# DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES

*Dissertation Submitted to*

**THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY**

*In Partial Fulfilment for the Degree of*

**MASTER OF DENTAL SURGERY**

**BRANCH IX**

**ORAL MEDICINE AND RADIOLOGY**

**MAY 2018**

**THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY**

**CHENNAI**

## DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled **"DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. S. KAILASAM, B.Sc., M.D.S.**, Professor and Head, Department of Oral Medicine & Radiology, Ragas Dental College and Hospital, Chennai.

A. Priyadharshini

**Dr. A. PRIYADHARSHINI**
Post Graduate Student
Department of Oral Medicine & Radiology
Ragas Dental College and Hospital
Chennai

**Date:** 30/01/18

**Place: Chennai**

## CERTIFICATE

This is to certify that this dissertation titled **"DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES"** is a bonafide record of work done by **Dr. A. PRIYADHARSHINI** under my guidance during her postgraduate study period 2015 – 2018.

This dissertation is submitted to **THE TAMILNADU Dr. M.G.R.MEDICAL UNIVERSITY,** in partial fulfilment for the degree of **MASTER OF DENTAL SURGERY, BRANCH IX – Oral Medicine & Radiology.**

It has not been submitted (partial or full) for the award of any other degree or diploma.

**Guided by:**

RAGAS DENTAL COLLEGE Chennai

P.V.L. Aparna 30/1/18

**Dr. P.Venkatalakshmi Aparna, M.D.S.,**
Reader
Department of Oral Medicine & Radiology,
Ragas Dental College & Hospital,
Chennai - 600119

Dr. P. VENKATALAKSHMI APARNA, MDS.,
READER
DEPARTMENT OF ORAL MEDICINE & RADIOLOGY,
RAGAS DENTAL COLLEGE & HOSPITAL
UTHANDI, CHENNAI-600 119.

S. Kailasam 30/01/2018.

**Dr. S.Kailasam, B.Sc., M.D.S.,**
Professor & Head
Department of Oral Medicine &Radiology,
Ragas Dental College & Hospital,
Chennai - 600119

Dr. S. KAILASAM, B.Sc., M.D.S.
PROFESSOR & HEAD
DEPT. OF ORAL MEDICINE & RADIOLOGY
RAGAS DENTAL COLLEGE & HOSPITAL
2/102, East Coast Road,
Uthandi Chennai - 600 119

**Dr. N.S.Azhagarasan, MDS.,**
Principal,
Ragas Dental College & Hospital, Chennai- 600119

PRINCIPAL
RAGAS DENTAL COLLEGE AND HOSPITAL
UTHANDI, CHENNAI-600 119.

**Date:** 30/01/18

**Place:** Chennai

**THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI**

**PLAGIARISM CERTIFICATE**

This is to certify the dissertation titled **"DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES"** of the candidate **Dr. A. PRIYADHARSHINI** for the award of Degree of **MASTER OF DENTAL SURGERY** in **BRANCH IX – Oral Medicine & Radiology.**

On verification with the urkund.com website for the purpose of plagiarism check, the uploaded thesis file contains from introduction to conclusion pages shows **4 percentage** of plagiarism, as per the report generated and it is enclosed in Annexure – VIII.

**Date:** 30/01/18

**Place:** Chennai

A. Priyadharshini

**Dr. A. Priyadharshini**

Post Graduate student,

Department of Oral Medicine &Radiology,

Ragas Dental College & Hospital,

Chennai – 600119.

**Guide sign with seal:**

P.V.L.Aparna 30/1/18

**Dr. P.Venkatalakshmi Aparna, M.D.S.,**

Reader

Department of Oral Medicine & Radiology,

Ragas Dental College & Hospital,

Chennai – 600119.

Dr. P. VENKATALAKSHMI APARNA, MDS.,
READER
DEPARTMENT OF ORAL MEDICINE & RADIOLOGY
RAGAS DENTAL COLLEGE & HOSPITAL
UTHANDI, CHENNAI - 600 119.

## ACKNOWLEDGEMENT

I take this opportunity to thank my Professor **Dr. S. Kailasam, B.Sc., MDS, Professor and Head**, of the Department of Oral Medicine and Radiology, Ragas Dental College and Hospital, Chennai, who was the pillar to support for my dissertation completion in all aspects. It was a good experience and also the knowledge shared during this dissertation by him gave an insight for my completion with thorough understanding of the subject. Through-out this project his zeal and enthusiasm provided the moral support for smooth execution from beginning to completion of the project.

I thank **Dr. N. S. Azhagarasan, MDS,** Principal and **Dr. N. R. Krishnaswamy, MDS,** Vice-principal, Ragas Dental College & Hospital for their generous support rendered throughout my course.

I also express my deep sense of gratitude to **Dr. N. Santana, MDS, Professor,** for her valuable help and motivation during the course.

I extend my sincere thanks to **Dr. P. Venkatalakshmi Aparna, MDS, Reader,** who was a guiding force for me at each and every activity to prepare this dissertation. Her comments have helped me to fine-tune the important areas of this dissertation and also to complete this on time.

I also thank **Dr. B. Anand, M.D.S, Dr. F. Massillamani, MDS, Dr. K. Sangeetha, MDS, Dr. R. Malavika M.D.S, Readers** and for their motivation towards the completion of the dissertation.

I also thank **Dr. Aneetha Raman, Dr. V. Athreya, Dr. M. Deivanayagi, Dr. I. K. Mammootty Senior Lecturers** for being so friendly, approachable and encouraging me through-out the course.

I express my heart full indebtness and owe a deep sense of gratitude to **Dr. K. Viswanathan,** Head of the Department, Department of Radiation Oncology, **Dr. Rai**, Head of the Department, Department of Surgical oncology, **Dr. Balasundaram,** Head of the Department, Department of Radiology, Rai Memorial Cancer Institute, for sincere guidance and inspiration in completing this project.

I also thank my batch-mates **Dr. Lakshminrusimhan, Dr. Niveditha, Dr. Vishnupriya,** my seniors **Dr. Niranjana, Dr. Banu, Dr. Akila** and juniors **Dr. Nagaleela, Dr. Leena, Dr. Geetha, Dr. Ezhilpallavi** for their support and encouragement.

I would like to take this opportunity to especially thank my **parents, my aunt, my sister, my husband**, my undergraduate college staffs for their love, care and encouragement in each and every step in my life.

Above all I thank to God almighty, for giving me an opportunity to pursue this course and for shaping me in a better version during my life journey.

.

## LIST OF ABBREVIATION

| S.NO | ABBREVIATION | EXPANSION |
|---|---|---|
| **1** | **US** | Ultrasound |
| **2** | **FNAC** | Fine Needle Aspiration Cytology |
| **3** | **USG FNAC** | Ultrasound guided fine needle aspiration cytology |
| **4** | **AJCC** | American Joint Committee on Cancer |
| **5** | **SCC** | Squamous cell carcinoma |
| **6** | **UICC** | Union for International Cancer Control |
| **7** | **CT** | Computed Tomography |
| **8** | **PET** | Positron Emission Tomography |
| **9** | **MRI** | Magnetic Resonance Imaging |
| **10** | **MHZ** | Mega hertz |
| **11** | **S/L ratio** | Short long axis ratio |
| **12** | **L/T ratio** | Longitudinal to the transverse ratio |

**CONTENTS**

## LIST OF TABLES

## LIST OF GRAPHS

## LIST OF FIGURES

# *Introduction*

## INTRODUCTION

The Lymphatic vessels form a network of branches that infiltrate almost all the body's tissues. These vessels are an accessory to the veins for returning fluid from the tissues. One of the major roles of the lymph vessel is to maintain fluid balance, returning excess fluid and proteins from the tissues that cannot be returned via venules and veins.

The lymphatic system's vessels branch through junctions called lymph nodes. The lymph nodes are numerous round, oval, or bean shaped bodies located along the course of lymphatic vessels, usually presenting a depressed area, the hilum on one side through which the blood vessels enter and efferent lymphatic vessels emerges, afferent vessels enter at many points of its periphery with their structure consisting of a fibrous capsule and internal trabecular supporting lymphoid tissue and lymph sinuses. Lymph enters a lymph node through an afferent lymphatic vessel and exits through an efferent lymphatic vessel. The lymphoid tissue is arranged in nodule in the cortex and cords in the medulla. [52]

About 300 lymph nodes are present in the neck. According to American academy of otolaryngology and the American joint committee on cancer, they are classified as follows:

Level I - Submental and submandibular nodes.

Level IA - Submental- found between the anterior belly of the digastric muscles.

Level IB - Submandibular triangle- found around submandibular glands in submandibular space.

Level II - Upper jugular nodes between posterior belly of digastric muscles superiorly and hyoid bone inferiorly.

Level IIA - Anterior, medial, lateral, posterior to internal jugular vein.

Level IIB - Posterior to internal jugular vein with tat plane between nodes and internal jugular vein.

Level III - Middle jugular nodes between the hyoid bone and cricoid cartilage.

Level IV - Lower jugular nodes- between the cricoid cartilage and the clavicle.

Level V - Posterior cervical or spinal accessory nodes, posterior to the sternocleidomastoid muscle.

Level VA- Spinal accessory nodes from skull base to bottom of cricoid cartilage.

Level VB- Spinal accessory nodes between cricoid and clavicle.

Level VI - Visceral space lymph nodes- midline group of cervical nodes from hyoid to sternal manubrium, includes prelaryngeal, pretracheal and paratracheal sub groups.

Level VII – Superior mediastinal nodes between carotid arteries from top of manubrium superiorly to innominate vein inferiorly.

Supraclavicular nodes – they lie at caudal or to the level of the clavicle and lateral to the carotid artery on each side of the neck, as seen on each axial scan.

Retropharyngeal nodes – within 2 cm of the skull base, they lie medial to the internal carotid arteries.

The functions of lymphatic circulation are extra amount of fluid left in the tissue space by capillary filtration is taken up by lymphatics and returned back to circulation. In liver and intestine, a significant quantity of proteins enters into interstitial space and is returned to circulation is a lymphatic. Thus, maintain protein content of plasma. Long chain fatty acids, cholesterol and fat-soluble vitamins absorbed from intestine are transported to circulation via lymphatics. Mononuclear phagocytes in lymph nodes remove bacteria and pathogenic organisms from lymph draining from the organ. Thus, they play protective function. [19]

Clinically the normal lymph nodes are difficult to palpate. Cervical lymphadenopathy is the most common finding in the head and neck disorders. The common cause of lymphadenitis are malignancies, bacterial, viral, protozoal, fungal infections, autoimmune disorders, drugs such as phenytoin and certain vaccines. In inflammatory condition and infection, the enlarged lymph node will have pain whereas in neoplastic condition, it is painless. The reactive lymph node enlargement is due to infection of head and neck region whereas the metastatic lymph node is enlarged as a result of malignant tumors. [32]

A sentinel lymph node is defined as the first lymph node to which cancer cells are most likely to spread from a primary tumor. Classically, the lymph nodes are fixed to underlying tissue. Although cervical lymph node metastasis plays an important role in the treatment and prognosis of patients with a cancer in the head and neck regions, the assessment of the cervical lymph node status remains a problem. Clinical palpation is insufficient in determining the cause of nodal enlargement, nodal size, extra-capsular growth or vascular involvement. [27]

Ultrasound has been studied adequately and has proved its efficacy for the detection of lymph node metastasis. [25] Ultrasound technique is a dynamic, noninvasive, reproducible, simple, easily accessible, painless and readily available technique. [17]

Normal cervical nodes show 5mm size hilar vascularity or appear avascular, round or elliptical in shape. The reactive nodes are more than 5mm in size, elliptical in shape and has smooth border. The echogenic hilus is present and shows hilar vascularity. [4]

The metastatic lymph nodes are more than 5mm in size and it is round shape, has sharp border. The echogenic hilus is absent and shows peripheral vascularity. Intranodal necrosis is seen. Echogenicity of metastatic lymph nodes are predominantly hypoechoic. [70]

FNAC (Fine Needle Aspiration Cytology) is a very simple and important diagnostic tool in the differentiation of reactive and metastatic cervical lymph nodes and has almost no complication. [26] Ultrasonography guided FNAC of sentinel lymph nodes in the head and neck region have been found to be good in picking up metastasis in clinically undetectable lymph nodes. The advance diagnostic ability of FNAC in the diagnosis of malignant lesion of the lymph nodes is probably due to the combination of factors such as the increased use of the technique, better and easier availability of reference material of similar study and increased experience of the trained observer's over the years. [10]

In this present study, the ultra-sonographic examination is conducted first because the pathology can be identified due to hyperechoic and hypoechoic structure and their vascular flow patterns of reactive and

metastatic cervical lymph nodes, which signifies the type of lesion within the cervical lymph nodes and this is considered as non-invasive procedure. This is followed by FNAC which can actually present the cytological features within the nodes to have comparative and confirmative study.

