20-30%.

Indications

- Primary lesion with 20% or greater risk of occult metastasis
- May elect to upgrade neck intraoperatively.
- Frozen section is needed to confirm in suspicious node.
- Need for post-op radiotherapy is high.

– Four common subtypes:

• Supraomohyoid neck dissection

• Posterolateral neck dissection

• Lateral neck dissection

• Anterior neck dissection

Supraomohyoid neck dissection

Supraomohyoid neck dissection is the most commonly performed SND. Expectant management of oral carcinoma with N0 neck is not advocated.

Oral cavity carcinomas rarely involve Level IV and V.

With this rationale supraomohyoid neck dissection involves en bloc removal of cervical lymph node groups I-III. The posterior limit is the cervical plexus and posterior border of the sternocleidomastoid. Inferior limit is the omohyoid muscle overlying the internal jugular vein.

Indications

Oral cavity carcinoma with N0 neck (T2-T4NO)

Unknown primary with palpable node <3cm, mobile, and in levels I or II (TXN1)

Adjuvant RT is given to patients with > 2- 4 positive nodes with or without extracapsular spread.

Lateral neck dissection

Lateral neck dissection involves en bloc removal of the jugular lymph nodes including Levels II-IV.

Indications

N0 neck in carcinomas of the oropharynx, hypopharynx, supraglottis, and larynxas occult metastases is seen 30-35%.

Bilateral dissection is often indicated in the majority of hypopharyngeal tumors because of extensive submucosal spread and involvement of multiple subsites.

Posterolateral neck dissection

Posterolateral neck dissection involves en bloc excision of lymph bearing tissues in Levels II-IV and additionally–suboccipital and postauricular node groups

Indications

– Cutaneous malignancies

- Melanoma
- Squamous cell carcinoma
- Merkel cell carcinoma

– Soft tissue sarcomas of the scalp and neck.

Anterior Compartment neck dissection

Anterior Compartment neck dissection involves en bloc removal of lymph structures in Level VI

- Perithyroidal nodes

- Pretracheal nodes
- Precricoid nodes (Delphian)
- Paratracheal nodes along recurrent nerves

The limits of the dissection are the hyoid bone, suprasternal notch and carotid sheaths.

Indications

– Selected cases of thyroid carcinoma

– Parathyroid carcinoma

– Subglottic carcinoma

– Laryngeal carcinoma with subglottic extension

– Carcinoma of the cervical oesophagus.

Extended Neck Dissection

Extended Neck Dissection is any dissection which includes removal of one or more additional lymph node groups and/or non-lymphatic structures.

It is usually performed with N+ necks in MRND or RND when metastases invade structures usually preserved.

Indications

– Carotid artery invasion

– Other examples:

- Resection of the hypoglossal nerve resection or digastric muscle

• Dissection of mediastinal nodes and central compartment for subglottic involvement

• Removal of retropharyngeal lymph nodes for tumors originating in the pharyngeal walls.

NECK DISSECTION

The incisions for any form of radical neck dissection must be planned to afford good access and to leave inconspicuous scars. In addition, skin viability must be preserved, as carotid artery exposed by skin breakdown has a risk of rupture. The blood supply of the skin of the lateral neck comes from all directions, with a resultant relatively poorly vascularized central area directly over the common carotid artery. Vertical incisions and three point junctions in this central area should therefore be avoided.

The skin flaps are elevated to include the platysma. In the submandibular area, in order to preserve the marginal mandibular branch of the facial nerve, the nerve is formally identified. If this is difficult, the flaps should be elevated by dissection in a deeper plane. This plane is on the body of the submandibular gland and the fascia over the gland is included in the flap.

Inferiorly the sternal and clavicular heads of sternocleidomastoid are divided to expose the carotid sheath. The internal jugular vein is

isolated by dissection around it, and the vagus nerve, lying in a deep plane between the vein and the common carotid artery, is identified and preserved. The vein is then divided between ligatures. On the left, the thoracic duct is commonly divided at this point and will require oversewing to prevent leakage. The dissection is continued laterally, above the prevertebral fascia, to the anterior border of trapezius, elevating the fat pad overlying the scalene muscles and dividing the inferior belly of the omohyoid muscle which is included in the specimen. The external jugular vein and supraclavicular cutaneous nerves must also be divided. The transverse cervical vessels lie between the fat pad and the prevertebral fascia and should, if possible, be preserved. Underneath the prevertebral fascia the phrenic nerve runs medially and downwards on scalenus anterior. It is identified and preserved. The trunks of the brachial plexus are also beneath this fascia.

Posteriorly the limit of dissection is trapezius, and the dissection is continued up along its anterior border. The transverse cervical artery gives a vertical branch which runs up the anterior border of trapezius and requires formal ligation and division. The accessory nerve is divided in the classical radical dissection as it enters the muscle, but is preserved in all modified neck dissections. The upper third of the trapezius approaches the posterior border of the sternocleidomastoid muscle, the fibres of which are divided close to their mastoid insertion.

Anteriorly the superior belly of the omohyoid muscle forms the boundary of the dissection and is followed to its insertion into the hyoid bone and divided. The submental fat pad is dissected off until the anterior bellies of both digastric muscles are identified.

The *deep dissection* is commenced by reflecting forwards the posterior margin of the dissection and releasing the fat pad, with the nodes, off the prevertebral fascia and the underlying muscles, the levator scapulae and the scalenes. It is tethered down by the three cutaneous branches of the cervical plexus, namely the anterior cutaneous nerve of the neck, the great auricular nerve and the lesser occipital nerve. These nerves are identified and divided well away from the phrenic nerve. The internal jugular vein is dissected out of the carotid sheath up to the jugular foramen. The transverse process of the atlas is palpated and, just above this, the posterior belly of digastric will be found.This is retracted upwards, and the upper end of the jugular vein exposed where it is again divided between ligatures, with care being taken to preserve the vagus nerve. The hypoglossal nerve can be seen crossing lateral to the external carotid artery, and is in turn crossed by three small veins draining from the tissue to be excised. These vessels must be ligated and divided or they will tear, and attempts to stop the bleeding will endanger the hypoglossal nerve. The remaining sternocleidomastoid fibres are divided at the level of a line extending from the tip of the mastoid process to the angle of the

jaw. A higher division places the facial nerve at risk, as it lies deep to the anterior border of the muscle.

Superiorly the submental fat pad, and the anterior edge of the submandibular gland, are dissected off the lateral surface of the mylohyoid muscle. The submental artery will require ligation and division. The posterior edge of mylohyoid is then retracted forwards, and the gland retracted inferiorly, to expose the lingual nerve which is freed and preserved. The submandibular duct is ligated. The facial vessels are ligated at the upper border of the gland, and the facial artery again at the inferior border.

COMPLICATIONS

Immediate complications include haemorrhage and pneumothorax, and raised intracranial pressure from compromised venous drainage. Necrosis of skin flaps, with exposure of the carotid artery, is a serious intermediate-term complication which requires further surgery at the earliest opportunity to cover the vulnerable vessel. A chylous fistula from injury to the thoracic duct is initially treated conservatively but occasionally may require surgical intervention. Late complications include a frozen shoulder, in addition to the inevitable loss of function if the accessory nerve has been sacrificed.

IV – MATERIALS AND METHODS

The study was conducted on 100 selected patients with cervical lymphadenopathy who presented to the General Surgical Department with cervical lymphadenopathy. Patients' informed written consent was taken. The patients were examined clinically after taking a detailed history. Nodes enlarged were classified according to Memorial Sloan-Kettering Cancer Centre leveling system of cervical lymph nodes. The number of nodes, their size, consistency and presence of periadenitis was noted at each level. Histories of any form of previous treatment to the nodes like radiotherapy, chemotherapy were excluded from the study. Terminally ill patients were also excluded.

Blood investigations and radiological investigations were made. Ultrasonography of the neck and CT scan were made wherever necessary. A pre FNAC clinical diagnosis was arrived. Patients requiring surgical biopsy either in the form of node biopsy or neck dissection were included in study.

A Fine Needle Aspiration Cytology was done.

The equipments used for FNAC

1. Spirit soaked cotton swab
2. 10 ml disposable syringe
3. 22 G disposable needle
4. 5 Glass slides

5. Jar with ether-alcohol fixative

PROCEDURE

Patient was made to lie on a table. The node was localized and skin prepared with a spirit swab. No local anaesthesia was used. About 5 ml of air was aspirated into the syringe before the introduction of the needle into the mass which was held between the finger and thumb of the other hand. This is to obtain a uniform distribution of aspiration material on the glass slide. The needle was introduced into the node. Once the node was entered the syringe was pulled to full suction and the needle advanced 3 to 5 times to various foci within the node. With the continued suction, till fluid or cellular material was seen to enter the hub of the needle. Care was taken to ensure that the material was not aspirated into the syringe. Thereafter the plunger was released and the fall in suction allows it to return to the 5ml mark. This prevents the forceful dispersion of the aspirate into the cylinder of the syringe while the needle is being withdrawn. Following removal of the aspirated needle, gentle pressure was applied to the aspirated site for 1 – 2 minutes to prevent hematoma formation.

The needle contents were then expressed to glass slides by touching the needle to surface to prevent air-drying and a smear was made in a manner similar to that for a blood film. At least 5 smears were

made, one was air dried and the others were immediately placed in the ether-alcohol fixative. The smears were stained with Eosin-Hematoxylin.

Hypocellular slides were excluded from the study. A repeat FNAC was allowed. The cytopathologist was final in deciding adequacy of yield of FNAC. Ultrasound guided FNAC was done were ever necessary to get adequate yield.

Patient was subjected to excision biopsy from the same node in cases with diagnosis of non-metastatic nodes. Patients diagnosed of secondaries in the nodes were subjected to appropriate composite resection with neck dissection.

Post-surgical excision the same node was subjected to histopathological examination.

The cytopathological diagnoses were compared with the histopathological results of the same excised nodes. Diagnostic sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) was calculated.

V – RESULTS AND ANALYSIS

A total of 100 patients were examined, subjected to FNAC of cervical lymph nodes and histopathological study. Patients with acute presentation of lymphadenopathy and diagnosed as non-specific lymphadenitis with or without FNAC correlation were excluded from

study. They were treated with antibiotics and followed up in the outpatient department. The size of the nodes, which were, sampled range from 1 – 6 cm. No complication due to cytology occurred in the series. All inadequate and inconclusive aspirations were repeated.

METASTATIC LYMPHADENOPATHY

Of the 59 patients who had a known primary, 58 patients had nodal metastasis in their exact nodal levels. Only one patient with carcinoma of tongue had skip metastasis. Level 2 nodes were the most common nodes involved.

FNAC done on 60 patients with metastatic nodes, all the cases showed positivity. The diagnostic accuracy was 100%. The type was not specified in 6 smears and only a diagnosis of positive for malignant cells was given. There was one case of papillary carcinoma of thyroid were aspirate was cystic, which on further aspiration with ultrasound guidance was positive.

LYMPHOMA

There was no definitive nodal pattern of involvement.

Of the 12 cases of lymphoma confirmed by histopathology, 11 cases were reported lymphoma. Of this 6 cases were just reported as lymphoproliferative disorder needing further biopsy correlation.

The overall diagnostic accuracy was 91%

TUBERCULOSIS

Of the 18 cases identified by histopathology correlation with FNAC was obtained in 16 cases. The diagnostic accuracy was 88%. In 2 cases a non-specific diagnosis of granulomatous adenitis was reported. Among the false negatives where a clinical suspicion was entertained (supplemented with positive Mantoux and history of exposure), two were reported as chronic non-specific adenitis.