# *Aim and Objectives*

# AIM AND OBJECTIVES

## AIM

To differentiate between reactive and metastatic cervical lymph nodes in the head and neck pathology by grey scale ultrasonography

## OBJECTIVES

1. To emphasize the sensitivity and specificity of grey scale ultrasonography in detecting the reactive and metastatic lymph nodes.
2. To emphasize grey scale ultrasonography as a good indicator for planning treatment of reactive and metastatic cervical lymph nodes.

# *Review of literature*

## LYMPH NODES

The lymphatic system was first described by Erasistratus in Alexandria as said by Russel R, Williams N more than 2000 years ago.[52] The presence of lymphatic vessels and lymph nodes was reported by ancient anatomists without any accurate knowledge of their true functions.

Lymph nodes were described as spongy structures, spread over the whole body for the support of vulnerable body parts. The lymph nodes are the core of the lymphatic system. They are situated in either groups or chains so that the afferent lymphatic vessels leading to these lymph nodes drain discrete anatomic regions. In addition to mechanical filtration of the lymph, the lymph nodes are involved with recognition and processing of antigens and lymphopoiesis. [19]

Lymph emerging from efferent channels is always enriched with more lymphocytes than the corresponding afferent lymph. Most lymph nodes have an oval or bean shape with a slight depression on the hilar side. The hilum contains arterioles, venules, and efferent lymphatic vessels. There are usually only 2 or 3 efferent vessels at the hilum, but between 6 and 25 afferent lymphatic vessels that enter the nodal periphery away from the hilum.[52]

Lymph nodes have a complex architecture that arranges variety of specific cell populations so that they interact in favourable environment that allows the various cellular components to process antigens, interact and

generate the immune response. This nodal architecture varies with the anatomic region and with the response to antigen stimulation. Thus, the lymph nodes that drain areas of active antigen stimulation, such as the neck, have larger and more numerous germinal centres, or areas of active lymphoid cell production, than do mesenteric lymph nodes.[55]

The circulating lymph travels to each node through the afferent lymphatic vessels. The lymph then circulates within a system of sinuses, first entering the marginal or subcortical sinuses, then the cortical or intermedullary sinuses, and lastly the medullary sinuses. Finally, the lymph exits the lymph node via the efferent lymph vessels in the nodal hilum. As the lymph flows through the lymph node, it first contacts the cortex, then the paracortex and then the medulla. Each of these areas has a distinct morphology and function.[52]

**THE ROUVIERE SYSTEM OF LYMPH NODES**

**Henri Rouviere** (1876–1952) was an anatomy professor from Le Bleymard in France. His seminal work on "Anatomy of the Human Lymphatic System", documented the lymph nodes of the human body and their associated drainage regions. He described a lymphoid collar of nodes encircling the top of the neck composed of the occipital, mastoid, parotid, facial, retropharyngeal, submaxillary, submental and sublingual lymph nodes. [51]

Anterior and lateral cervical groups of lymph nodes respectively, descended from the collar along the front and sides of the neck. Rouviere

described the deep lateral cervical group as being composed of an internal jugular chain, a spinal accessory (posterior triangle) chain, and a transverse cervical (supraclavicular) chain. These three chains, joined at their edges, formed a lateral triangle of nodes in the neck. The deep cervical or internal jugular lymph node chain is the primary drainage pathway of the head and neck and ultimately receives lymph from all of the other nodal chains. [51]

Two nodes in this chain are of special importance. The first is the jugulodigastric or sentinel node, which lies near the angle of the mandible and receives lymph from the tonsils, pharynx, mouth, and facial region. As a result of numerous infections in its drainage area, this node tends to be hyperplasic and larger than most other lymph nodes. The second node is the juguloomohyoid node, which lies near the point at which the omohyoid muscle crosses the internal jugular chain. The jugloomohyoid node receives all of the lymph from the tongue, and if enlarged, it may be the first physical finding to suggest an otherwise clinically silent tongue tumour.[52]

The lymphatics of the head and neck, with the exception of the tongue, are organized into two circles or cylinders: an outer one that contains the superficial nodes extending from the chin to the occiput (the submental, submandibular, buccal, mandibular, preauricular and occipital nodes) and an inner one that lies within the outer one and surrounds the upper aerodigestive tract.

Specifically, the nodal groups included in the inner circle are the retropharyngeal, pretracheal and paratracheal nodes. Lying vertically between these two circles and accompanying the internal jugular veins are the deep cervical jugular chain nodes, into which virtually all of the lymph from both the inner and outer circles of nodes drains.

The increased size of a lymph node is due to the multiplication of the cells that is present within the lymph node such as lymphocytes, monocytes, plasma cells, histiocytes and also by the infiltration of cells from outside the node such as neutrophils and malignant cells.[55]

Cervical lymphadenopathy could be seen in several pathologic processes such as lymphoma, tuberculosis and metastasis. Therefore, an accurate differentiation between these conditions is of utmost importance to select an appropriate treatment and assess the prognosis.

**NODAL METASTASIS**

The incidence of nodal metastasis from upper respiratory and digestive tract carcinoma varies from less than 1% to 85%. Ipsilateral metastasis occurs in 50% of the T3 and T4 carcinomas of the oral cavity, oropharynx, hypopharynx and supraglottis. Bilateral metastasis or isolated contralateral metastasis is less frequent, varying from less than 2% up to 35%. Paratracheal

and pretracheal lymph node metastasis are present in more than 20% of subglottic, retro cricoid and pyriform sinus carcinomas.[29]

**Mohantatabai et al (1986) [28],** found a significant correlation between tumour thickness greater than 1.5 mm and subsequent development of neck metastasis in a series of patients with Stage I and Stage II carcinomas of the floor of mouth.

**Spiro et al (1986) [28],** found in a study of 105 patient with oral and oropharyngeal carcinoma with N0 necks, that lymph node metastasis occurs more frequently in patient whose tumour measured 2 mm in thickness or more. In recent years the relationship of occult cervical lymph node metastasis with thickness of the tumour has been widely investigated.

**Granstrom et al (1989) [22],** in their study reported that 60% of the patients with metastatic lymph node had no visible tumour. After an elective tonsillectomy procedure, they did show up a primary malignant tumour.

**Brown et al (1989) [14],** noted that 38% of patients with tumour thickness less than 3 mm developed regional disease, compared with 41% of patients with tumour thickness of 3 mm to 7 mm and with 55% of patients with tumour thickness greater than 7 mm. He also showed that increasing tumour thickness is associated with greater perineural invasion.

**Bath et al (1992) [11],** reported three cases of cervical metastasis none of which had any visible primary tumour. Two of the patients had a palpable mass

over the tonsils, and the third patient had a tonsil carcinoma detected only during elective surgical procedure.

**Tytor et al (1992) [60],** conducted a study involving 176 patients with oral cavity carcinoma showed that the rate of cervical lymph node metastasis was 14% in patients with T1 tumours, 37% in patients with T2 tumours and 57% in patients with tumour size greater than 4 cm in diameter.

**Bryne et al (1995) [28],** have shown that oral cavity carcinomas that exhibit an infiltrating margin with abundant mitosis and nuclear polymorphism is associated with a dismal survival.

**Close et al (1995) [28],** found lymph node metastasis in a study of 43 patients in that 77% of the cases in which vascular invasion is present, but only in 25% of the cases in which it is not present.

**Williams et al (1995) [28],** reported that angiogenesis was strongly related to probability of metastases in a group of 66 patients with oral cavity tumours and N0 neck.

**Fukano et al (1997) [20],** conducted a study of 34 patients showed that cervical metastasis increased from 5.9% for tongue carcinomas less than 5 mm thick to 64.7% for tongue carcinomas more than 5 mm thick.

**Calabrese et al (2006) [15],** stated that prognosis of oral SCC becomes worse as nodal involvement increases; in cN1 pN1 cases, neck dissection is

potentially curative with a low morbidity. Management of cN0 patients remains controversial since up to 50% are cN0 pN1.

**Leemans et al (2012) [28],** reported the overall incidence of distant metastasis in a group of 281 head and neck cancer patients who underwent neck dissection was 10.7% while it was 46.8% in the group of patients with two or more positive lymph nodes.

**The level of neck metastasis:** Several studies have suggested that survival decreases as lymph node in lower levels of the neck are involved.

**Ho and Tos et al (2007) [28],** demonstrated for nasopharyngeal carcinoma; the lower the level the worse the prognosis.

**Woolgar et al (2007) [66],** used a review of histopathologic findings to define expected and aberrant patterns of neck metastasis. The study was included 439 patients with oral and oropharyngeal carcinoma who underwent comprehensive or selective neck dissection.

Hence, multiple factors that can affect the rate of cervical metastasis, therefore it is important for the head and neck oncologic surgeon to provide patients the best counsel about the appropriate treatment modalities. The presence of clinically obvious, histologically proven lymph node metastasis decreases the overall survival by at least one half.

## STAGING

The joint UICC/ AJCC classification for regional cervical lymphadenopathy, published in 2009 is the current system used for staging. This system is based not only presence or absence of cervical lymphadenopathy but also the size, number and laterality of lymph nodes.

### TNM classification of regional nodes

NX Regional lymph nodes cannot be accessed

N0 No regional lymph nodes 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 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 a single ipsilateral lymph node, more than 3 cm, but not more than 6 cm in greatest dimension

N2b Metastasis in multiple ipsilateral 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

This classification applies to all head and neck tumours apart from those arising from primaries of the thyroid, nasopharynx and mucosal melanomas.

**CLINICAL IMPLICATIONS OF METASTATIC LYMPH NODES**

Nodal metastasis results in poor outcome of the treatment. Therefore, accurate pre-treatment knowledge about the nodal status of both neck sides is of utmost important for the surgical oncologist and radiotherapist.

The N0 is so defined, when there is no clinical or radiological evidence of cervical lymph node metastasis in patients presenting with the primary tumour. The N+ is so defined when there is a clinical or radiological evidence of cervical lymph node metastasis in the patients.

**DIAGNOSIS OF CERVICAL LYMPH NODE METASTASIS**

Lymph node metastases are a poor prognostic indicator in many tumors and therefore accurate identification during staging is important prior to commencing treatment. Five-year survival of patients with metastatic lymph node in one side of neck is 50% and presence of metastatic lymph nodes in both

sides reduces the 5-year survival to 25%. The presence of lymph node metastases can significantly alter patient management and therefore accurate diagnosis of the presence and extent of nodal disease can help optimize patient management. [29]

It is important to identify the lymph node status accurately in head and neck carcinomas as the management of N0 and N+ neck is different, and also prognosis is poor in N+ neck. It is estimated that the 10-year survival rate for head and neck squamous cell carcinoma drops from 85% to 10% to 40% in patients with positive lymph nodes. Apart from the clinical examination, ultrasonography (USG), computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), radionuclide imaging are the various modalities available for detection of lymph nodes metastasis in head and neck cancer patients. The main roles of imaging are:

1. To confirm the N0 status of the neck
2. To document lymphadenopathy contralateral to clinically palpable disease,
3. To assess the regional extent of disease especially in relation to neurovascular structures and
4. Nodal surveillance

## CLINICAL EXAMINATION

The reliability of palpation in cervical lymph node metastasis depends on the experience of the examiner and the anatomy of the individual neck. The incidence of false negative nodes on palpation varies in the literature from 16% to 60%.[30]

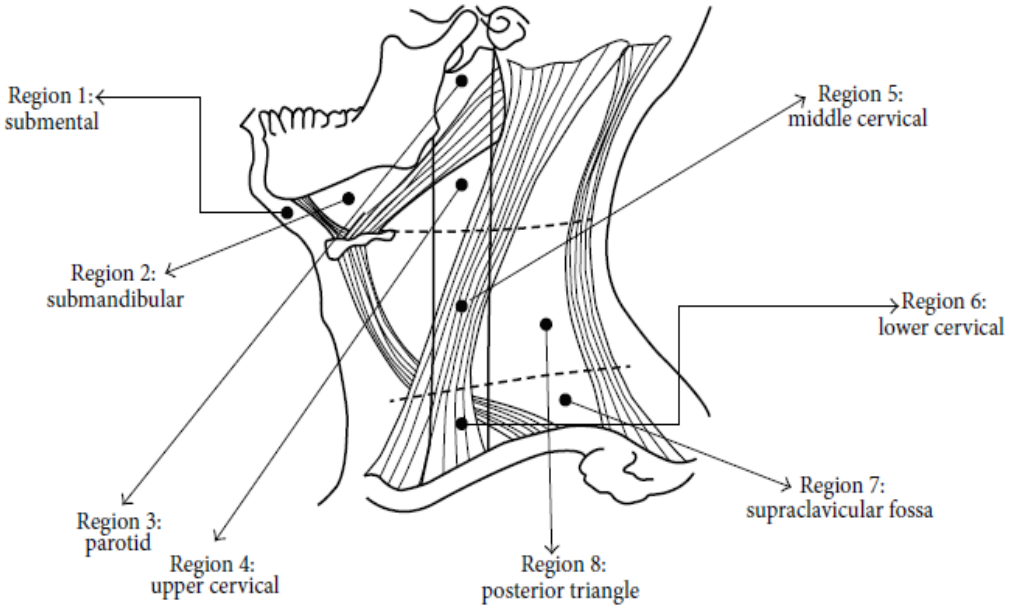
Palpation of the neck was done thoroughly; first from the back, then from the front of the neck, after exposing the neck down to the level of the clavicle bilaterally to determine the presence or absence of enlarged cervical lymph node. [53]

Clinical examination of patients though easy and inexpensive but errors may occur in the clinical assessment of regional lymph nodes by palpation alone, especially in patients with a short, stout neck, in patients with fibrotic changes secondary to previous radiotherapy, and in patients with metastatic lymph nodes at sites typically inaccessible by routine physical examination, such as the para pharyngeal space.

The incidence of occult nodes on physical examination in the literature varies from 16%- 60%. Low sensitivity and specificity of palpation has forced the way to further studies in search of other accurate diagnostic means for detecting neck nodes. Imaging modalities currently available in improving the sensitivity and specificity for the detection of reactive and metastatic lymph node involvement include ultrasonography (USG), computed tomography (CT),

and magnetic resonance imaging (MRI) scans, positron emission tomography (PET) scans and radionuclide scintigraphy.[49]

**FIG.1: HAJEK'S CLASSIFICATION FOR ULTRASOUND EXAMINATION OF CERVICAL LYMPH NODES**



**Finn et al (1996) [28],** reported 34 patients in whom surgeons had divided lymph nodes, intra-operatively, into clearly benign, clearly malignant and suspect and correlated the clinical impression with pathological results. Sensitivity of macroscopic evaluation was 56% and specificity was 70%.

**Merritt et al (1997) [41],** reported that in a systematic review of studies comparing palpation with computed tomography (CT), found a sensitivity of 75% and 83% and a specificity of 81% and 83% for palpation and CT, respectively.

**Arora N et al (2017) [7],** reported that in a study of 60 patients, the sensitivity of physical examination in detecting cervical lymph node metastasis in our study was 82.9%, the specificity was 69.2%, and the positive predictive value was 90.6%, while negative predictive value was 52.9%.

## ULTRASOUND

Ultrasound is helpful in understanding the normal anatomy of lymph node, and its differentiation from other form such as inflammatory or metastasis. There is no single sonographic characteristic of a lymph node that defines malignancy, but rather a composite of findings may allow the clinician to be strongly suspicious. Cross sectional imaging has improved our ability to detect the normal and abnormal lymph nodes. [25]

Different approaches have been made to differentiate benign from malignant cervical lymphadenopathy using ultrasound examination. Assessment of nodal status is essential in patients with head and neck carcinomas as it predicts prognosis and helps in the selection of treatment options and better outcome.

Ultrasonography is a useful imaging tool in the assessment of cervical lymph nodes. The identification of metastases in lymph nodes of the neck has a major effect on the prognosis and treatment of head and neck cancer. Several imaging modalities such as computed tomography, magnetic resonance imaging and ultrasonography have also been used for evaluation of cervical lymph nodes in the differentiation of reactive and metastatic cervical lymph nodes. [65]

Although some studies reported ultrasonography as the most sensitive technique, some others reported no statistical difference between these modalities in evaluation of cervical lymph nodes. Moreover, ultrasonography is a fast and relatively inexpensive modality and could determine small lymph nodes (< 55 mm) better than other techniques. In addition, ultrasonography could assess both internal and external anatomy of cervical lymph nodes. Grey scale sonography is used for evaluation of number, size, shape and borders of lymph nodes. There will be morphological and angio-architectural difference among various cervical nodal diseases which aid in differentiating benign from malignant lymph nodes.[67]

The normal blood vessel morphology in metastatic nodes is destroyed by neoplastic infiltration, whereas in inflammatory nodal disease there will be dilatation of intranodal vessels due to local humoral agents. Cervical lymph nodes, which have the advantage of being located superficially, can be studied with even better spatial resolution. High-resolution ultrasound is a useful imaging tool for the assessment of cervical lymph nodes because of its high imaging resolution, its high sensitivity (98%) and specificity (95%) when combined with fine-needle aspiration cytology (FNAC). [68]

Normal cervical nodes show 5mm size hilar vascularity or appear avascular, round or elliptical in shape. The reactive nodes are more than 5mm in size, elliptical in shape and has smooth border. The echogenic hilus is present and shows hilar vascularity.[69]

Ahuja et al [1] in their review outlined features suggestive of malignant lymphadenopathy.

1. **Size** –The size is one of the criteria used to differentiate reactive from metastatic nodes. Although larger nodes tend to have a higher incidence of malignancy, reactive nodes can be as large as metastatic nodes. Therefore, different cut-offs of the nodal size to differentiate reactive and metastatic nodes have been reported (5 mm, 8 mm and 10 mm).

2. **Shape** – Shape is usually described in terms of the ratio between the maximum longitudinal and transverse diameters (L/T ratio). Normal lymph

nodes are usually elliptical or oval in shape with an L/T ratio of >2 whereas metastatic nodes tend to be rounder.

3. **Border** – Metastatic nodes tend to have sharp border and in advance stage may demonstrate ill-defined borders, indicating extracapsular spread.

4. **Echogenicity** – Metastatic nodes are predominantly hypoechoic.

5. **Echogenic hilus** – Metastatic nodes usually do not show an echogenic hilus, and the presence of an echogenic hilus within lymph nodes was usually considered a sign of benign lymph nodes.

6. **Intranodal necrosis** – Intranodal necrosis may be a cystic or echogenic area within the node. Intranodal necrosis may be found in metastatic node and tuberculosis nodes. Regardless of the nodal size, the presence of intranodal necrosis should be considered pathologic.

7. **Calcification** – is seen in metastatic nodes from papillary carcinoma of thyroid. The calcification in these lymph nodes is usually punctuate, peripherally located with acoustic shadowing using a high-resolution transducer.

8. **Ancillary features** – On grey ultrasound, the presence/absence of ancillary features such as matting of lymph nodes and adjacent soft tissue oedema should also be evaluated, metastatic nodes with extra capsular nodes can invade adjacent soft tissues and cause oedema, and patient with previous

radiation therapy of the neck may also show post radiotherapy oedema and nodal matting.

9. **Vascularity** – the evaluation of vascularity of cervical lymph nodes has been highly reliable, with a repeatability of 85%. Normal or reactive nodes usually show hilar vascularity, or apparently avascular. Peripheral or mixed vascularity is common in metastatic lymph nodes.

**Hajek PC et al (1986) [24],** performed high resolution sonography of the neck to assess the lymph nodes. Ultrasound was able to delineate all important lymph node groups. Pathological lymph nodes are usually more than 5 mm in diameter, however inflammatory and malignant nodes could not be distinguished. In 58% of patient's ultrasound revealed findings different from clinical examination leading to change in the management protocol of 56% of patients. Ultrasonography revealed nodes in 27% of patients with clinically negative necks, necessitating a neck dissection.

**Robert J. Battenberg et al (1989) [9],** in their study compared the results of palpation and ultrasound examination were compared with histopathologic examination results of 120 neck dissection specimens. Furthermore, the value of ultrasound examination, combined with cytologic examination, of neck nodes was evaluated. Ultrasound examination was characterized by high sensitivity (96.8%) and specificity was 32.0%. When the results of ultrasound-guided fine-

needle aspiration biopsy were added to the ultrasound findings, specificity was as high as 92.9%.

**Vassallo P et al (1992) [63],** in their study reported that ultrasound is useful in differentiating the reactive and metastatic lymph nodes. They have found that a ratio of longitudinal diameter to transverse diameter of less than 2 to 1 in the absence of a hilum is a suggestive feature of malignancy involving the lymph nodes.

**DG John et al (1993) [30],** compared the results of clinical examination and ultrasound examination. They concluded that ultrasound did not add significantly to the information obtained by the simple neck palpation. But other studies established the role of ultrasound in head and neck cancers.

**Bressani Doldi et al (1998) [13],** proposed that ultra-sonographic evaluation of the neck can be done with a 7.5 or 10 MHz transducer with selective scanning of the lymph node chains of the internal jugular veins and supraclavicular regions. The S/L ratio was a useful way to detect lymph node metastasis. From their study they found that 18 patients with metastatic cervical lymph nodes. Of these 17 had metastatic cervical lymph nodes confirmed by cytology from fine needle biopsy. Lymph node exceeding 5mm in long axis and with an S/L over 0.5 showed a higher incidence of metastasis than those with an S/L under 0.5.

**Chikui et al (2000) [58],** in their study stated that the presence of hilar echoes and hilar blood flow was seen in reactive lymph nodes and enlargement of the short axis diameter is predictive of metastatic cervical lymph nodes. Many other authors like Van den Brekel et al. suggested that there is indeed a slightly better outcome with ultrasound rather than computed tomography or magnetic resonance imaging, but it was not as precise as expected.

**Manfred Blum S (2005) [39],** stated that ultrasound can detect cancer that is metastatic to cervical lymph nodes with a sensitivity of 92.6%. The two most useful diagnostic characteristics are the ratio of longitudinal to the transverse diameter of the lymph node (L/T ratio) and the presence of central echogenic hilum.

**Anand et al (2006) [6]**, in their study showed ultrasound had 82% sensitivity and specificity of 92.5% in diagnosing the metastatic lymph nodes. They felt ultrasonography advantageous in having low cost, minimum stress to patients, ease of application and possibility of frequent repetition with no exposure to radiation.

**Thakur J S et al (2007) [56],** conducted the sensitivity and specificity of ultrasound in a study was 93.93% and 70% respectively. But ultrasonography has its own drawbacks. It is a dynamic investigation which is highly operator dependent and nodes smaller than 1 cm likely to be missed.

**Kim et al (2010) [34],** found that there was no significant difference between benign and malignant nodes in terms of their largest diameter, but there was marked difference in terms of their L/S (L/T) ratio which can be assessed without limitations only with ultrasound scanning. Since metastasis causes lymph node enlargement by malignant cell proliferation it alters the normal ovoid shape of the lymph node to a more spherical form, while benign processes tend to maintain the oval shape of the lymph node, in which enlargement occurs by benign lymphoid cell proliferation. The tendency of benign nodes to be "oval" (L/S >2) and malignant nodes to be "round" (L/S <2) has also been reported by other observers.

**Ashraf et al (2011) [8],** evaluated 534 patients for cervical lymph node metastasis and in their study; Doppler USG correctly identified 136 node-positive patients (n = 148; sensitivity 91.8%, specificity 97%). CT imaging correctly identified 122 patients with metastatic lymph nodes (n = 148; sensitivity-83%, specificity-93%). Positive predictive values of USG and CT imaging were 95.6% and 91.3%. They suggested that the accuracy and sensitivity of USG in detection of cervical lymph node metastasis make it a potentially promising and cheap preoperative tool for staging neck node metastases.

**Mahyar Ghafoori et al (2013) [21],** stated in the study that included 41 males and 22 females with a mean age of 57.56 ± 13.79 years. The number of metastatic lymph nodes was 47, while the remaining 16 were reactive. There

were significant differences in length (P = 0.037), width (P = 0.001), resistance index (P < 0.001), pulsatility index (P < 0.001) and systolic velocity (P < 0.001) of metastatic and reactive lymph nodes. Cut points for resistive and pulsatility indexes and systolic velocity were calculated as 0.695, 1.35 and 16.5, respectively. The most valuable factor for defining a lymph node as metastatic was circulation pattern with accuracy, sensitivity and specificity of 94%, 85% and 93%, respectively.

**Biatek EJ et al (2017) [12],** stated that the overall ultrasound picture along with all criteria for the assessment of a lymph node should be taken into account during ultrasound imaging. It seems that the safest management is to refer patients diagnosed with lymph node abnormalities for ultrasound-guided targeted fine needle aspiration biopsy followed by a total lymph node resection for histopathological examination in the case of suspected lymphoma.

## ULTRASOUND GUIDED FINE NEEDLE ASPIRATION CYTOLOGY

**Patra et al (1983) [45]**, stated that FNAC has been found to be much simpler than the lymph node biopsy. By FNAC, high accuracy was achieved, with the cervical lymph node being the most commonly involved group, of which adenocarcinomas and squamous carcinomas comprised the commonest pathology in many of those cases, a cytological diagnosis was adequate in making the choice of the treatment plan.