REACTIVE NODES

Another 10 patients who had chronic lymphadenitis, cytologically reported as reactive nodes were subjected to biopsy and the study correlated in all of them.

FNAC RESULT IN CERVICAL LYMPHADENITIS

	DISEASE Positive	DISEASE Negative
FNAC positive	87	0
FNAC negative	3	10

Specificity – 100%

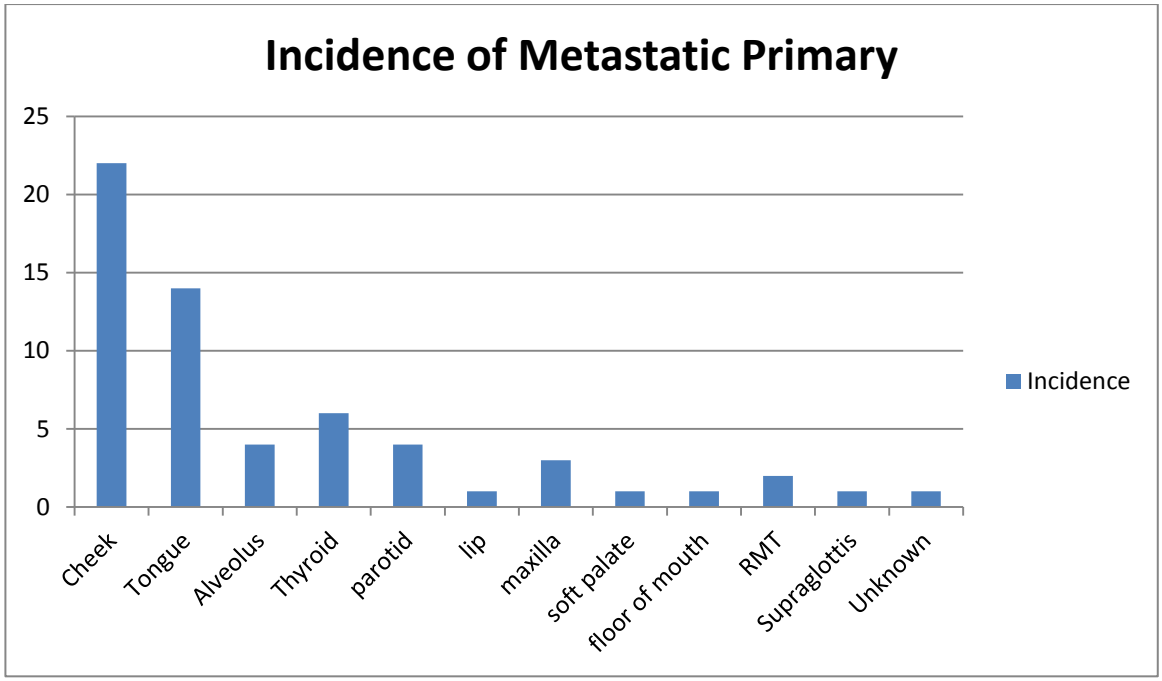
Sensitivity- 96.66%

Positive Predictive Value – 100%

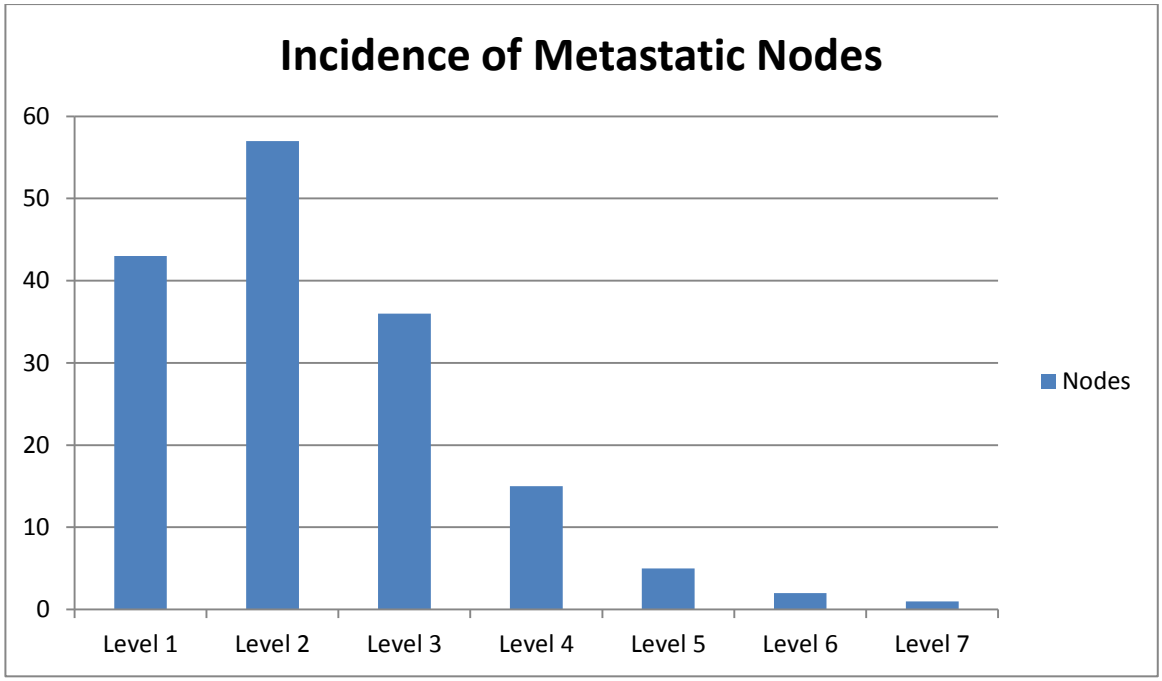
Negative Predictive Value – 76.92%

Overall, FNAC had a very high specificity and positive predictive value.

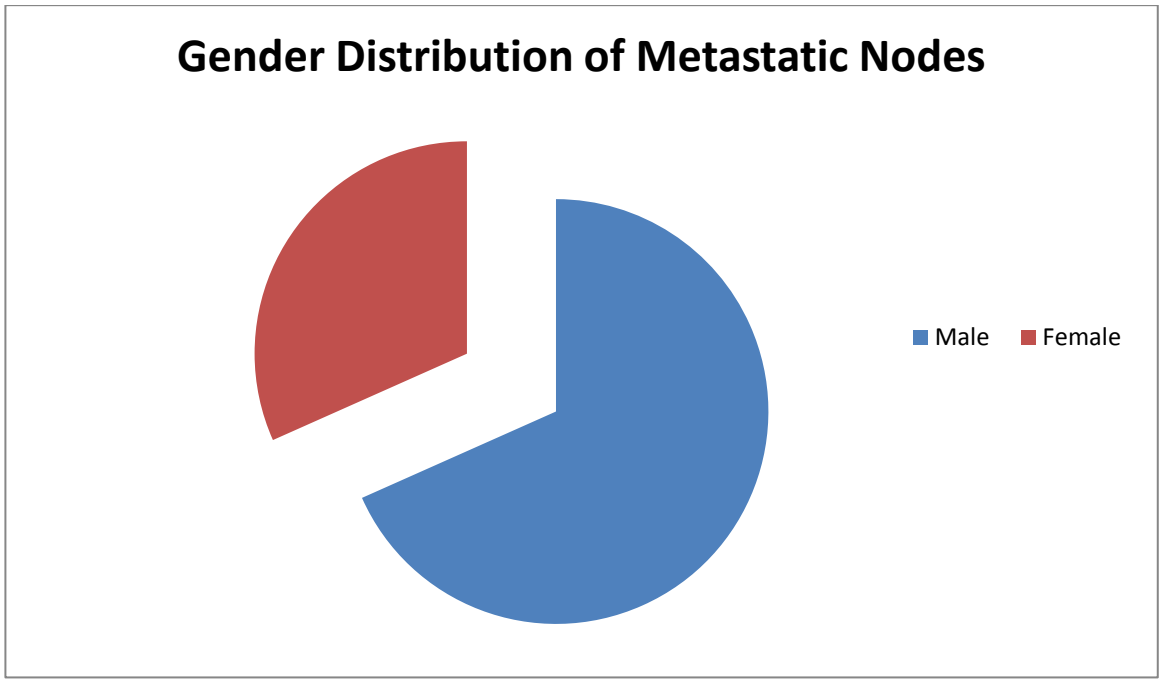
A positive FNAC is very significant. A negative FNAC may not rule out the disease.



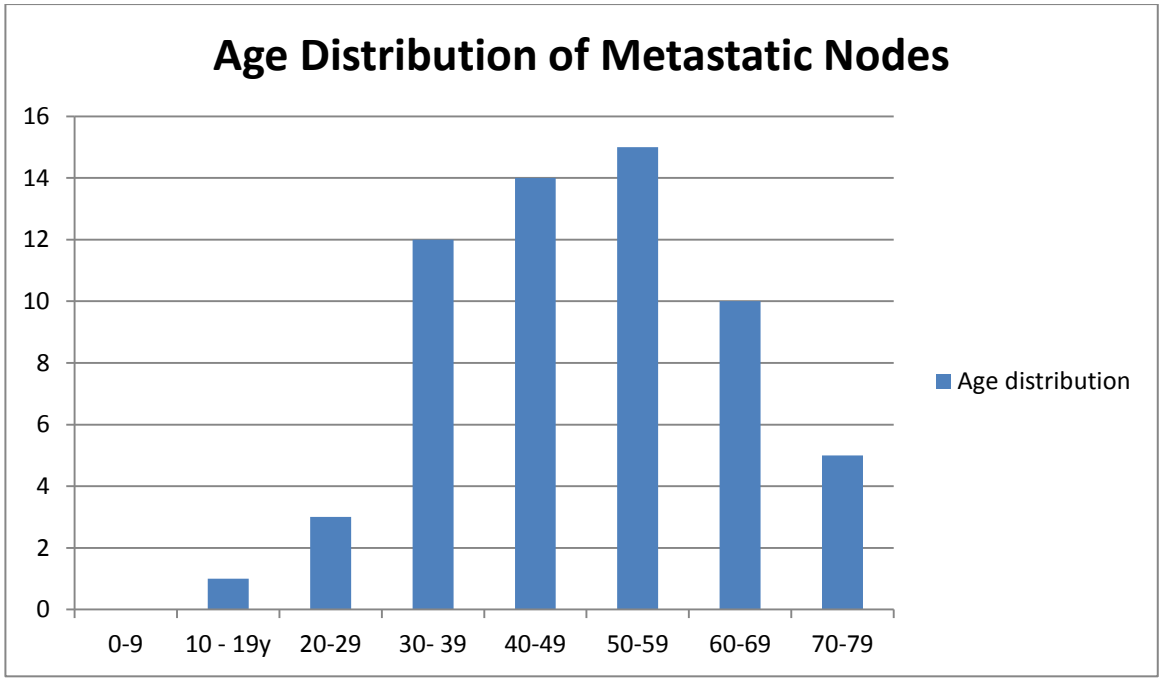
Incidence of Metastatic Primary	
Cheek	22
Tongue	14
Alveolus	4
Thyroid	6
Parotid	4
Lip	1
Maxilla	3
Soft Palate	1
Floor Of Mouth	1
Retromolar trigone	2
Supraglottis	1
Unknown	1
TOTAL	60