**Van den Brekel et al (1993)** [62], compared CT, MRI, US and US-FNAC in N0 head and neck squamous cell carcinoma. The study population was 132 patients who underwent a total of 180 neck dissections including 88 that were clinically N0. In the N0 subgroup, the US criteria for malignancy were based on size with a cut-off of 8 mm (9 mm for level Ib) and grouping of three or more borderline lymph nodes. The criteria for CT and MRI included a size cut-off of 7 mm, the presence of necrosis and grouping as above. US-FNAC was performed on any node with minimum short axis diameter of 4 mm. In this group of patients US-FNAC performed significantly better than any other technique with a sensitivity of 73%, specificity of 100% and accuracy of 86% compared to 68% for US alone, 66% for CT and 75% for MRI.

**Righi et al (1996)** [49], in their study of twenty-five patients have shown equal efficacy of ultrasound fine needle aspiration cytology (US-FNAC) and CT scan. US-FNAC is 100% specific for nodal metastases in head and neck squamous cell carcinoma. They also reported similar accuracy, CT about 87.9% and US- FNAC about 84.9%.

**Henry et al (1997)** [26]**,** in their study of tongue swellings and growths of seventy-five lesions which were examined by Fine Needle Aspiration Cytology for the period of 11 years. The lesions included seventeen malignant tumours, fifteen benign tumours and forty-three non-neoplastic benign conditions. Thirteen of the seventeen malignant lesions were diagnosed cytologically as malignant, three suspicious for malignancy and one as atypical with biopsy

recommended. There were no false positive diagnoses. They concluded that this method as the first diagnostic step in the evaluation of tongue swellings.

**Melek Ustun et al (2002) [40],** in their study reported that FNAC which is highly useful in diagnosing the metastatic cervical nodes. They stated that it was safe and inexpensive outpatient diagnostic procedure with accuracy in malignant lymphadenopathy that exceeds 90%. They carry a false positive and false negative rate less than 1% - 3%.

**Nicholas et al (2002) [43],** stated in their study consists of two hundred sixty ultrasound core biopsies were performed in 247 patients with cervicofacial lymphadenopathy. In 28 patients, the histologic diagnosis was considered highly probable. In the 210 patients in whom adequate material was obtained and an unequivocal histologic diagnosis was given, the sensitivity, specificity and accuracy of ultrasound guided core needle biopsy in differentiating benign from malignant lymphadenopathy were 98.1%, 100% and 98.7% respectively. Seventy biopsies were performed in sixty-six patients with lymphoma. Sensitivity, specificity and accuracy in differentiating lymphoma from reactive lymphadenopathy were 98.5%, 100% and 98.7% respectively.

**Gupta N et al (2006) [23],** in their study they reported that left supraclavicular lymph nodes were commonly involved. 64 cases showed metastatic deposits and 13.5 % of cases were diagnosed as tuberculosis. 10% of cases showed reactive lymphoid hyperplasia, 0.5 % case showed necrosis. In

7.5% cases, diagnostic material could not be aspirated after many attempts. The common metastatic tumours were from lung, breast, cervix and oesophagus. In 13.3 % cases the primary site was unknown and the diagnosis of malignancy obtained from the FNAC.

**Alam K et al (2009) [5],** studied 275 patients who had enlarged lymph nodes with a clinical suspicion of primary or secondary malignancy, the FNAC of 221 cases (80.4%) were metastatic tumors of lymph node while 42 cases (15.3%) were primary tumors. The primary site of malignancy had been identified in approximately 90% of cases of metastasis with the help of FNAC and clinical data.

**Liao et al (2012) [38],** in their systemic review and meta-analysis suggested that Ultrasound guided Fine Needle Aspiration Cytology has a very high specificity and if the US-FNAC cytology had a positive result, almost all of the histology specimen results also proved positive. Therefore, they suggested ultrasound is preferred for neck follow up in watchful waiting patients; and US-FNAC can be performed if nodal metastasis is suspected.

# *Materials and Methods*

## MATERIALS AND METHODOLOGY:

### STUDY DESIGN

This study is to differentiate metastatic from reactive cervical lymph nodes by Greyscale Ultrasonography which was confirmed with FNAC (Fine Needle Aspiration Cytology) was conducted in the Department of Oral Medicine and Radiology, Ragas Dental College and Hospital, Chennai, Tamilnadu.

### STUDY POPULATION

Includes all patients reporting to Dr. Rai Memorial Cancer Institute, Outpatient Department, Teynampet seeking service and who are from a wide variety of socioeconomic background.

### STUDY SAMPLE

Subject of the present study consists of thirty patients reporting to Ragas Dental College and Hospital, and Dr. Rai Memorial Cancer Institute, Outpatient Department, divided into three groups Group I as healthy controls, Group II as patients with head and neck infections, Group III includes patients with head and neck malignancies.

**INCLUSION CRITERIA**

**GROUP I**

1. Consists of ten patients reporting to the Ragas Dental College and Hospital, Outpatient Department for dental check-up without signs and symptoms of infection and neoplasm.
2. Consent from the patient/guardian was obtained in writing.

**GROUP II**

1. Group consists of ten patients with signs and symptoms of infection in head and neck region. Such with diffuse swelling of face, diffuse swelling in dento alveolar region with cervical lymph node involvement, showing clinical signs of reactive lymphadenitis.
2. Consent from the patient/guardian was obtained in writing.

**GROUP III**

1. Comprises of ten patients with signs and symptoms of neoplasm of head and neck region such as Hoarseness persisting for > 6 weeks, Ulceration of oral mucosa persisting > 3 weeks, Oral swelling persisting > 3 weeks, all red or red and white patches on the oral mucosa, Dysphagia persisting > 3 weeks, Unilateral nasal obstruction particularly when associated with purulent discharge, Unexplained tooth mobility not associated with

periodontal disease, Unresolved neck masses for > 3 weeks, Cranial neuropathies, Orbital masses with cervical node involvement which shows clinical signs of metastases.

2. Consent from the patient/guardian was obtained in writing.

**EXCLUSION CRITERIA**

**GROUP I**

Patients with lesion in the head and neck region with palpable cervical lymph nodes

**GROUP II**

Patients with primary malignancy in head and neck region and signs of malignancy and metastatic cervical lymph nodes such as fixed nodes.

**GROUP III**

Patients with no signs of malignancy and metastatic cervical lymph nodes such as fixed nodes.

**OBTAINING APPROVAL FROM AUTHORITIES**

Permission from the ethical committee of the Ragas Dental Hospital was obtained before starting the study for interrogating and examining patients and

also for ultra sonographic scanning and to perform FNAC from the involved cervical lymph nodes.

**MATERIALS**

1.For examining the patients

a) Physiological dental chair with provision for artificial illumination
b) Mouth mask
c) Sterile glove
d) Mouth mirror
e) Explorer
f) Periodontal probe
g) Kidney tray
h) Cotton
i) Tweezers

2.For Grey Scale ultrasonography procedure

a) GE Sonography System
b) 7.5 MHZ linear scanner
c) Sonography gel

3.For FNAC Procedure

a) Sterile Glove
b) Kidney tray
c) Cotton
d) Tweezers
e) 19 G Needle with 5ml syringe
f) Lignocaine HCL with 1:80000 adrenaline
g) Glass slides
h) 10% formalin solution

**METHODOLOGY**

Patients were subjected to clinical examination before Ultrasonography Scanning and FNAC procedure.

**PROCEDURE FOR ULTRA SONOGRAPHIC SCANNING OF CERVICAL LYMPH NODES**

For sonographic examination patient was laid supine in the bed with neck extended and turned to the side to be examined. Sonographic gel was applied over the involved lymph nodal region for proper conductance of the sound waves. The 7.5 MHz linear scanning probe was positioned over the involved lymph node and it was slowly moved over it in upward direction and down ward direction gently

and slowly moved over it in whole lymph node structure was examined in both transverse and longitudinal section to search the minimal and maximal diameter, presence of hilum, parenchymal echogenicity, calcification, nodal borders, shape and size. After this the frame was freezed on the screen and photograph was taken.

**PROCEDURE FOR FNAC**

On the appointment day during the procedure for the selected patients, Fine needle aspiration was done in the involved cervical lymph node for histopathological examination under aseptic condition. After anaesthetizing the subject with local anaesthesia of 2% lignocaine HCL with sterile 19G needle and 2ml disposable sterile syringe 0.5 ml of lymph fluid was aspirated from the involved cervical lymph node and the smear was given to the Department of Pathology for histopathological examination.

**HAEMATOLOGICAL EXAMINATION**

The samples collected from group I, II and III patients were subjected to haematological examination such a total leucocytic count, Differential leucocytic count, Haemoglobin % distribution and Erythrocytic Sedimentation rate.

**GREY SCALE SONOGRAPHIC FEATURES FOR DIAGNOSIS OF CERVICAL IMPHADENOPATHY**

All sonographically detectable lymph nodes in each region were assessed for

1. Size (maximum transverse diameter)
2. Shape (short axis/long axis)
3. Echogenic hilus
4. Nodal borders
5. Internal Echogenicity
6. Nodal Necrosis

**SIZE**

Size of the lymph nodes were measured by measuring maximal transverse diameter of the largest involved cervical lymph node. Malignant nodes tend to be larger. Inflammatory nodes can be as large as malignant nodes. Moreover, metastatic deposit could be found in small nodes. Therefore, size of lymph nodes cannot be used as the sole criterion in differential diagnosis. However, in clinical practice, size of lymph nodes are useful when there is an increase in nodal size on serial examination in a patient with known primary tumour, which is highly suggestive for metastases. Also, serial change in size of malignant nodes are useful in monitoring patient's response to treatment.

**SHAPE**

Nodal shape should be considered as the sole criterion in the diagnosis. The shape of lymph nodes was determined by the ratio of the short and long axes, which were measured in a plane showing the maximum cross-sectional area of the lymph node under examination. A short axis- long axis ratio of less than 0.6 indicated a long or oval node, whereas a ratio of 0.6 or greater indicates a round node. Malignant nodes are usually round in shape with a short axis to long axis (S/L) ratio greater than or equal to 0.6, whereas reactive and normal nodes are usually long or oval-shaped. It has been reported that normal submandibular and parotid nodes tend to be round in shape.

**NODAL BORDER**

Classified as sharp or smooth; metastatic nodes tend to have sharp borders, whereas reactive and normal nodes usually show smooth borders. The sharp borders in malignant nodes are believed to be due to tumour infiltration and the reduced fatty deposition within the lymph nodes which increase the acoustic impedance difference between the lymph node and these are due to the oedema and inflammation of the surrounding soft tissue.

**ECHOGENICITY**

Classified as hypoechoic or hyperechoic; normal, and reactive lymph nodes are predominantly hypoechoic when compared with the adjacent muscles.

Metastatic nodes are usually hyperechoic when compared with the adjacent muscles.

**INTRANODAL NECROSIS**

Lymph nodes with intranodal necrosis are considered to be pathologic. Intranodal necrosis can be classified into coagulation necrosis and cystic necrosis, where cystic necrosis is more common than coagulation necrosis. Coagulation necrosis appears as an intranodal echogenic focus, whilst cystic necrosis appears as an echo lucent area within the lymph nodes. Cystic necrosis is commonly found in metastatic nodes from squamous cell carcinomas.

**STATISTICS FOLLOWED**

Statistical analysis using SPSS software V21.0 were done. The test used was Chi Square Test.

# *Figures*

**Fig.2: Armamentarium for Clinical Examination**

**Fig.3: Armamentarium for Greyscale Ultrasonography examination**

**Fig.4: Armamentarium for FNAC Examination**

**Fig.5: Clinical picture of squamous cell carcinoma in left buccal mucosa and alveolar mucosa**

**Fig.6: Greyscale ultrasonographic scanning procedure on cervical lymph nodes**

**Fig.7 : FNAC procedure on involved cervical lymph nodes**

**Fig.8 :Ultrasound images of normal cervical lymph nodes**

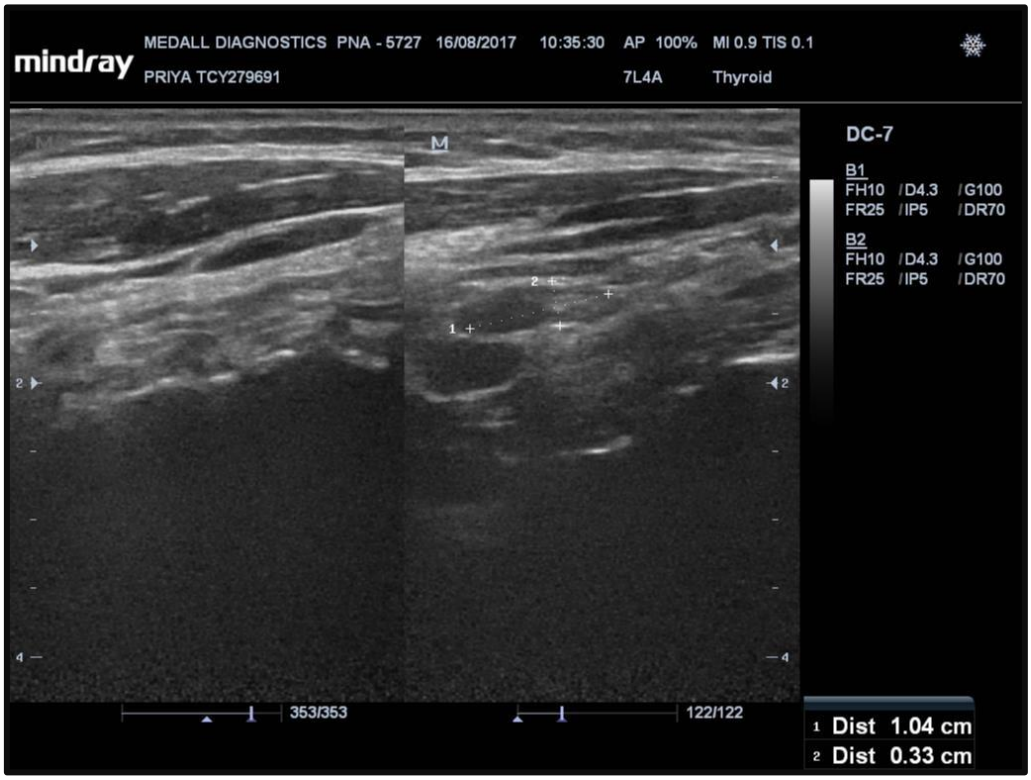


**Fig.9: Ultrasound images of reactive cervical lymph nodes**

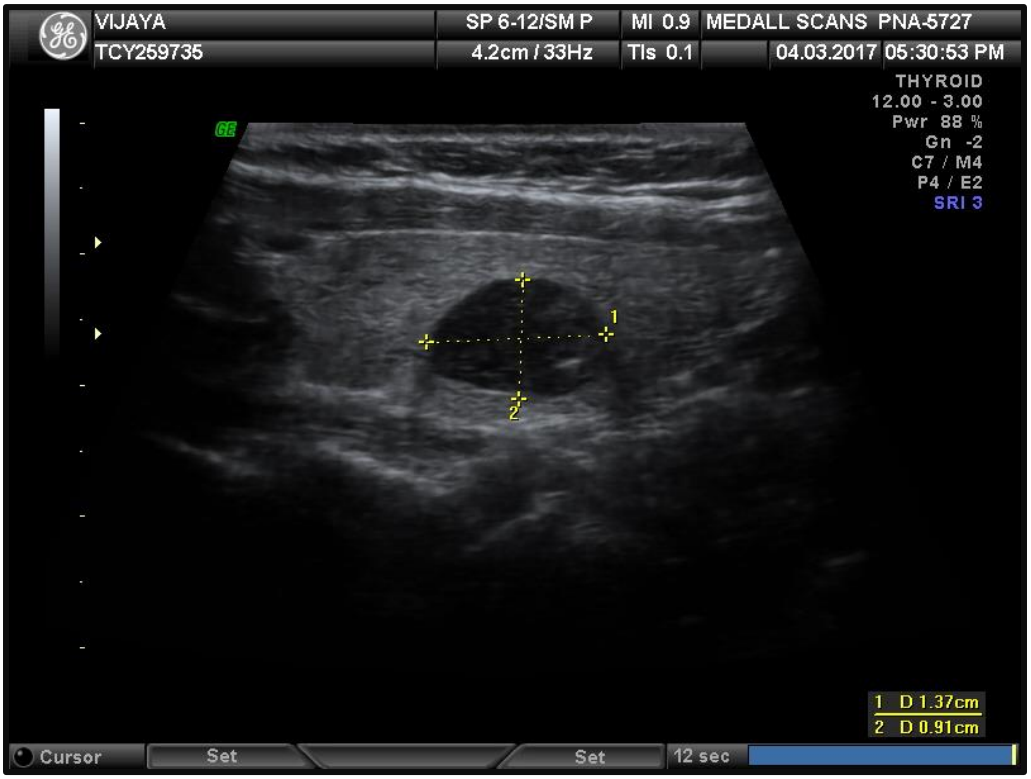
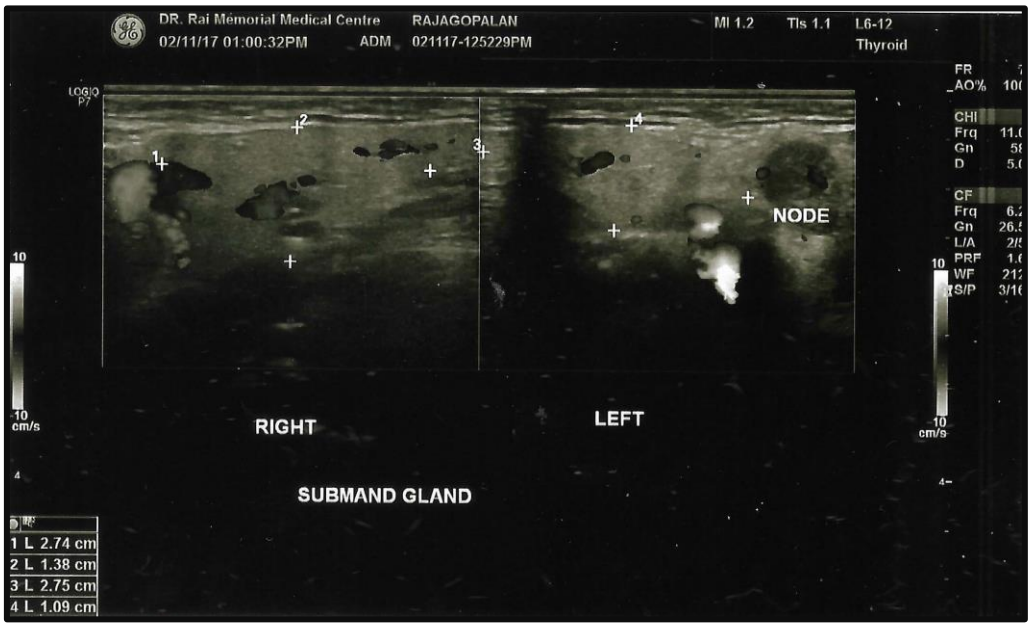


**Fig.10: Ultrasound images of metastatic cervical lymph nodes**



# Results

## RESULTS

In the present study, a total number of 30 subjects were studied. They were divided into 3 groups. The study was conducted in Ragas Dental College and Hospital, Uthandi, Chennai and Dr. Rai Memorial Cancer Institute, Teynampet, Chennai.

### Group I

The control group consisted of 10 healthy individuals without any signs of infections in head and neck region

### Group II

Group II consisted of 10 patients who had reactive cervical lymph nodes due to infections in the head and neck region

### Group III

Group III consisted of 10 patients who had metastatic cervical lymph nodes due to malignancy in the head and neck region

Group I consisted of 10 individuals of whom 6 were females and 4 were males. Group II consisted of 10 patients of whom 4 were females and 6 were males. Group III consisted of 10 patients of whom all of them were males. The mean age for Group I, Group II, Group III were 25.9±4.22, 36.9±5.17, 61.2±13.49 respectively.

In our study, Group I individuals none of them had any pathology in the head and neck region and there were no palpable lymph nodes. Group II patients all of them had dental pathologies and had the presence of soft, mobile, tender unilateral submandibular lymph nodes. Group III 6 patients had squamous cell carcinoma of buccal mucosa among those 4 patients had metastatic, firm, fixed, non-tender unilateral submandibular lymph node and 1 patient had bilateral metastatic firm, fixed, non-tender submandibular lymph nodes and 1 patient had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes, 2 patients with squamous cell carcinoma of alveolus had metastatic firm, fixed, nontender unilateral submandibular cervical lymph node, 1 patient with squamous cell carcinoma of palate had metastatic firm, fixed, non-tender bilateral submandibular cervical lymph nodes, 1 patient with squamous cell carcinoma of the tongue had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes.

Regarding size grayscale ultrasonography revealed that in Group I healthy individuals with normal cervical lymph node and the mean value of size of the lymph node is 0.91 cm. In Group II patients with reactive cervical lymph node and the mean value of the size of the cervical lymph node is 1.37 cm. In Group III patients with metastatic cervical lymph node and the mean value of the involved cervical lymph node is 2.54 cm.

Regarding shape greyscale ultrasonography revealed that in Group I, 9 individuals had oval shape (90%) and 1 individual had round shape (10%) of selected normal cervical lymph node. In Group II 8 patients had oval shape (80%) and 2 patients had round shape (20%) in the involved cervical lymph node. In Group III 2 patients had oval shape (20%) and 8 patients had round shape (80%) in the involved cervical lymph node with significant p value 0.002

Regarding nodal borders greyscale ultrasonography revealed that in Group I all the 10 individuals had smooth nodal borders of selected normal cervical lymph node (100%). In Group II all the 10 patients had smooth nodal border of the involved reactive cervical lymph node (100%). In group III all the 10 patients had sharp nodal border of the involved metastatic cervical lymph node with significant p value 0.000

Regarding hilar echo greyscale ultrasonography revealed that in Group I, 6 individuals had presence of hilar echogenicity (60%) and 4 individuals had absence of hilar echogenicity (40%). In Group II all the 10 patients had presence of hilar echogenicity (100%). In Group III all the patients had absence of hilar echogenicity (100%) with significant p value 0.00

Regarding internal echogenicity pattern greyscale ultrasonography revealed that in Group I 8 individuals had hypoechoic pattern and 2 individuals had hyperechoic pattern of the selected cervical lymph nodes. In Group II 7 patients had hypoechoic pattern and 3 patients had hyperechoic

pattern of the involved reactive cervical lymph node. Group III all the 10 patients had hyperechoic pattern with significant p value 0.001

Regarding intranodal necrosis greyscale ultrasonography revealed that in Group I all the individuals had absence of intranodal necrosis in the selected normal cervical lymph node. In Group II patients had absence of intranodal necrosis in the involved reactive cervical lymph nodes. In Group III 6 patients had intranodal necrosis in the metastatic cervical lymph node and 4 patients had no intranodal necrosis in the involved metastatic cervical lymph node with significant p value 0.001

The FNAC of given specimens from the Group II patients showed moderate cellularity composed of polymorphous population of lymphoid cells, few macrophages against a fibrinous and hemorrhagic background which confirmed reactive cervical lymph nodes. In Group III patients showed clusters and sheets of malignant cells having enlarged pleomorphic and hyperchromatic nuclei and moderate amount of eosinophilic cytoplasm in a hemorrhagic background which confirmed metastatic cervical lymph nodes.

The sensitivity and specificity of greyscale ultrasonography in differentiating reactive cervical lymph nodes from metastatic cervical lymph nodes using six parameters were for size 86.1% and 68.8% respectively, for shape 92.2% and 86.5% respectively, for border 96% and 97 % respectively, for hilum 100% and 100% respectively and for internal echogenicity 77% and 100% respectively, for intranodal necrosis 41.2% and 100% respectively.