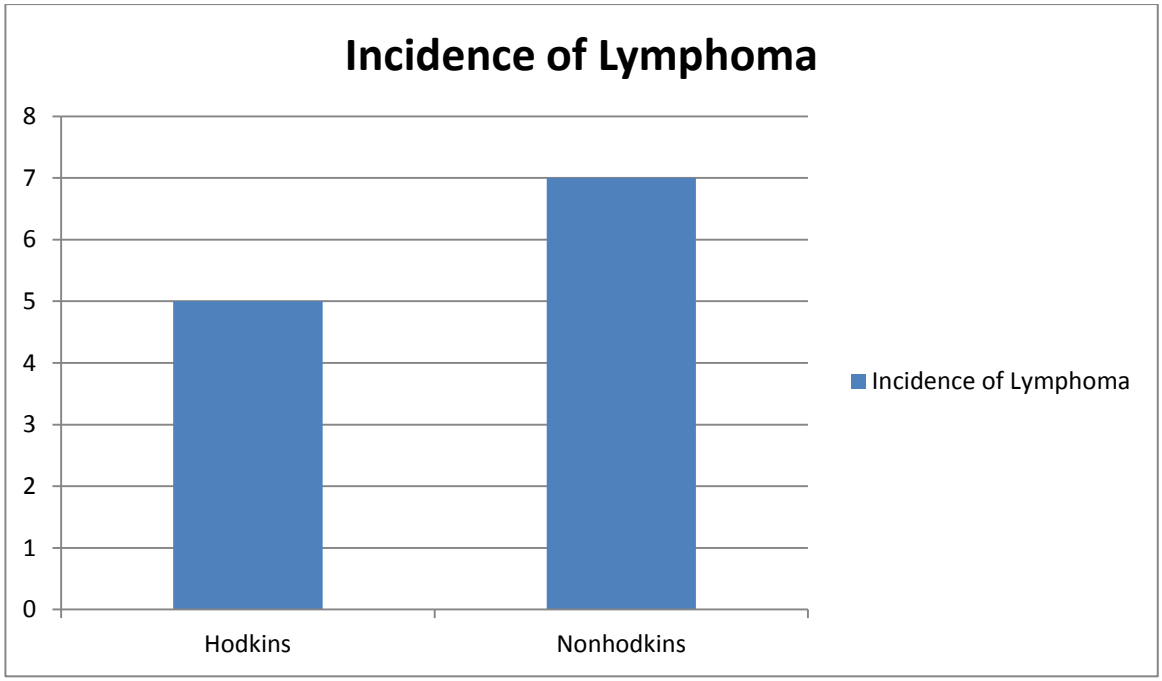
Incidence of Metastatic Nodes	
Level 1	43
Level 2	57
Level 3	36
Level 4	15
Level 5	5
Level 6	2
Level 7	1



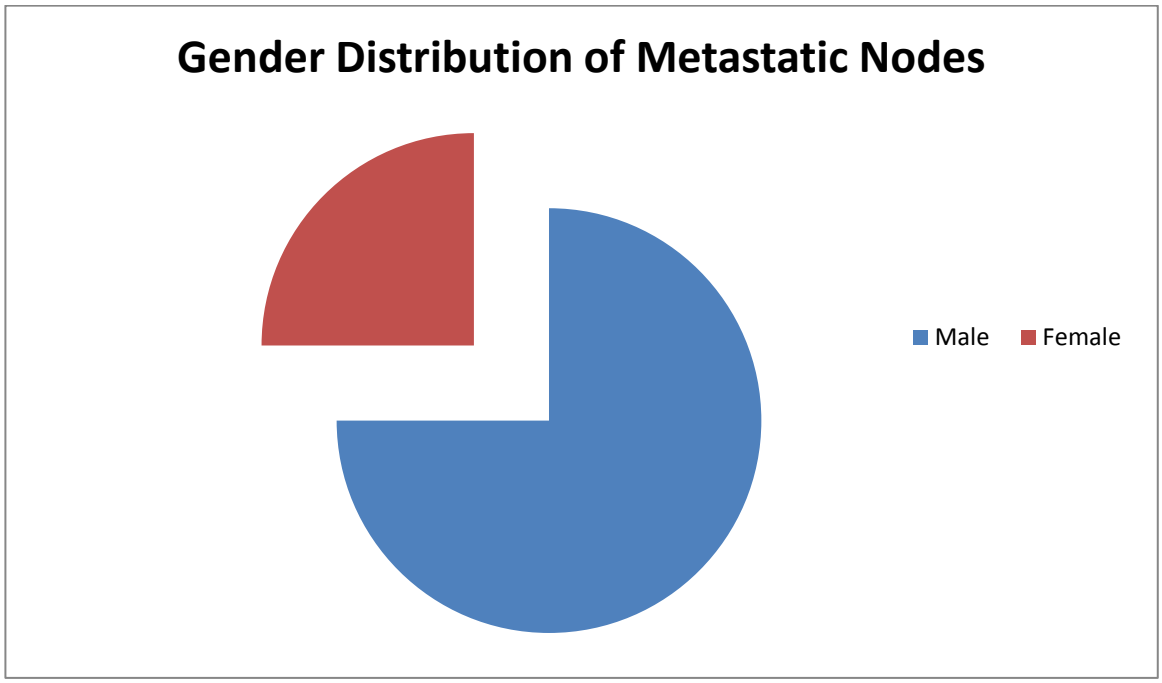
Gender Distribution of Metastatic Nodes	
Male	41
Female	19



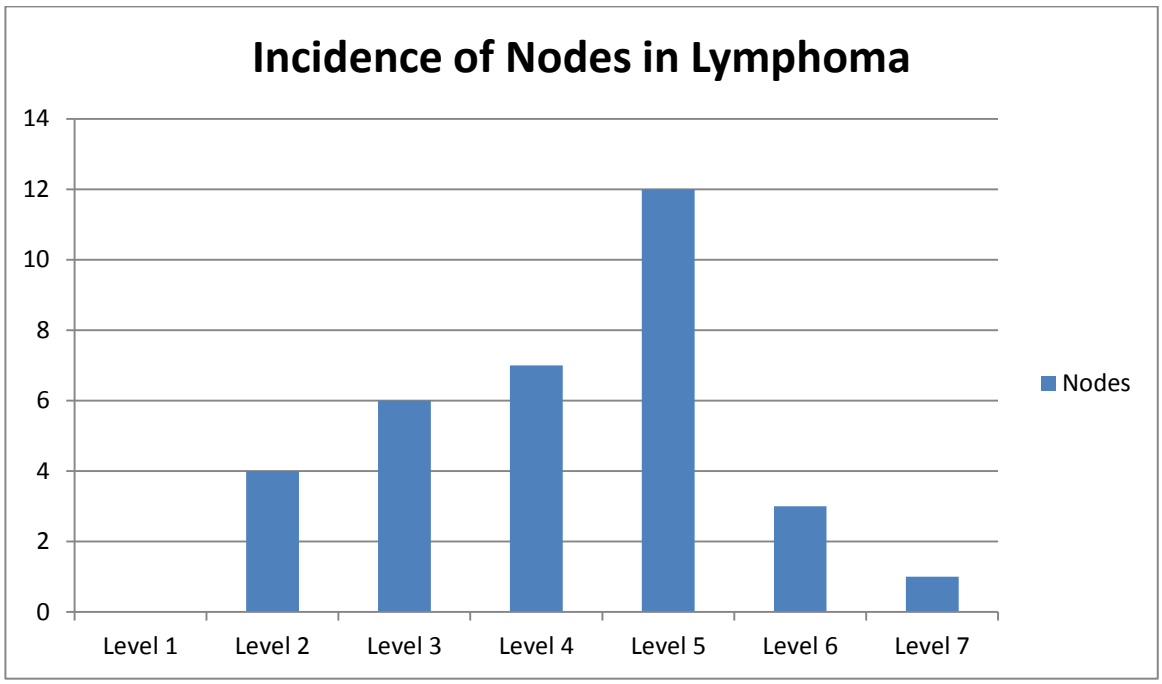
Age Distribution of Metastatic Nodes	
0-9	-
10 - 19y	1
20-29	3
30- 39	12
40-49	14
50-59	15
60-69	10
70-79	5
TOTAL	60



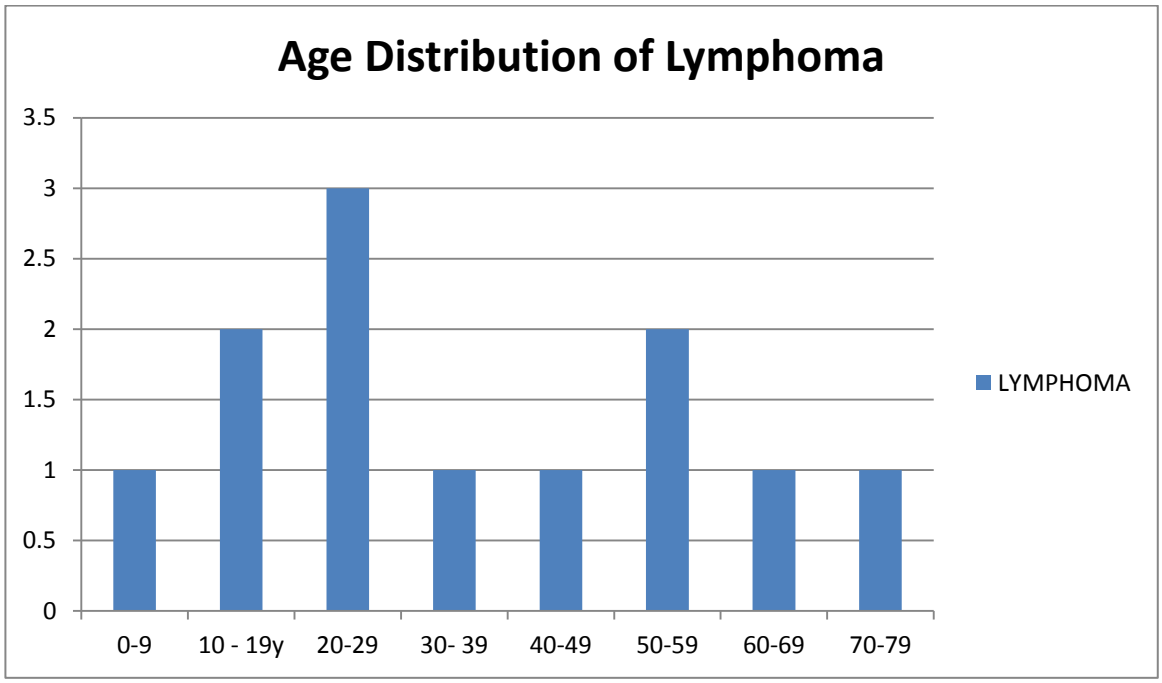
Incidence of Lymphoma	
Hodkins	5
Nonhodkins	7