# *Tables and Graphs*

**TABLE - 1**

**AGE DISTRIBUTION IN RELATION TO GROUP I, II, III**

| Groups | Mean age |
|---|---|
| I | 25.9±4.22 |
| II | 36.9±5.17 |
| III | 61.2±13.49 |

**P value 0.01**

**TABLE - 2**

**GENDER DISTRIBUTION IN RELATION TO GROUP I, II, III**

| Group | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 4 | 40 | 6 | 60 | 10 | 100 |
| II | 6 | 60 | 4 | 40 | 10 | 100 |
| III | 10 | 100 | 0 | 0 | 10 | 100 |

**P Value 0.01**

**TABLE - 3**

**DISTRIBUTION OF HILAR ECHO IN RELATION TO GROUP I, II, III**

| GROUP | PRESENT | | ABSENT | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 6 | 60 | 4 | 40 | 10 | 100 |
| II | 10 | 90 | 0 | 10 | 10 | 100 |
| III | 0 | 0 | 10 | 100 | 10 | 100 |

**P value 0.00**

**TABLE - 4**

**DISTRIBUTION OF SHAPE OF LYMPH NODES IN RELATION TO GROUP I, II, III**

| GROUP | OVAL | | ROUND | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 9 | 90 | 1 | 10 | 10 | 100 |
| II | 8 | 80 | 2 | 20 | 10 | 100 |
| III | 2 | 20 | 8 | 80 | 10 | 100 |

**P value 0.002**

**TABLE - 5**

**DISTRIBUTION OF BORDER OF THE LYMPH NODES**

**IN RELATION TO GROUP I, II, III**

| GROUP | SMOOTH | | SHARP | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 10 | 100 | 0 | 0 | 10 | 100 |
| II | 10 | 100 | 0 | 0 | 10 | 100 |
| III | 0 | 0 | 10 | 100 | 10 | 100 |

**P value 0.000**

**TABLE - 6**

**DISTRIBUTION OF ECHOGENICITY OF LYMPH NODES IN RELATION TO GROUP I, II, III**

| GROUP | HYPOECHOIC | | HYPERECHOIC | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 8 | 80 | 2 | 0 | 10 | 100 |
| II | 7 | 70 | 3 | 30 | 10 | 100 |
| III | 0 | 0 | 10 | 100 | 10 | 100 |

**P value 0.001**

**TABLE - 7**

**DISTRIBUTION OF INTRANODAL NECROSIS IN RELATION TO GROUP I, II, III**

| GROUP | PRESENT | | ABSENT | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 0 | 0 | 10 | 100 | 10 | 100 |
| II | 0 | 0 | 10 | 100 | 10 | 100 |
| III | 6 | 60 | 4 | 40 | 10 | 100 |

**P value 0.001**

**TABLE – 8**

**COMPARISON OF ULTRASONOGRAPHY WITH FNAC IN PATIENT WITH REACTIVE CERVICAL LYMPH NODE**

| GROUP | PRESENT | | ABSENT | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 0 | 0 | 10 | 100 | 10 | 100 |
| II | 10 | 100 | 0 | 0 | 10 | 100 |
| III | 0 | 0 | 10 | 100 | 10 | 100 |

**P value 0.000**

**TABLE - 9**

**COMPARISON OF ULTRASONOGRAPHY WITH FNAC IN PATIENTS WITH METASTATIC LYMPH NODES**

| GROUP | PRESENT | | ABSENT | | TOTAL | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| I | 0 | 0 | 10 | 100 | 10 | 100 |
| II | 0 | 0 | 10 | 100 | 10 | 100 |
| III | 10 | 100 | 0 | 0 | 10 | 100 |

**P value 0.000**

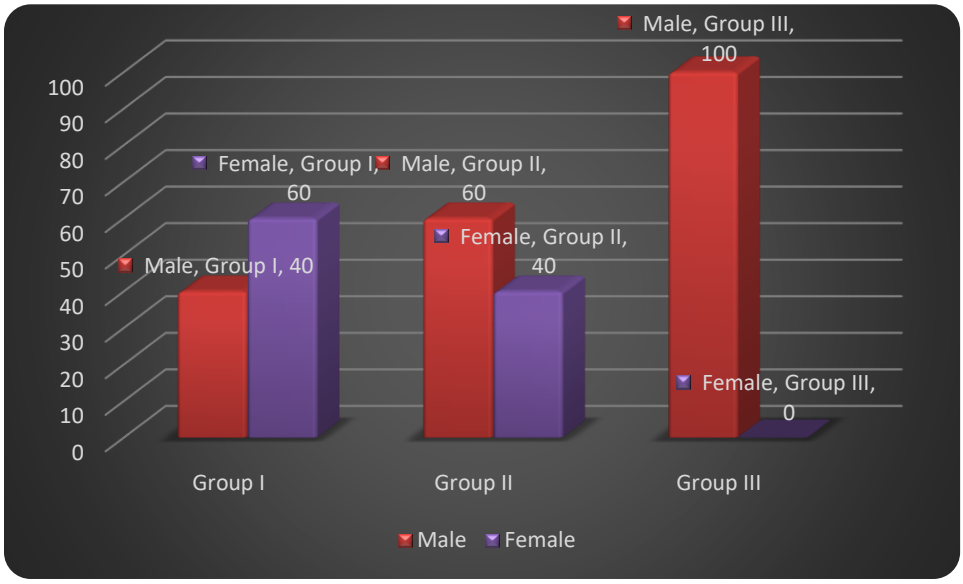
**TABLE – 10**

**SENSITIVITY AND SPECIFICITY OF ULTRASONOGRAPHY IN DIFFERENTIATING METASTATIC FROM REACTIVE CERVICAL GROUP OF LYMPH NODES**

| PARAMETERS | SENSITIVITY | SPECIFICITY |
|---|---|---|
| Size | 86.1% | 68.8% |
| Shape | 92.2% | 86.5% |
| Border | 96% | 97% |
| Hilum | 100% | 100% |
| Echogenicity | 77% | 100% |
| Necrosis | 41.2% | 100% |

**GRAPH - 1**

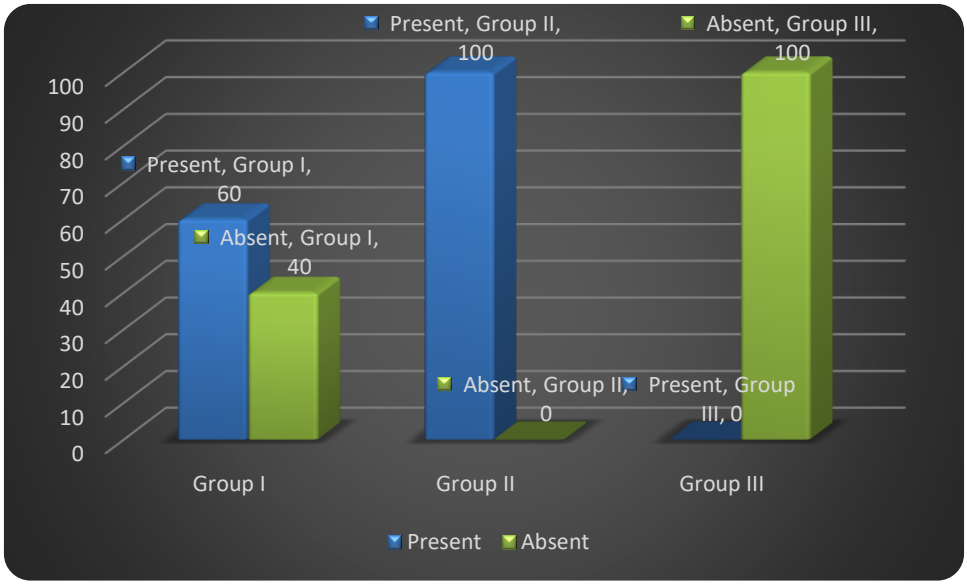
**GENDER DISTRIBUTION IN RELATION TO GROUP I, II, III**



**GRAPH - 2**

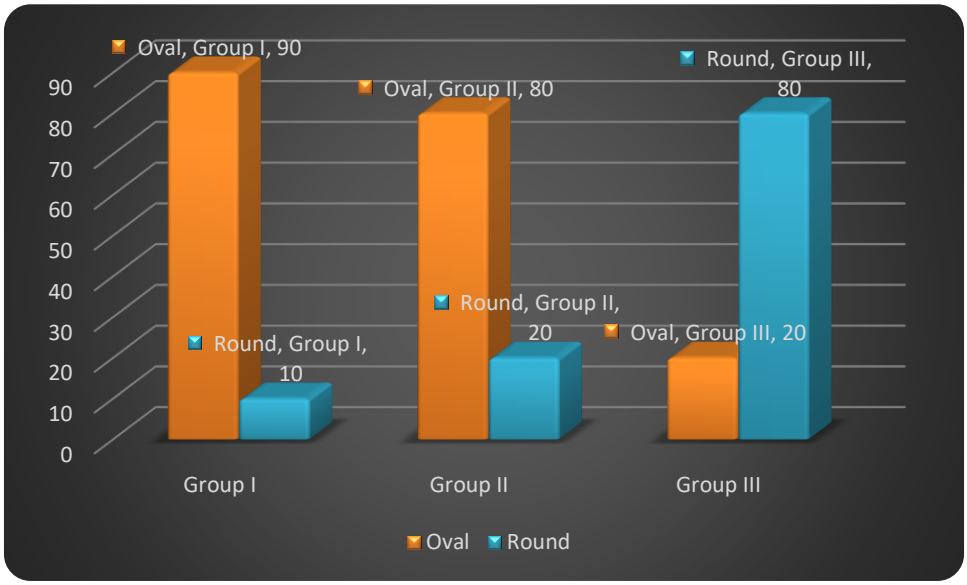
**DISTRIBUTION OF HILAR ECHO IN RELATION TO**

**GROUP I, II, III**



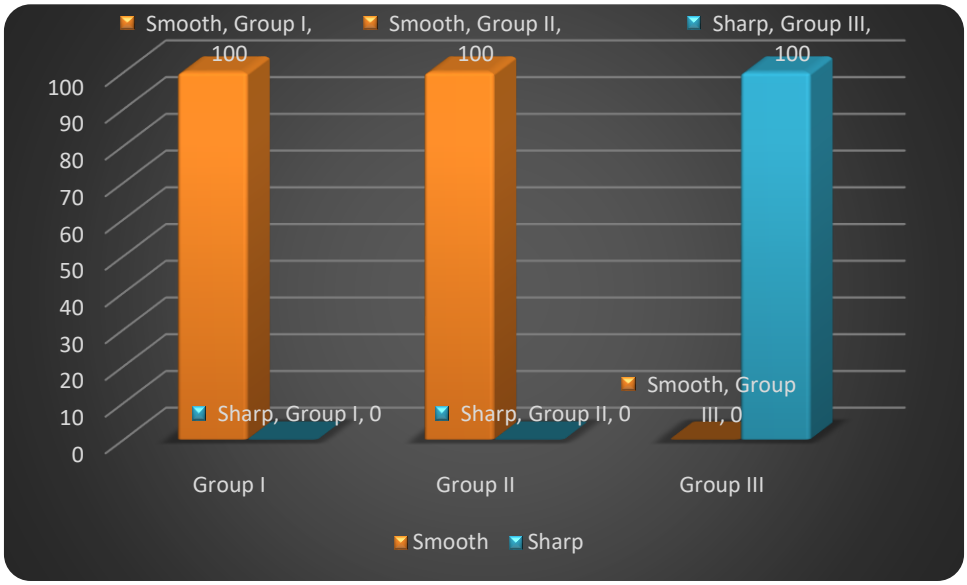
**GRAPH – 3**

**DISTRIBUTION OF SHAPE OF LYMPH NODES IN RELATION TO GROUP I, II, III**



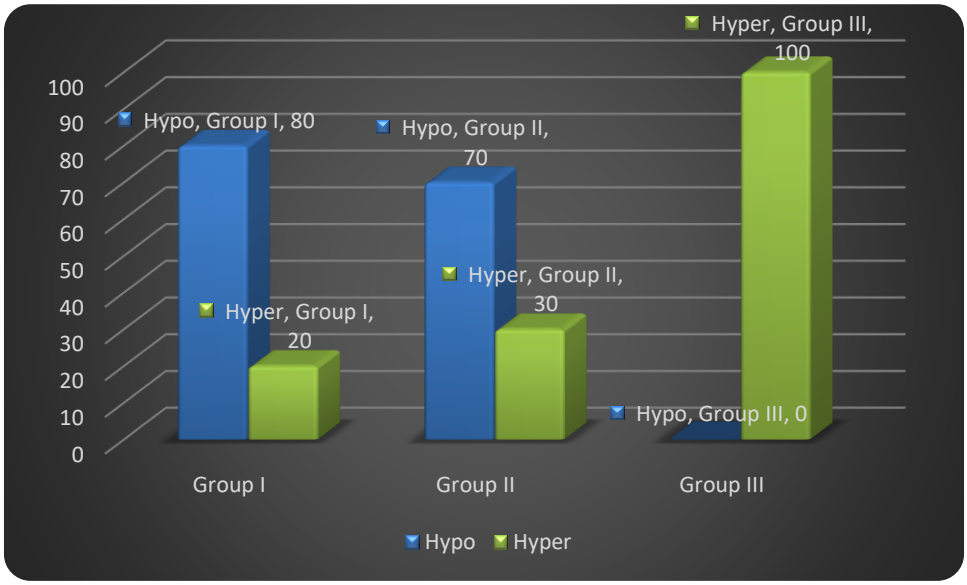
**GRAPH – 4**

**DISTRIBUTION OF BORDER OF THE LYMPH NODES IN RELATION TO GROUP I, II, III**



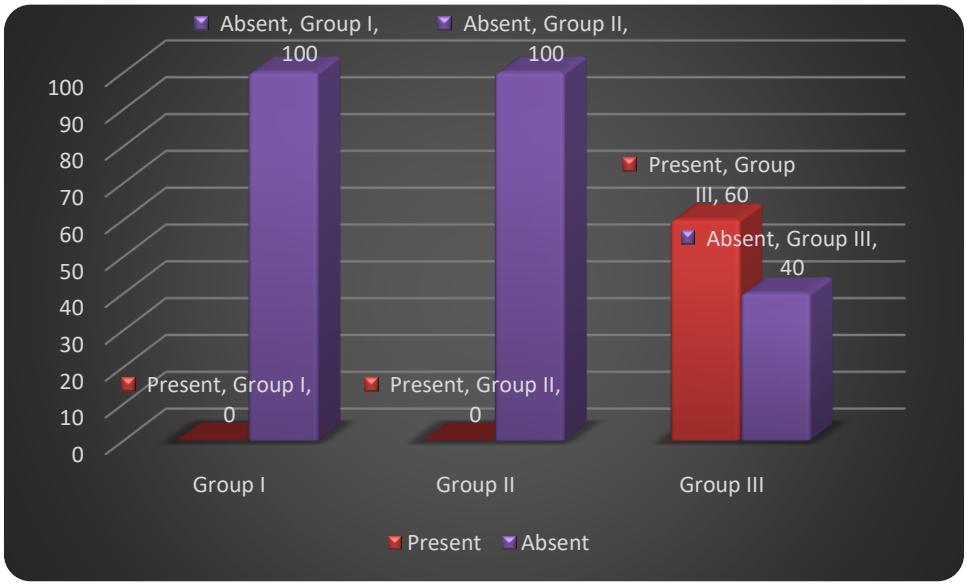
**GRAPH – 5**

**DISTRIBUTION OF ECHOGENICITY OF LYMPH NODES IN RELATION TO GROUP I, II, III**



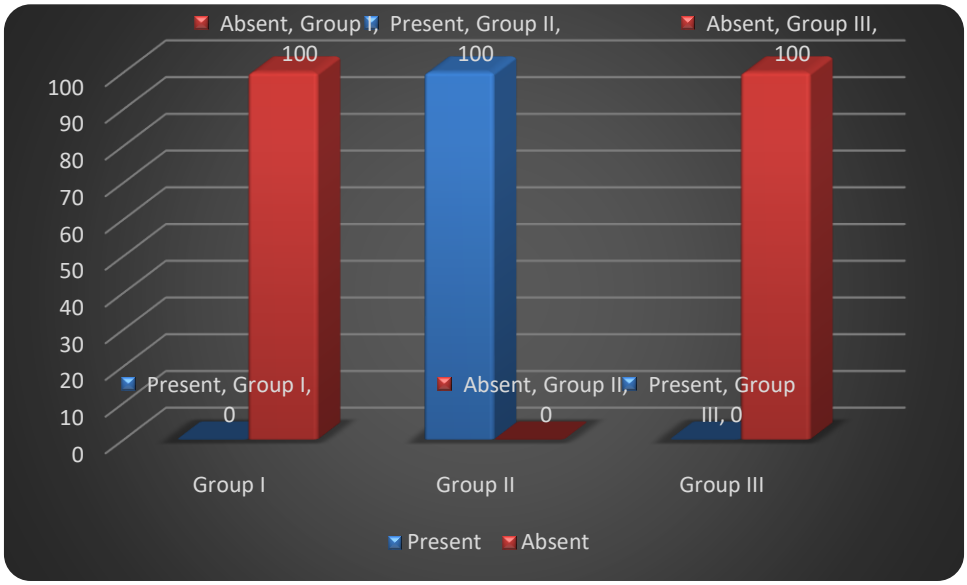
## GRAPH - 6

## DISTRIBUTION OF INTRANODAL NECROSIS IN RELATION TO GROUP I, II, III



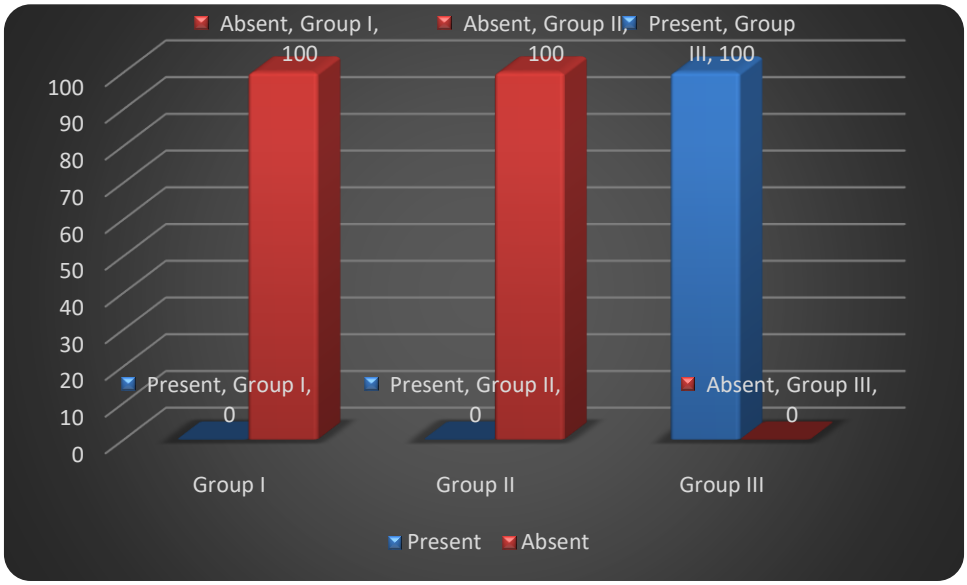
**GRAPH – 7**

**COMPARISON OF ULTRASONOGRAPHY WITH FNAC IN PATIENTS WITH REACTIVE LYMPH NODES**



## GRAPH – 8

## COMPARISON OF ULTRASONOGRAPHY WITH FNAC IN PATIENTS WITH METASTATIC LYMPH NODES



# *Discussion*

## DISCUSSION

The clinical examination of the cervical lymph nodes is very difficult as there are about 300 lymph nodes are present in the cervical portion of the neck. Metastases in cervical lymph nodes are common in the head and neck malignancies. [55]

In our study, Group I individuals none of them had any pathology in the head and neck region and there were no palpable lymph nodes. Group II patients all of them had dental pathologies and had the presence of soft, mobile, tender unilateral submandibular lymph nodes. Group III 6 patients had squamous cell carcinoma of buccal mucosa among those 4 patients had metastatic, firm, fixed, non-tender unilateral submandibular lymph node and 1 patient had bilateral metastatic firm, fixed, non-tender submandibular lymph nodes and 1 patient had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes, 2 patients with squamous cell carcinoma of alveolus had metastatic firm, fixed, nontender unilateral submandibular cervical lymph node, 1 patient with squamous cell carcinoma of palate had metastatic firm, fixed, non-tender bilateral submandibular cervical lymph nodes, 1 patient with squamous cell carcinoma of the tongue had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes.

**Rajalakshmi C et al (2014)** [47], in their study reported that the presence of an ipsilateral metastatic cervical lymph nodes reduces the survival rate to 50% and the presence of bilateral metastatic cervical lymph nodes reduces the survival rate to 25%. Therefore, the evaluation of cervical lymph nodes is crucial in differentiating the reactive from metastatic cervical nodes for patients with head and neck malignancies. It helps in the assessment of patients for proper diagnosis and treatment planning.

**Battenburg de Jong RJ et al (1989)** [9], in their study reported that ultrasound is a useful imaging modality in assessing the metastatic cervical lymph nodes. When the greyscale ultrasonography is combined with the fine needle aspiration cytology it has high sensitivity and specificity of 98% and 95% respectively.

Greyscale ultrasonography was used in this study to differentiate the normal, reactive and metastatic cervical lymph nodes by using the six parameters such as **size, shape, nodal borders, presence of echogenic hilum, pattern of internal echogenicity and intranodal necrosis**. The following authors **Hiroshia Yusha(1999)** [70]**, Toruchikui (2000)** [58]**, Pedro Weslley souza Rosario( 2005)** [46]**, Micheal T C Ying, Anil T Ahuja(2006)** [4]**, Rajalakshmi C(2014)**[47] had advocated the greyscale ultrasonography criteria to differentiate reactive from metastatic cervical lymph nodes.

**Micheal T C Ying, Anil T Ahuja(2006) [4],** In a literature, they have reported that the metastatic lymph nodes tend to be larger. However, the reactive cervical lymph nodes can be as large as metastatic cervical lymph nodes. Moreover, the metastatic deposit can be also found even in the smaller nodes. Thus, the size of the lymph node can be used as a criterion in the differential diagnosis. We can also evaluate the size of the node in monitoring patient's response to the treatment.

Metastatic cervical lymph nodes are usually round whereas the normal and reactive cervical lymph nodes are usually oval. But it also has been reported that normal submandibular and parotid lymph nodes tend to be round. Thus, the nodal shape should also be considered in the diagnosis.

Metastatic cervical lymph nodes tend to have sharp borders whereas normal and reactive cervical lymph nodes tend to have smooth borders. The sharp border of the metastatic cervical lymph node is due to the infiltration of the malignant cells and also as a result of reduced fatty deposition which causes the increase acoustic imprudence between the lymph node and the surrounding tissues. In reactive cervical lymph nodes, the smooth border is due to the edema and the inflammation of the surrounding tissues.

In greyscale ultrasonography the presence of hilum is considered as a feature of reactive lymph nodes and sometimes also can be noticed in the

normal lymph nodes. The hilum is completely absent in the metastatic lymph nodes.

The pattern of internal echogenicity varies, in normal and reactive cervical lymph nodes are predominantly hypoechoic when compared with the adjacent structures whereas the metastatic cervical lymph nodes tend to be hyperechoic.

The presence of intranodal necrosis is invariably seen in metastatic cervical lymph nodes. The intranodal necrosis can be classified into two types such as coagulation necrosis and cystic necrosis. Cystic necrosis is most commonly found in metastatic cervical lymph nodes from squamous cell carcinoma and can be seen in case of papillary carcinoma of thyroid.

In our study the results were interpreted by using chi- square test with SPSS 21.0

Grayscale ultrasonography with respect to size revealed that in Group I individuals with normal cervical lymph node and the mean value of size of the lymph node is **0.91 cm**. In Group II patients with reactive cervical lymph node and the mean value of the size of the cervical lymph node is **1.37 cm**. In Group III patients with metastatic cervical lymph node and the mean value of the involved cervical lymph node is **2.54 cm**. These results were compared with the results given by **Hajek et al (1989) [24].**

Greyscale ultrasonography with respect to shape revealed that in Group I, 90% individuals had oval shape and 10% individual had round shape of selected normal cervical lymph node. In Group II 80% of the patients had oval shape and 20% of the patients had round shape in the involved cervical lymph node. In Group III 20% of the patients had oval shape and 80% of the patients had round shape in the involved cervical lymph node with significant **p value (P=0.002)** which is comparable with the findings given by **Hiroshi Yusha (1999)** [70] who reported that metastatic lymph node was round while reactive lymph node were oval shape. **Toriyabe et al (1997)** [57] found that 81% of the metastatic cervical lymph nodes were round.

Greyscale ultrasonography with respect to nodal borders revealed that in Group I 100% of the individuals had smooth nodal borders of selected normal cervical lymph node. In Group II 100% of the patients had smooth nodal border of the involved reactive cervical lymph node**.** In group III 100% of the patients had sharp nodal border of the involved metastatic cervical lymph node with significant **p value (P= 0.000).** Comparable results were reported by. **Hiroshi Yusha (1999)** [70] found 74% of the metastatic cervical lymph nodes had round nodal borders 100% of the reactive cervical lymph nodes had smooth borders in their studies. Similar results found by **Ahuja and Ying (2005)** [4]**.** They have reported that 94% of the metastatic lymph node had sharp nodal borders and 100% of the reactive cervical lymph nodes had smooth borders

Greyscale ultrasonography with respect to hilar echo revealed that in Group I, 60% of the individuals had presence of hilar echogenicity and 40% of the individuals had absence of hilar echogenicity**.** In Group II all the 10 patients had presence of hilar echogenicity**.** In Group III 100% of the patients had absence of hilar echogenicity with significant **p value (P= 0.00).** This result was compared with the results given by **Hiroshi Yusha (1999) [70]** where he found 97% absence of hilar echo in metastatic lymph nodes and 73% in reactive cervical lymph nodes with P value < 0.001. **Ying et al (2002) [1]** found that the echogenic hilum is found to be a normal feature of cervical lymph nodes in 96% of the cases. They have also stated that the presence of hilum can be seen in early cases of malignancy and it has lost its pattern during the advanced stages

Greyscale ultrasonography with respect to internal echogenicity revealed that in Group I 80% of the individuals had hypoechoic pattern and 20% of the individuals had hyperechoic pattern of the selected cervical lymph nodes. Group II 70% of the patients had hypoechoic pattern and 30% of the patients had hyperechoic pattern of the involved reactive cervical lymph node. Group III 100% of the patients had hyperechoic pattern with significant **p value (P= 0.001)** which was compared with the results given by **Hiroshi Yusha (1999) [70]** who found that internal echogenicity of metastatic cervical lymph nodes was 86% hyperechoic and reactive cervical lymph nodes was 2% hyperechoic in their study.