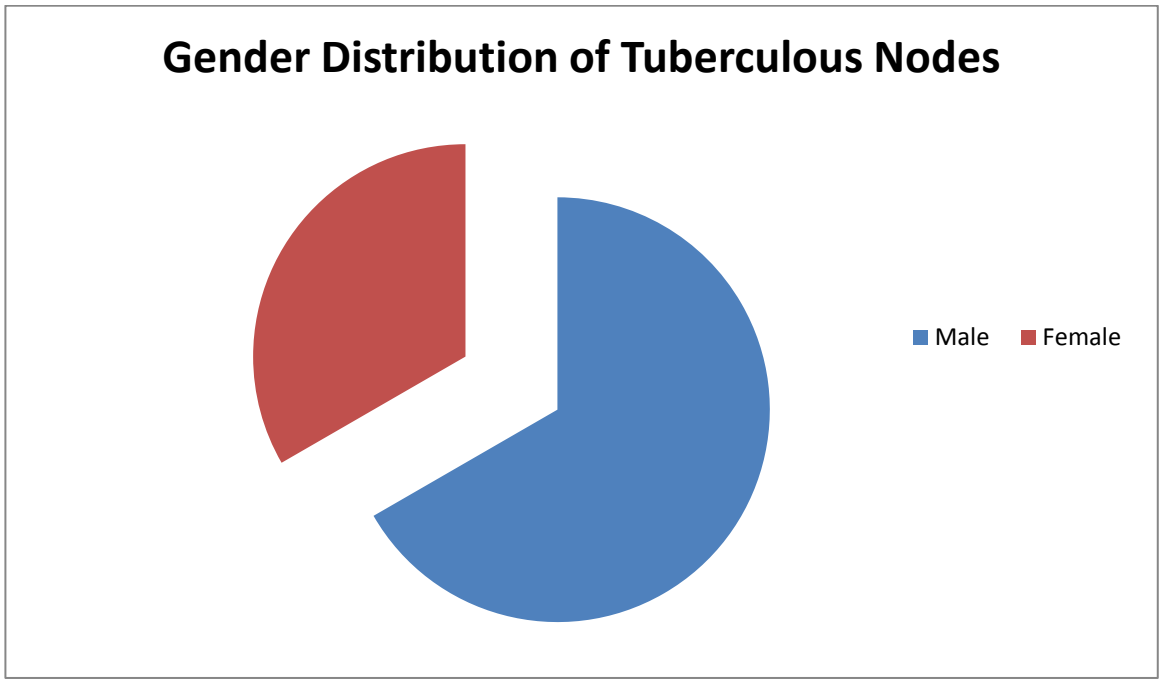
Gender	
Male	9
Female	3



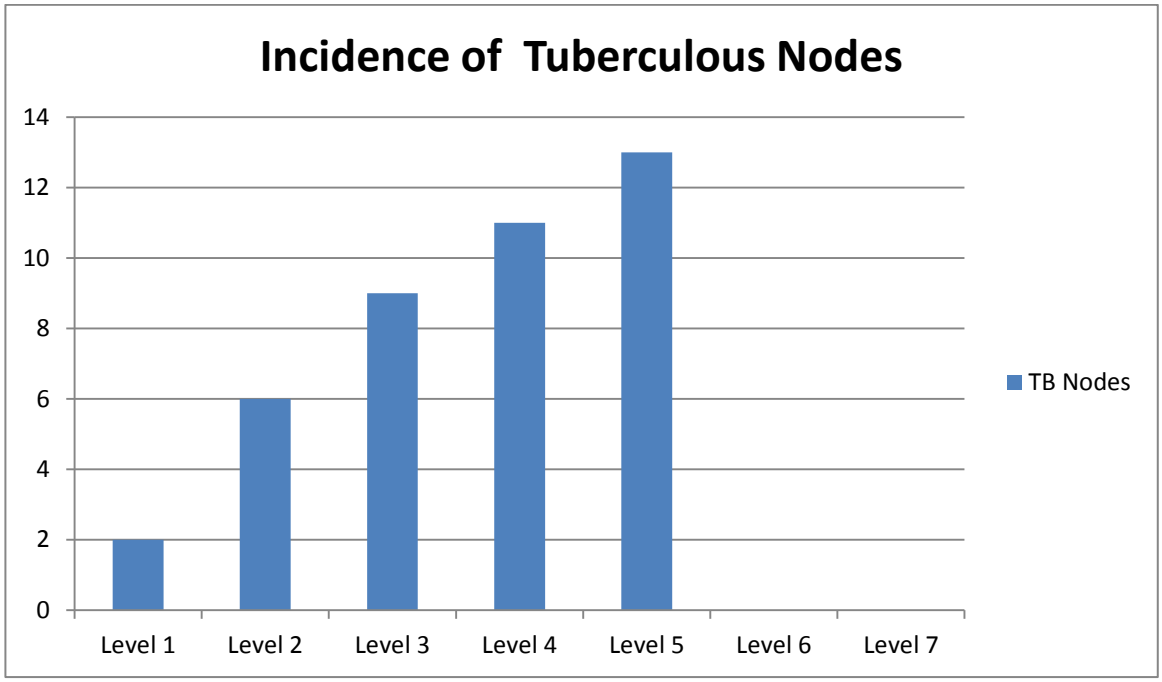
Incidence of Nodes in Lymphoma	
Level 1	-
Level 2	4
Level 3	6
Level 4	7
Level 5	12
Level 6	3
Level 7	1



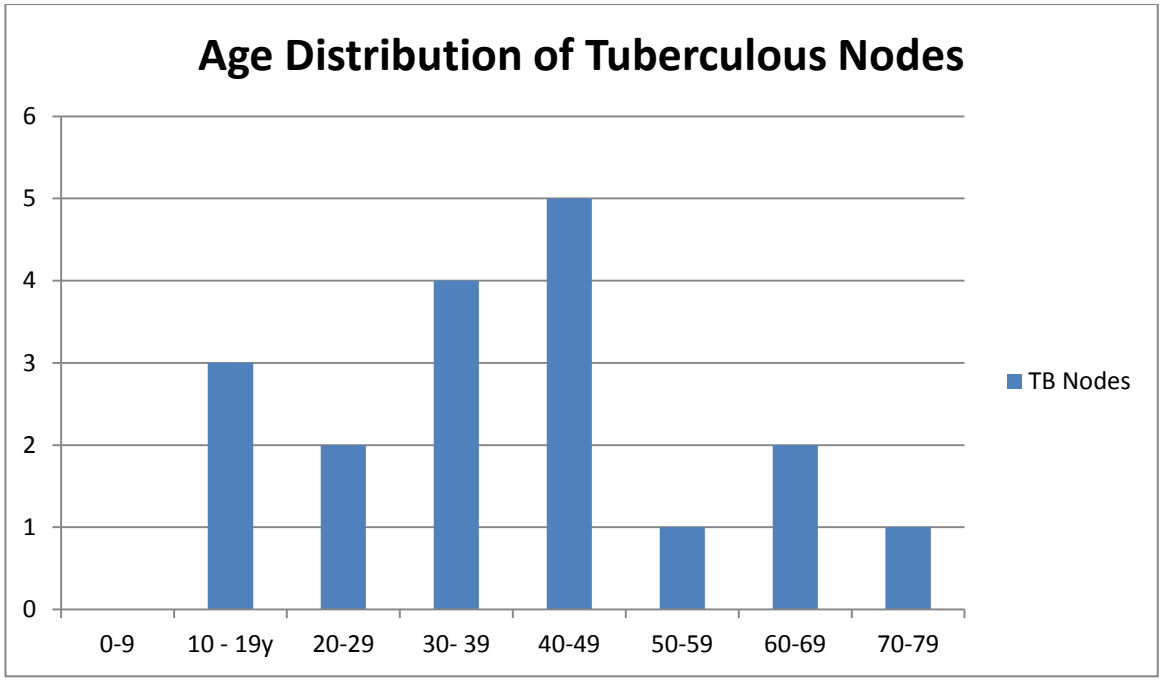
Age Distribution of Lymphoma	
0-9	1
10 - 19y	2
20-29	3
30- 39	1
40-49	1
50-59	2
60-69	1
70-79	1
Total	12



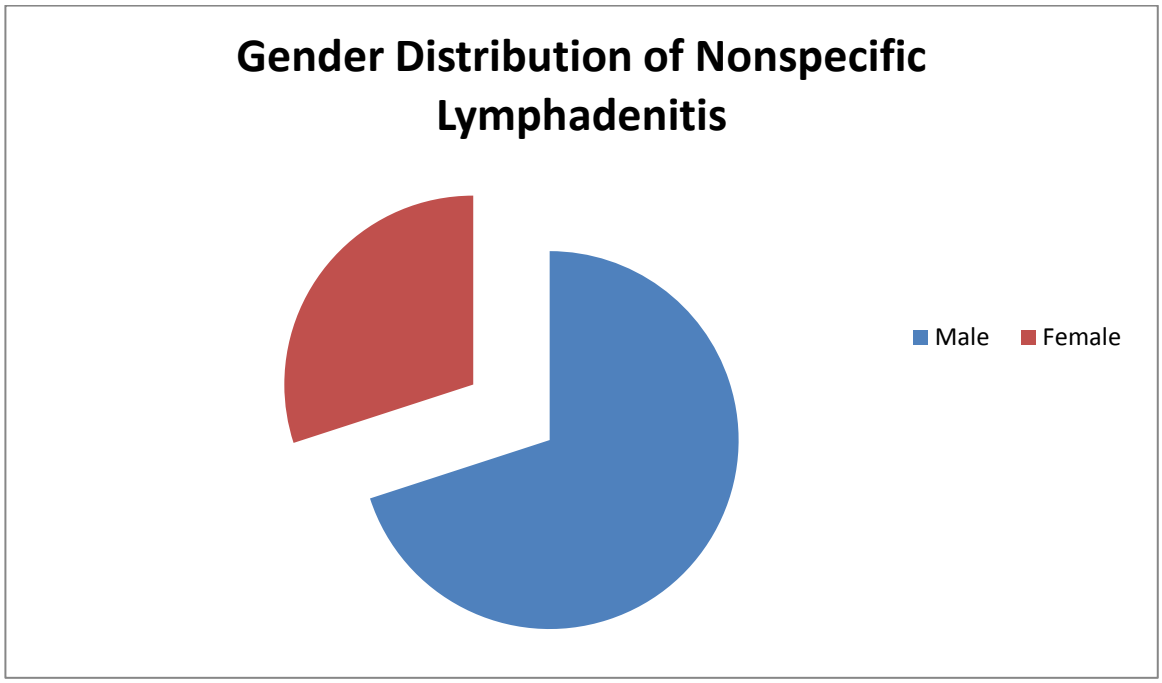
Gender	
Male	12
Female	6



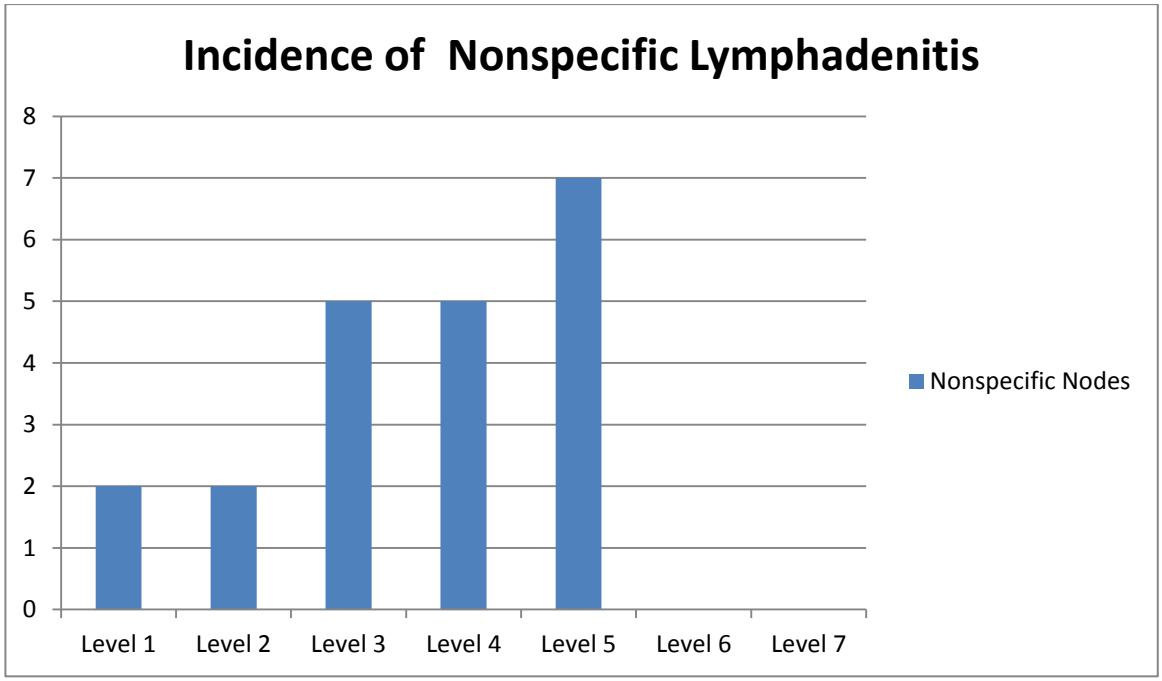
Incidence of Tuberculous Nodes	
Level 1	2
Level 2	6
Level 3	9
Level 4	11
Level 5	13
Level 6	-
Level 7	-



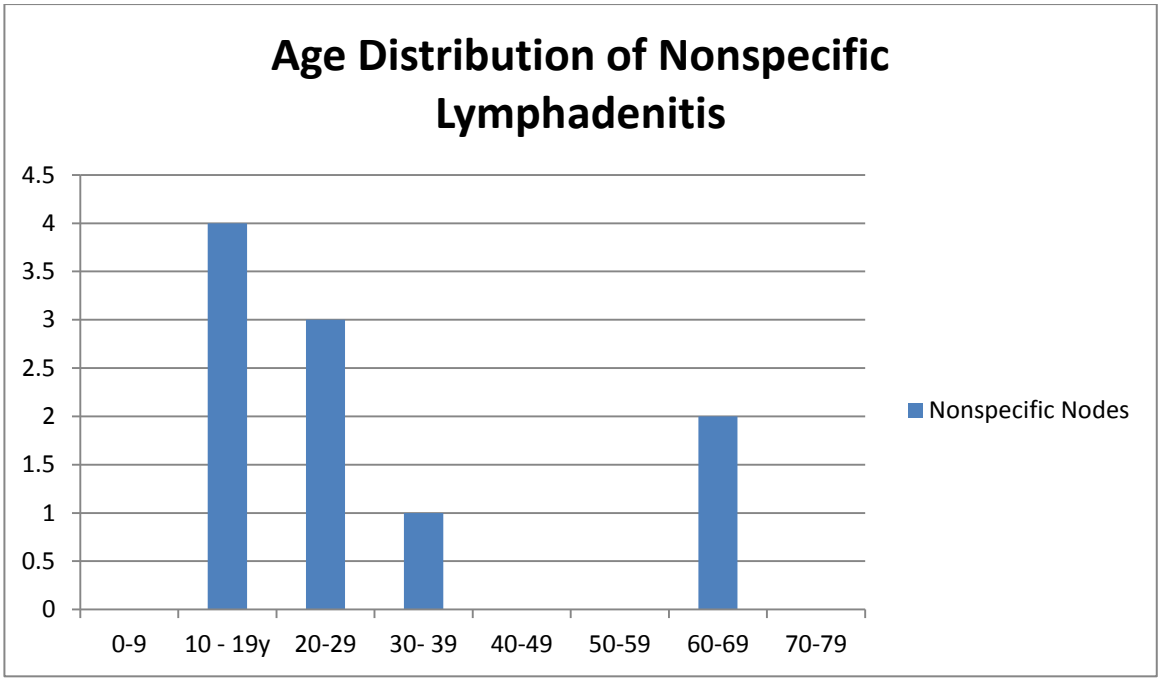
Age Distribution of Tuberculous Nodes	
0-9	-
10 - 19y	3
20-29	2
30- 39	4
40-49	5
50-59	1
60-69	2
70-79	1
Total	18



Gender Distribution of Nonspecific Lymphadenitis	
Male	7
Female	3



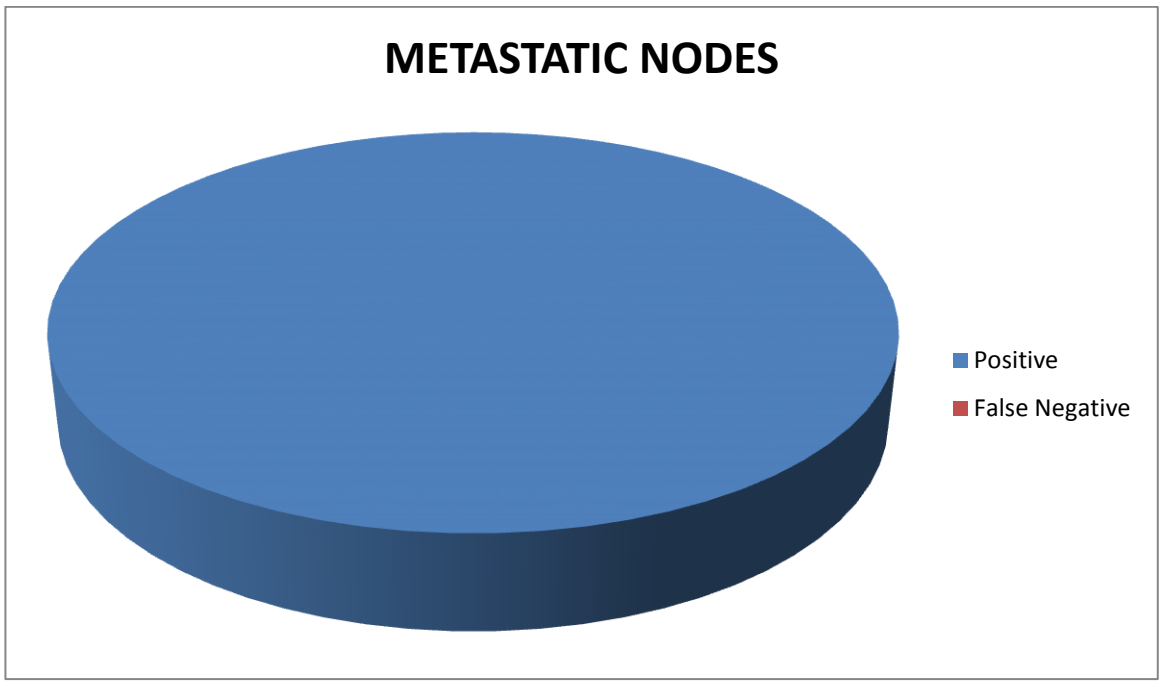
Incidence of Nonspecific Lymphadenitis	
Level 1	2
Level 2	2
Level 3	5
Level 4	5
Level 5	7
Level 6	-
Level 7	-



Age Distribution of Nonspecific Lymphadenitis	
0-9	-
10 - 19y	4
20-29	3
30- 39	1
40-49	-
50-59	-
60-69	2
70-79	-
Total	10

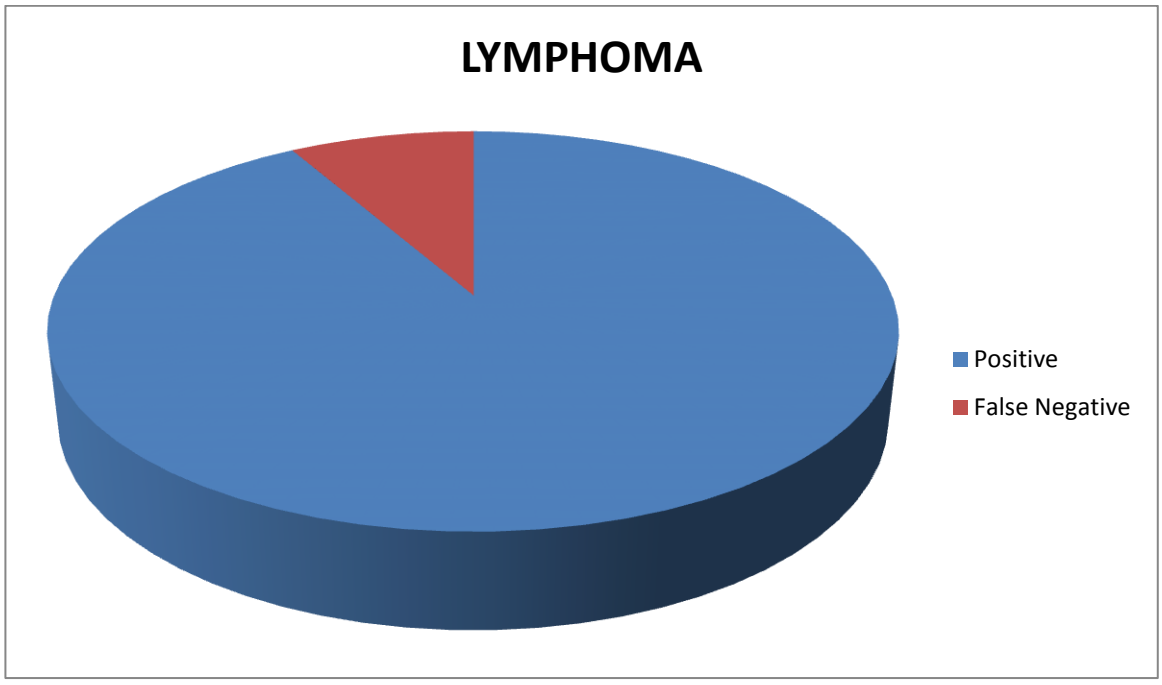
FNAC RESULT IN METASTATIC LYMPHADENOPATHY

FNAC positive	Histopathology positive
60	60



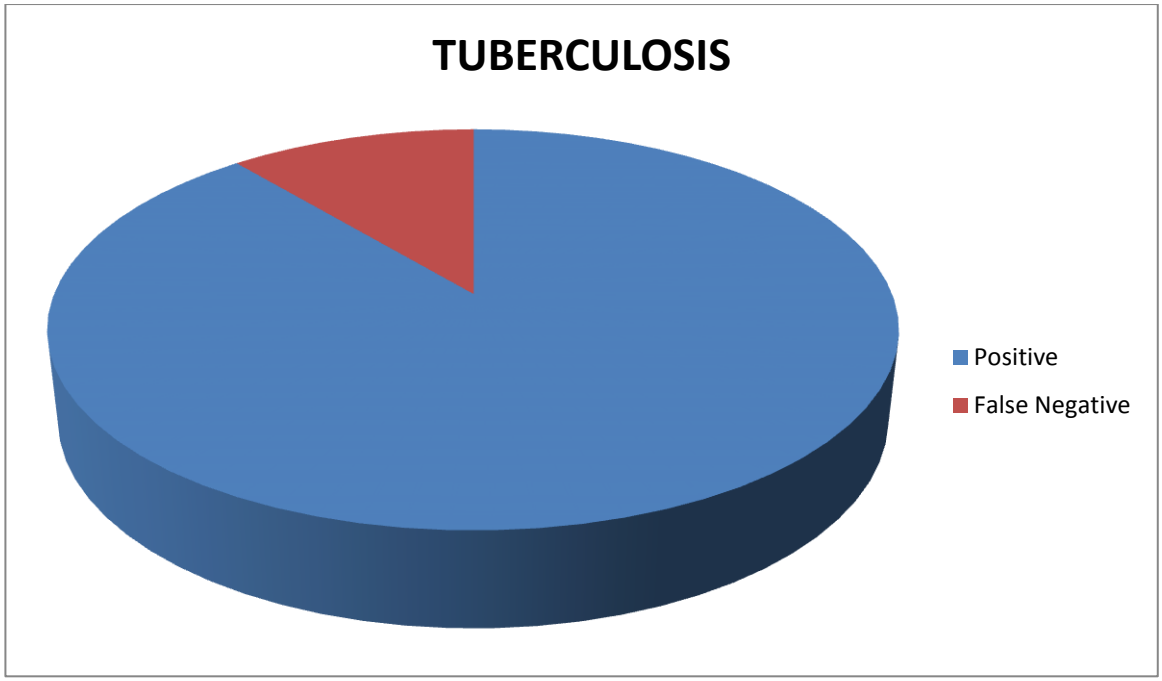
FNAC RESULT IN LYMPHOMA

FNAC positive	Histopathology positive
11	12



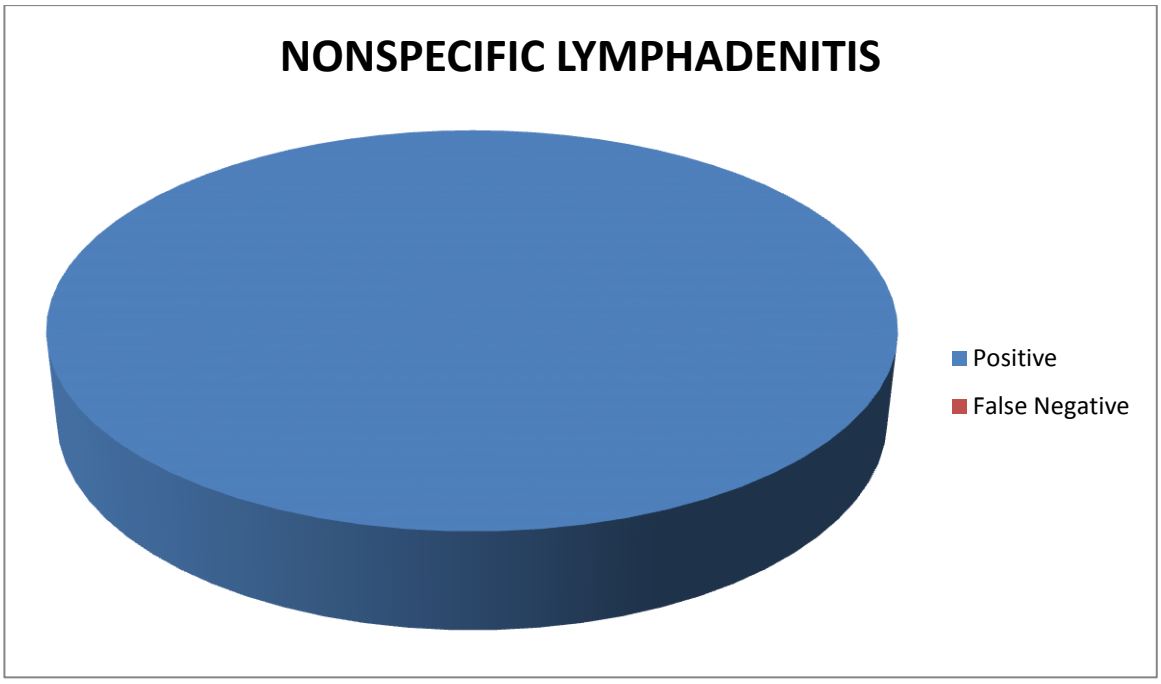
FNAC RESULT IN TUBERCULOSIS

FNAC positive	Histopathology positive
16	18



FNAC RESULT IN NONSPECIFIC LYMPHADENITIS

FNAC positive	Histopathology positive
10	10



VI – CONCLUSION

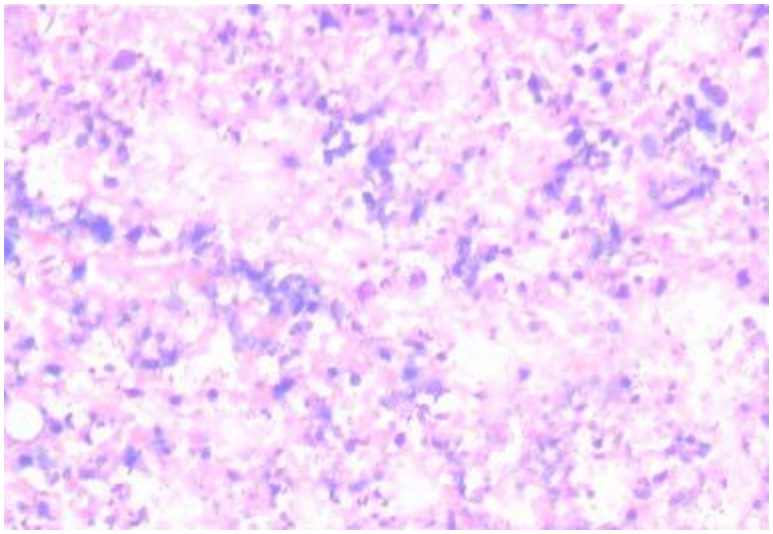
Cervical lymphadenopathy can be due to varying causes. The diagnosis of which involves clinical examination, imaging and pathological correlation. The fact that secondaries from head and neck primary, follows definitive patterns of nodal spread proves very valuable.

Cytology forms one of the most important investigations in the initial evaluation of cervical lymphadenopathy. Early confirmation of the disease facilitates institution of immediate treatment. In case of discordance between clinical and cytological findings, FNAC is always repeatable. Further a positive cytology is always significant. A negative result does not rule out the disease and may require further evaluation. A good cytological study requires a good communication between an experienced cytologist and treating surgeon. This study demonstrates that fine needle aspiration is a safe, accurate and valuable tool in the evaluation of cervical lymphadenopathy. It helps in planning surgery for malignant cases, where definitive operative intervention can be performed in one session. It permits early institution of anti-tubercular drugs in patients with tuberculous lymphadenitis. In case of undetected primary tumour, FNAC directs further investigations towards the possible primary.

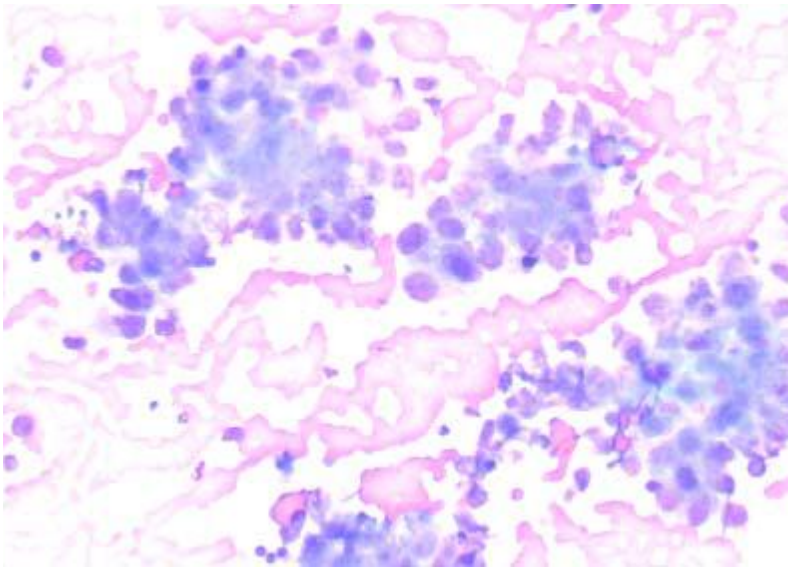
The two fundamental requirements on which the success of cytology depends are representativeness of the sample and high quality of

the preparation. The main advantage of FNAC lies in its simplicity. Being an uncomplicated outpatient procedure that offers a rapid and specific diagnosis with little trauma, it is very cost-effective. It is ideal for developing countries and smaller hospitals with limited resources.

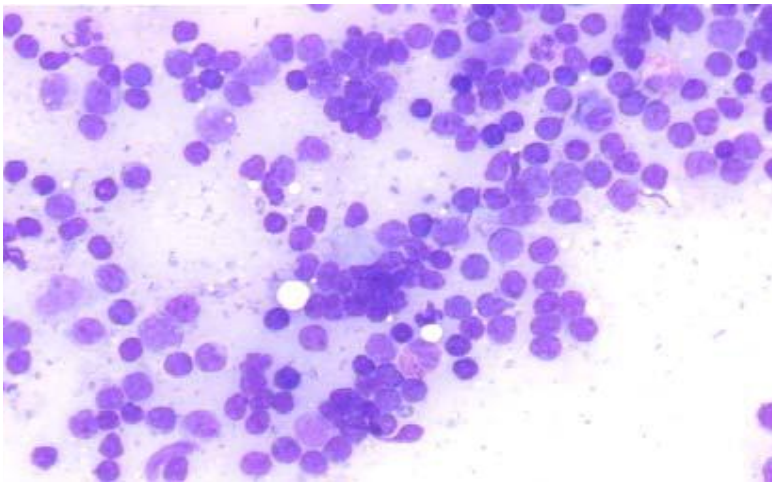
FNAC Slides



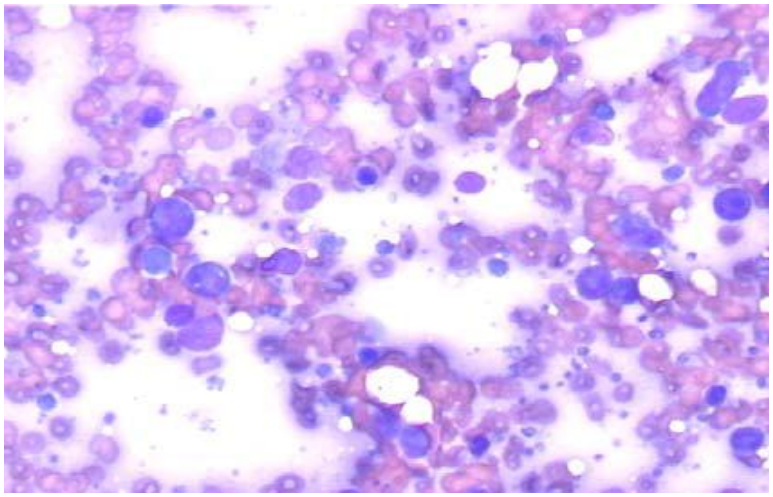
METASTATIC SQUAMOUS CELL CARCINOMA



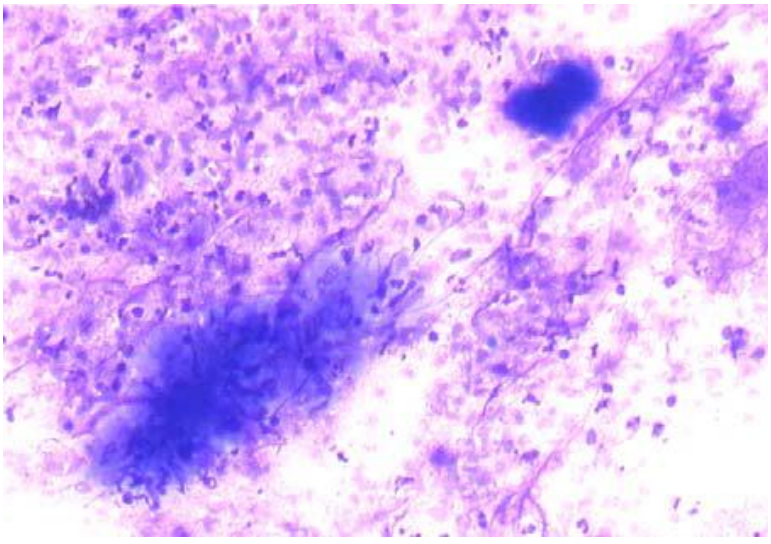
FNAC OF METASTATIC ADENOCARCINOMA



HODGKIN'S DISEASE

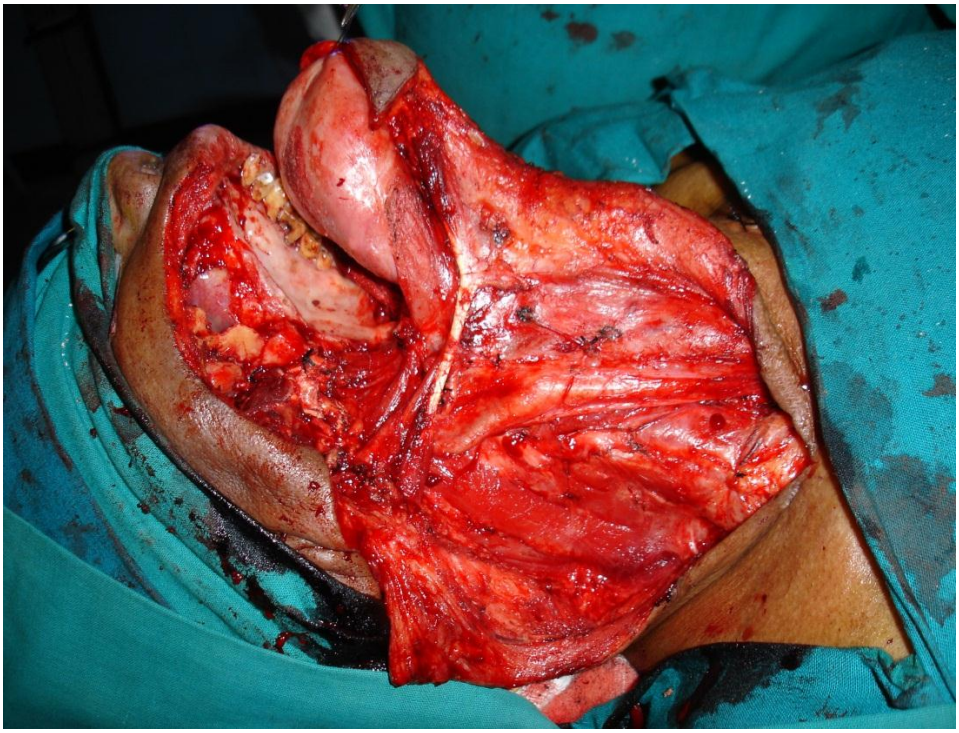


NON-HODGKIN'S DISEASE

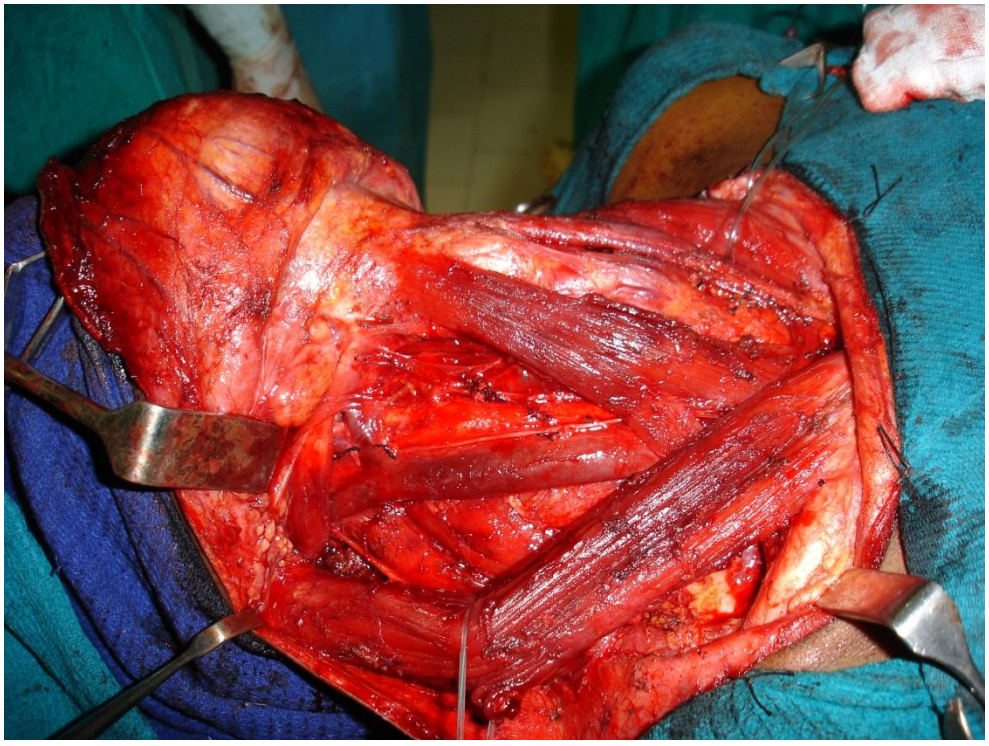


TUBERCULOUS LYMPHADENITIS

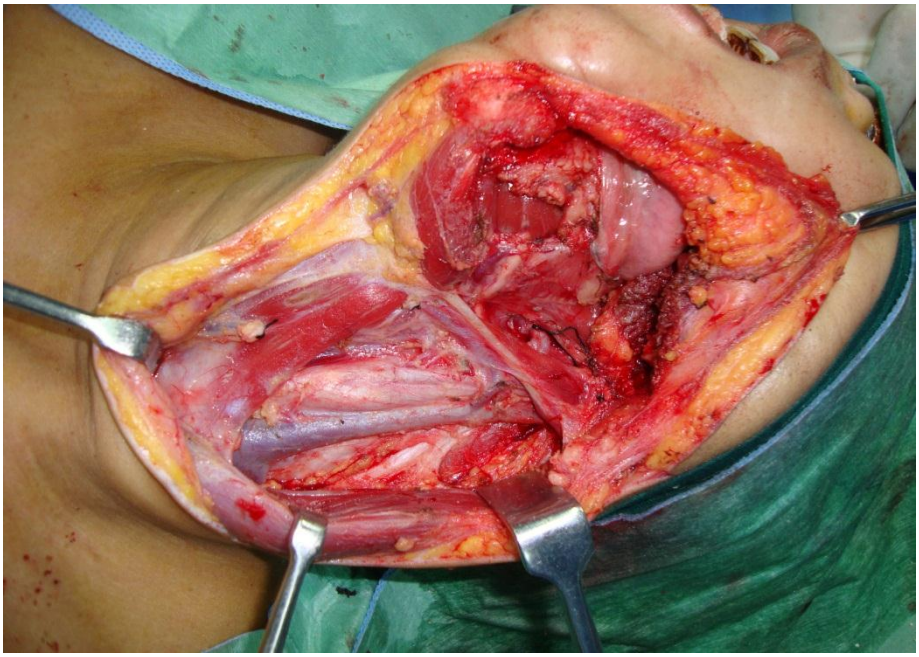
NECK DISSECTIONS



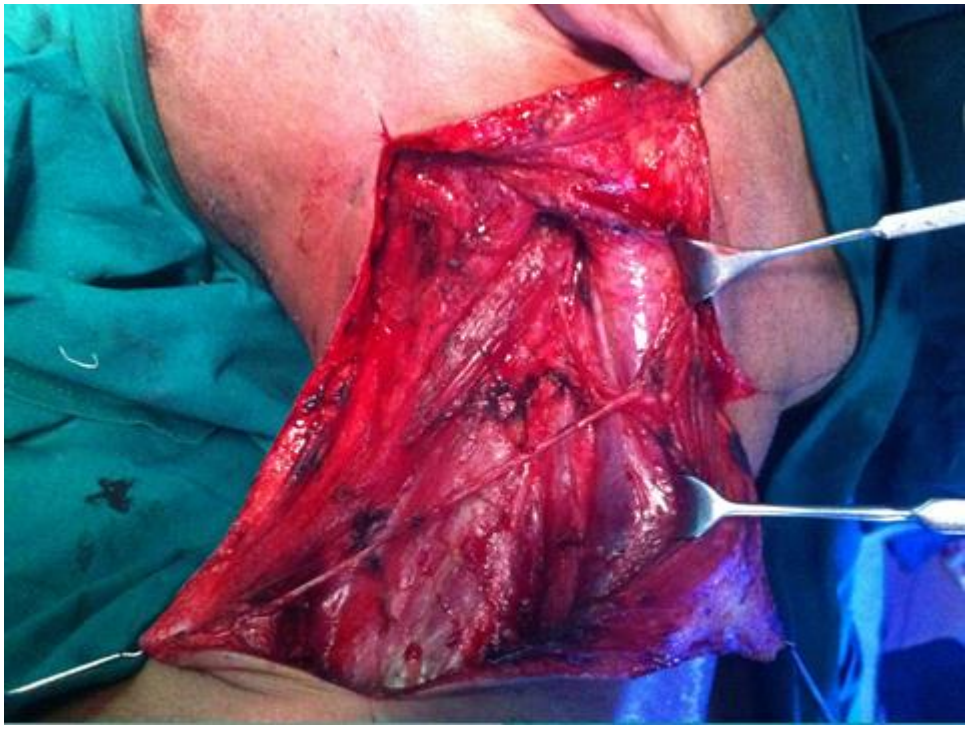
RADICAL NECK DISSECTION



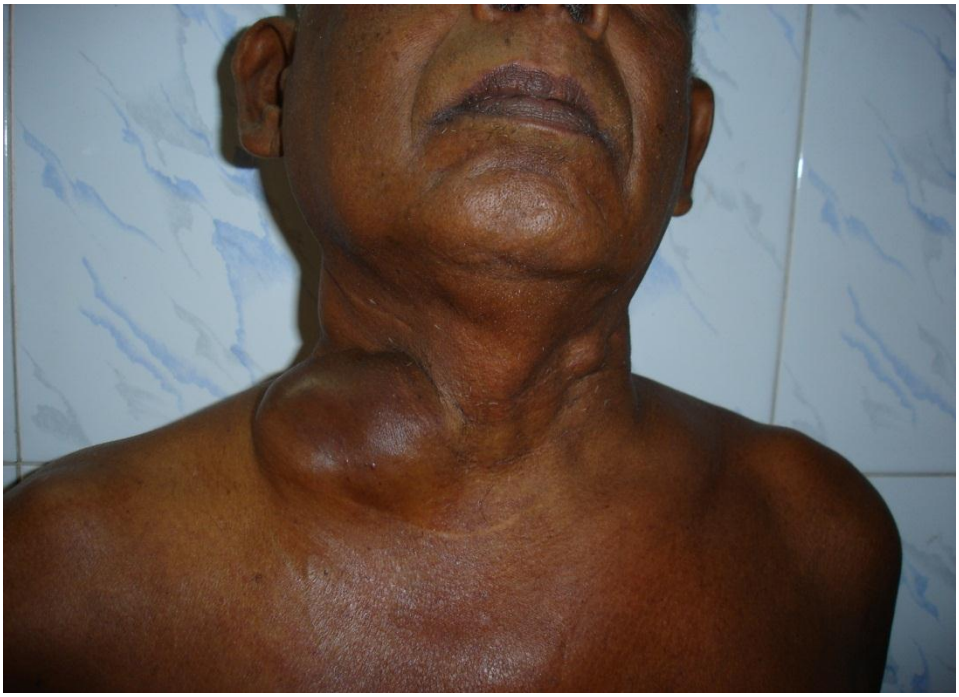
MODIFIED RADICAL NECK DISSECTION

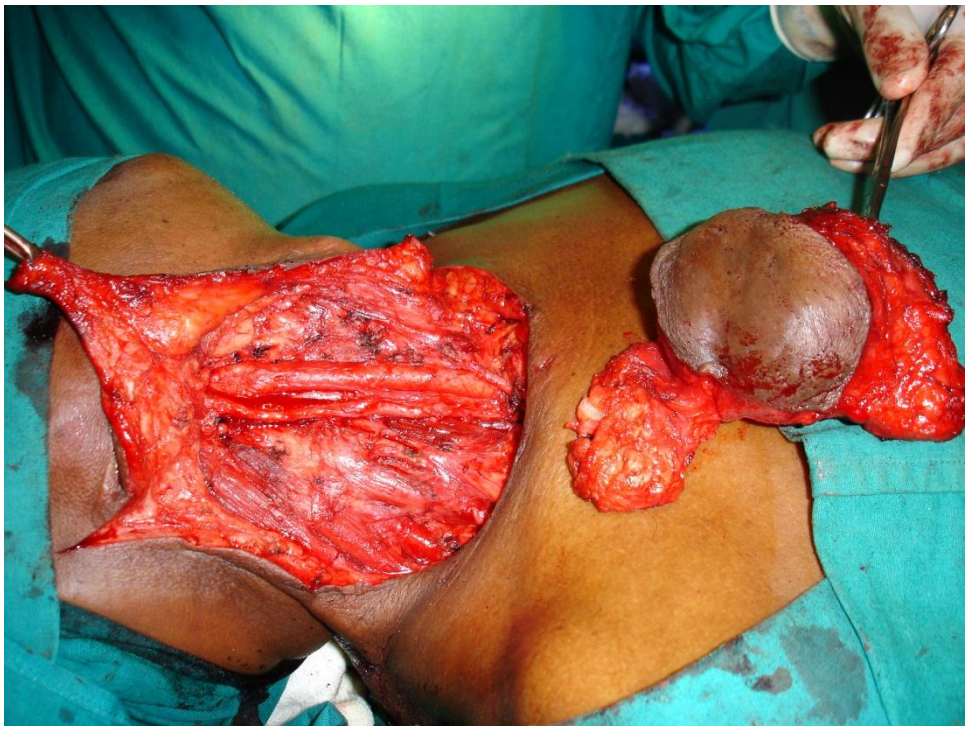


SELECTIVE NECK DISSECTION- SUPRAOMOHYOID



SELECTIVE NECK DISSECTION- POSTEROLATERAL





PROFORMA

Role of cytological evaluation in cervical lymphadenopathy

Name Diagnosis

Age/Sex **Date:**

Op/Ip No

HISTORY

Duration

Examination

Nodes enlarged:

RIGHT					LEFT				
Levels	Size	Number	Consistency	Periadenitis	Levels	Size	Number	Consistency	Periadenitis
I					I				
II A/B					II A/B				
III					III				
IV					IV				
V A/B					V A/B				
VI					VI				

Previous treatment:

OTHERS

INVESTIGATIONS

CBC

X ray

SPL INV

USG

CT neck Other CT

Informed consent

Pre FNAC DIAGNOSIS:
Date.

FNAC material yield :

FNAC REPORT:

Repeat FNAC

SURGERY:

HPE:

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- Concise textbook of surgery –S Das

MASTER CHART

Sl no.	Name	Age	SEX	IP No	Primary	Clinical	FNAC	Histopathology
1	Krishna Kumar	36	M	91806	Tongue	L1,2	SCC	SCC
2	Perumal	60	M	91849	Cheek	L1,2	SCC	SCC
3	Janaki	33	F	91799	Parotid	L2,3	Mucoepidermoid Ca	Mucoepidermoid Ca
4	Janani	17	F	92731	Pap Thyroid	L2,3,4	PAP Ca	PAP Ca
5	Sangothy	60	F	71496	Cheek	L1	SCC	SCC
6	Govindaswamy	70	M	84646	Tongue	L1,2,3	SCC	SCC
7	Jainullabudin	72	M	91745	Tongue	L2,3	SCC	SCC
8	Suguna	42	F	96803	Cheek	L1,2	SCC	SCC
9	Sathyasheelan	56	M	100617	Cheek	L1,2	SCC	SCC
10	James	32	M	100281	Cheek	L1,2,3,4	SCC	SCC
11	Samyayya	56	M	101399	Maxilla	L1,2	SCC	SCC
12	Saravannan	33	M	105404	Cheek	L1,2	SCC	SCC
13	Sunderraj	31	M	1855	Cheek	L1,2,3	SCC	SCC
14	Shanmugam	75	M	105978	Pap Thyroid	L2,3,4,6,7	PAP Ca	PAP Ca
15	Gomathy	38	F	3457	Maxilla	L2,3	Adenocystic Ca	Adenocystic Ca
16	Thangamani	58	M	116716	Retromolar trigone	L2,3,4,5	SCC	SCC
17	Madhavan	50	M	3938	Tongue	L1,2,3	SCC	SCC
18	Kandaswamy	23	M	5357	Soft Palate	L2,3	SCC	SCC

19	Mani	50	M	5256	Cheek	L1,2	SCC	SCC
20	Jayammal	70	F	6130	Cheek	L1,2,3	SCC	SCC
21	Dhanam	70	F	10234	Cheek	L1,2	SCC	SCC
22	Prabhu	48	M	15040	Cheek	L1	SCC	SCC
23	Sivakumar	43	M	3915	Tongue	L1,2,3	SCC	SCC
24	Penchilammal	45	F	13334	Cheek	L1,2	SCC	SCC
25	Arivazhagan	42	M	6895	Cheek	L1,2	SCC	SCC
26	Irudhayamary	50	F	19749	Retromolar trigone	L1,2,3,5	SCC	SCC
27	Manarswamy	65	M	12615	Lower Lip	L1,2,3	SCC	SCC
28	Kaliyaperumal	53	M	18209	Parotid	L2,3,5	Mucoepidermoid	Mucoepidermoid
29	Kannan	36	M	17571	Parotid	L2	Mucoepidermoid	Mucoepidermoid
30	Rajavel	48	M	19740	Cheek	L1,2,3,4	SCC	SCC
31	Zahir Hussain	31	M	25283	Tongue	L1,2	SCC	SCC
32	Sagayaraj	45	M	20415	Tongue	L1	SCC	SCC
33	Shyamala	48	F	29117	Tongue	L2,3	SCC	SCC
34	Samsudeen	62	M	17526	Thyroid	L2,3,4	PAP Ca	PAP Ca
35	Somasundaram	55	M	52311	Maxilla	L1,2,3	SCC	SCC
36	Muniammal	65	F	46057	Cheek	L1,2	SCC	SCC
37	Ramaminthammal	40	F	46090	Cheek	L1,2	SCC	SCC
38	Chandra	45	F	54640	Alveolus	L1,2,3	SCC	SCC
39	Mohan	50	M	60160	Supraglottis	L2,3,4	SCC	SCC
40	Vapu	64	M	61732	Unknown	L 2,3	SCC	SCC

41	Saddique Basha	32	M	62533	Tongue	L1,2	SCC	SCC
42	Sathyashelan	56	M	60164	Cheek	L1,2	SCC	SCC
43	Vedhachalam	49	M	69817	Cheek	L1,2	SCC	SCC
44	Thiruvenkatam	65	M	67347	Parotid	L2,3,4	Mucoepidermoid	Mucoepidermoid
45	Antony	50	M	76960	Cheek	L1,2,3	SCC	SCC
46	Maria	65	M	78226	Thyroid	L2,3,4	PAP Ca	PAP Ca
47	Saroja	45	F	83465	Cheek	L1,2	SCC	SCC
48	Kanagammal	57	M	84208	Tongue	L1,2,3	SCC	SCC
49	Sankar Narayanan	22	M	86623	Thyroid	L2,3,4,6	PAP Ca	PAP Ca
50	Kamalakannan	33	M	89090	Tongue	L1,2	SCC	SCC
51	Gobinath	32	M	85353	Tongue	L1,2,3	SCC	SCC
52	Kanaga	55	F	86665	Cheek	L1,2	SCC	SCC
53	Vittabai	65	F	86670	Cheek	L1,2	SCC	SCC
54	Kesavan	40	M	85783	Alveolus	L1,2,3	SCC	SCC
55	Lakshmi	45	F	75307	Cheek	L1,2	SCC	SCC
56	Loganathan	58	M	99400	Floor Of Mouth	L1,2,3,4	SCC	SCC
57	Thanikachalam	65	M	104092	Lower Alveolus	L1,2,3	SCC	SCC
58	Rafiq Khan	38	M	103074	Tongue	L1,2,3	SCC	SCC
59	Sunitha	27	F	7950	Pap Thyroid	L3,4	PAP Ca	PAP Ca
60	Ramani	53	F	78641	Tongue	L1,2,3	SCC	SCC
61	Rani	57	F	5552	NHL	L3,4,5	NHL	NHL
62	Murugan	45	M	76643	NHL	L2,3,5	Reactive	NHL
63	Kannan	75	M	63475	NHL	L3,4,5	NHL	NHL

64	Vignesh	9	M	100457	HL	L4,5	HL	HL
65	Ajith Kumar	15	M	232626	NHL	L2,5	NHL	NHL
66	Samikannu	50	M	98039	HL	L4,5,6,7	HL	HL
67	Jayaseelan	19	M	95466	HL	L4,5	HL	HL
68	Pugazhendi	23	M	2005	HL	L3,5	HL	HL
69	Vanitha	37	F	74085	NHL	L2,3,5	NHL	NHL
70	Suryakala	25	M	54499	HL	L4,5,6	HL	HL
71	Prema	60	F	92979	NHL	L4,5,6	NHL	NHL
72	Suresh	27	M	120182	NHL	L2,3,5	NHL	NHL
73	Mahesh	18	M	13271	TB lymphadenitis	L5	TB	TB
74	Devaraj	41	M	69895	TB lymphadenitis	L4,5	TB	TB
75	Jeganathan	19	M	87518	TB lymphadenitis	L5	TB	TB
76	Kumar	35	M	3681	TB lymphadenitis	L3,4,5	TB	TB
77	Malathy	30	F	203004	TB lymphadenitis	L1,2,3	TB	TB
78	Padma	60	F	6538	TB lymphadenitis	L2,3,4,5	TB	TB
79	Seetharamaman	75	M	50599	TB lymphadenitis	L2,3	TB	TB
80	Karumbairam	46	M	103920	TB lymphadenitis	L4,5	TB	TB
81	Snehapriya	16	F	171388	TB lymphadenitis	L5	TB	TB
82	Parthasarathy	30	M	4699	TB lymphadenitis	L3,4,5	Reactive	TB
83	Karthickdas	50	M	89397	TB lymphadenitis	L2,3,4	TB	TB
84	Vadivel	67	M	56494	TB lymphadenitis	L3,4,5	TB	TB
85	Dhanalakshmi	32	F	10903	TB lymphadenitis	L5	TB	TB
86	Nagalakshmi	48	F	37789	TB lymphadenitis	L4,5	TB	TB

87	Mohanavel	45	M	48985	TB lymphadenitis	L4,5	TB	TB
88	Amudha	42	F	31184	TB lymphadenitis	L2,3,4	Reactive	TB
89	Jagadesan	22	M	25449	TB lymphadenitis	L1,2,3	TB	TB
90	Giri	26	M	67138	TB lymphadenitis	L4,5	TB	TB
91	Santha	64	F	64571	Non specific	L5	Reactive	Reactive
92	Kavitha	24	F	61201	Non specific	L5	Reactive	Reactive
93	Srinivas	25	M	95788	Non specific	L3,4,5	Reactive	Reactive
94	Jayashree	13	F	98225	Non specific	L4,5	Reactive	Reactive
95	Munivel	25	M	16722	Non specific	L1,2,3	Reactive	Reactive
96	Kuppan	62	M	2805	Non specific	L3,4	Reactive	Reactive
97	Shaukat Ali	38	M	2181	Non specific	L3,4,5	Reactive	Reactive
98	Ajith	15	M	115914	Non specific	L1,5	Reactive	Reactive
99	Harikrishnan	13	M	29422	Non specific	L2,5	Reactive	Reactive
100	Gokul	14	M	105811	Non specific	L3,4	Reactive	Reactive