Greyscale ultrasonography with respect to intranodal necrosis revealed that in Group I 100% of the individuals had absence of intranodal necrosis in the selected normal cervical lymph node. In Group II 100% of the patients had absence of intranodal necrosis in the involved reactive cervical lymph nodes. In Group III 60% of the patients had intranodal necrosis in the metastatic cervical lymph node and 40% of the patients had absence of intranodal necrosis in the involved metastatic cervical lymph node with significant **p value (P= 0.001).** This result was compared with report given by **Rajalakshmi et al (2014)** [47] who found 26.67% of metastatic cervical lymph nodes had intranodal necrosis and there was absence of intranodal necrosis in reactive cervical lymph nodes.

The FNAC of given specimens from the Group II patients showed moderate cellularity composed of polymorphous population of lymphoid cells, few macrophages against a fibrinous and hemorrhagic background which confirmed reactive cervical lymph nodes. In Group III patients showed clusters and sheets of malignant cells having enlarged pleomorphic and hyperchromatic nuclei and moderate amount of eosinophilic cytoplasm in a hemorrhagic background which confirmed metastatic cervical lymph nodes.

The sensitivity and specificity of greyscale ultrasonography in differentiating reactive cervical lymph nodes from metastatic cervical lymph nodes using six parameters were for **size 86.1% and 68.8%** respectively, for **shape 92.2% and 86.5%** respectively, for **border 96% and 97 %**

respectively, for **hilum 100% and 100%** respectively and for **internal echogenicity 77% and 100%** respectively, for **intranodal necrosis 41.2% and 100%** respectively. This results which is comparable with the report given by **Rajalakshmi et al(2014) [47].**

# *Summary and Conclusion*

## SUMMARY

The study was conducted to differentiate between reactive and metastatic cervical lymph nodes in head and neck pathology by grey scale ultrasonography. The main purpose of this study is to emphasize the sensitivity and specificity of grey scale ultra-sonography in detecting the reactive and metastatic cervical lymph nodes.

The present study was conducted in 30 patients. Group I consisted of 10 normal healthy individuals. Group II consisted of 10 patients who had reactive cervical lymph nodes due to infections in the head and neck region. Group III consisted of 10 patients who had metastatic cervical lymph nodes due to malignancy in the head and neck region.

In our study, Group I individuals none of them had any pathology in the head and neck region and there were no palpable lymph nodes. Group II patients all of them had dental pathologies and had the presence of soft, mobile, tender unilateral submandibular lymph nodes. Group III 6 patients had squamous cell carcinoma of buccal mucosa among those 4 patients had metastatic, firm, fixed, non-tender unilateral submandibular lymph node and 1 patient had bilateral metastatic firm, fixed, non-tender submandibular lymph nodes and 1 patient had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes, 2 patients with squamous cell carcinoma of alveolus had metastatic firm, fixed, nontender unilateral submandibular cervical lymph node, 1 patient with squamous cell

carcinoma of palate had metastatic firm, fixed, non-tender bilateral submandibular cervical lymph nodes, 1 patient with squamous cell carcinoma of the tongue had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes.

In our study, we used the following six greyscale ultrasonographic parameters to differentiate reactive from metastatic cervical lymph nodes. They are size, shape, borders, hilum, internal echogenicity, intranodal necrosis.

In our study, the size of the metastatic lymph node was greater than the normal and reactive cervical lymph nodes.

In our study, 80% of the metastatic cervical lymph nodes were round when compared to normal and reactive cervical lymph nodes, which showed 10% and 20% of the round cervical lymph node respectively with significant p value 0.002

In our study regarding nodal border, 100% of metastatic cervical lymph nodes had sharp border and 100% of normal and reactive cervical lymph nodes had smooth border.

In our study there were 100% absence of hilar echo in the metastatic cervical lymph nodes when compared to normal and reactive cervical lymph nodes which showed 60% and 100% presence of hilar echo respectively with significant p value 0.00

In our study the internal echogenicity showed 100% hyperechoic pattern in metastatic cervical lymph nodes when compared to normal and reactive cervical lymph nodes which showed 20% and 30% hyperechoic pattern respectively with significant p value 0.001

In our study intranodal necrosis were found in 60% of metastatic cervical lymph nodes and there were no intranodal necrosis in normal and reactive cervical lymph node with significant p value 0.001

Regarding size the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 86.1% and 68.8% respectively. Regarding shape the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 92.2% and 86.5% respectively. Regarding nodal borders the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 96% and 97 % respectively. Regarding the hilum the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 100% and 100% respectively. Regarding the internal echogenicity the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 77% and 100% respectively. Regarding intranodal necrosis the sensitivity and specificity of ultrasonography in differentiating reactive from metastatic cervical lymph nodes were 41.2% and 100% respectively.

## CONCLUSION

From the current study we have concluded that cervical group of lymph nodes showing ultrasonographic features such as round shape, absence of hilar echo, sharp nodal borders, hyperechoic internal echogenicity and presence of intranodal necrosis were highly suggestive of metastatic cervical lymph nodes. Fine Needle Aspiration Cytology is a rapid, safe, simple and non-expensive technique which can be used for initial diagnosis of metastatic cervical lymph nodes. This study helps to differentiate the reactive cervical lymph nodes from the metastatic lymph nodes by using Greyscale ultrasonography which was confirmed by Fine Needle Aspiration Cytology procedure. Thus, the early diagnosis and proper treatment planning can be implemented at the earliest.

# *Bibliography*

## BIBLIOGRAPHY

1. Ahuja A, Ying M. An overview of neck node sonography. Invest Radiol 2002; 37:333.
2. Ahuja A, Ying M. Sonography of neck lymph nodes. II. Abnormal lymph nodes. Clin Radiol 2001;56:111-115.
3. Ahuja AT, Ying M, Ho SY, Antonio G, Lee YP, King AD and Wong KT. Ultrasound of malignant cervical lymph nodes. Cancer Imaging. 2008 Mar 25;8:48-56.
4. Ahuja AT, Ying M. sonographic evaluation of cervical lymph nodes. American Journal of Roentgenology, 2005;184( 5): 1691-1699.
5. Alam K Khan A, Siddiqui , Jain A, Haider N, Maheswari V. Fine needle aspiration cytology(FNAC):A handy tool for metastatic lymphadenopathy. Int J Pathol 2010; 10 : 2.
6. Anand N, Chaudhary N, Mittal MK, Prasad R. Comparison of efficacy of clinical examination, ultrasound neck and computed tomography in detecting and staging of cervical lymph node metastasis in head and neck cancers. Indian Journal of Otolaryngology and Head and Neck surgery.2006;59:19-23.
7. Arora N et al. Evaluation of cervical lymph node metastasis in head and neck cancers. J Otolarygnol ENT research.2017;7(5):00219.

8. Ashraf M, Biswas J, Jha J, Nayak S, Singh V, Majumdar S, Bhowmick A, Dam A. Clinical utility and prospective comparison of ultrasonography and computed tomography imaging in staging of neck metastases in head and neck squamous cell cancer in an Indian setup.Int J ClinOncol. 2011 Dec;6(6):686-93.

9. Baatenburg de Jong RJ, Rongen RJ, Lameris JS, Harthoorn M, Verwoerd CD, Knegt P. Metastatic neck disease. Palpation vs ultrasound examination. Arch Otolaryngol Hea Neck Surg 1989;115:689.
10. Bagwan IN, Kane SV, Chinoy RF. Cytologic evaluation of the enlarged neck node: FNA utility in metastatic neck disease. Int J Pathol 2007; 6:2.
11. Bath AP, Muray GE, Bradley PJ. Branchial cyst- to endoscope or not? J Laryngol Otol 1992;106:1006-7.
12. Biatek EJ, Jakubowski W. Mistakes in ultrasound diagnosis of superficial lymph nodes. J Ultrason 2017;17:59-65.
13. Bressani Doldi S, Lattuada E. Ultrasonographic evaluation of cervical lymph nodes in preoperative staging of esophageal neoplasm. Dentomaxillofac Radiol. 1998;19:165-70.
14. Brown B, Barnes L, Mazariegos J, Taylor F, Johnson J, Wagner RL. Prognostic factors in mobile tongue and floor of mouth carcinoma. Cancer 1989;64:1195– 202.

15. Calabrese L et al. Role of sentinel lymph node biopsy in oral cancer. Acta Otorhinolaryngol Ital . 2006; 26:345-349.
16. Chan JM, Shin LK, Jeffery RB.Ultrasonography of abnormal neck lymph nodes. Ultrasound Q.2007;23(1):47-54.
17. Dijkmans .P.A., Juffermans L.F.M, Musters R.J.P. et al. Microbubbles and ultrasound : from diagnosis to therapy. Eur J Echocardiography. 2004; 5:245-256.
18. Douglas L, Miller , Michalakis A, Averkiou, Andrew A. Brayman et al. Bioeffects consderations for diagnostic ultrasound contrast agents. J Ultraound Med. 2008;27:611-632.
19. Foldi M, Foldi E, Strossenreuther T, et al. Foldi's textbook of lymphology for physicians and lymphedema therapists. 3rd ed. Munchen : Urban & Fischer;1989.
20. Fukano H, Matsuura H, Hasegawa Y, et al. Depth of invasion as a predictive factor for cervical lymph node metastasis in tongue carcinoma. Head Neck;19:205-10.
21. Ghafoori M, Azizian A, Pourrajabi Z, Vaseghi H. Sonographic evaluation of cervical lymphadenopathy; comparison of metastatic and reactive lymph nodes in patients with head and neck squamous cell carcinoma using Greyscale and doppler technique. Iran J Radiol.2015;12(3):e11044.

22. Granstrom G, Edstrom S. The relationship between cervical cyst and tonsillar carcinoma in adults. J Oral Maxillofac Surg 1989;47:16-20.
23. Gupta N, Rajwanshi A, Srinivasan R. FNAC role in head and neck lesions. J Laryngol Otol 2006;13:20-25.
24. Hajek PC, Salomonowitz E, Turk R, Tscholakoff D, Kumpan W, Czembirek H. Lymph nodes of the neck: evaluation with US, Radiology. 1986 Mar;158(3):739-42.
25. Hayashi T. Application of ultrasonography in Dentistry- Review. Japanese dental sciences.2012;28(1):5 -15.
26. Henry K A, Domanski, Akerman A. FNAC as a diagnostic tool in Head and Neck region: A study of 75 cases. J Laryngol Otol 19n98; 12:12-15.
27. Hoft S, Muhle C, Brenner W, Sprenger E, Maune S. Fine needle aspiration cytology of the sentinel lymph node in head and neck cancer. J Nucl Med 2002;43:1585-90.
28. Houck JR, Medina JE. Management of cervical lymph nodes in squamous carcinomas of the Head and Neck. Seminars in Surgical Oncology.1995.11:228- 39.
29. Ishii JI, Amagasa T, Tachibana T, Shinozuka K, Shioda S. US and CT evauation of cervical lymph node metastasis from oral cancer. J Cranio-Max-Fac Surg 1991; 19:123.

30. John DG, Anaes FC, Williams SR, Ahuja A, Evans R, To KF, King WW, van Hasselt CA. Palpation compared with ultrasound in the assessment of malignant cervical lymph nodes, J Laryngol Otol. 1993 Sep;107(9):821-23.

31. Johnson JT, Barnes EL, Myers EN, et al. The extracapsular spread of tumors in cervical node metastasis. Arch Otolaryngol 1981;107:725.

32. Kerr DA, Ash MM, Millar HD. Oral Diagnosis. 6th ed. USA: CV Mosby; 1983. p . 67

33. Khajuria R, Goswami KC, Singh K, Dubey VK. Pattern of lymphadenopathy on fine needle aspiration cytology in Jammu. JK Sci 2006;8:157-9.

34. Kim H C, Yoon D Y, Chang SK, Han H. small atypical lymph nodes detected on sonography in patients with squamous cell carcinoma of the head and neck: probability of metastasis. J Ultrasound Med.2010;29(4):531-7.

35. Knappe M, Louw M, Gregor RT. Ultrasonography – guided fine needle aspiration for the assessment of cervical metastases. Arch Otolaryngol Head Neck Surg 2000; 126:1091-6.

36. Kowakski LP, Medina JE. Nodal metastasis. Otolaryngologic Clinics of North America; 1998;Vol 31:621-37.

37. Kumar S, Cotran K, Robbins S. Neoplasia 6th edition, Harcourt publication, 2000p 132-133.
38. Liao LJ, Lo WC, Hsu WL, Wang CT, Lai MS. Detection of cervical lymph node metastasis in head and neck cancer patients with clinically N0 neck-a meta analysis comparing different imaging modalities, BMC Cancer. 2012 Jun 12;12(1):236.
39. Manfred Blum et al. Ultrasonography a useful diagnostic procedure in detection of metastatic cervical lymph nodes. J Ultrasound Med 2005;11:132-135.
40. Melek Ustun. Cystic change in metastatic lymph nodes. A common diagnostic pitfall in fine needle aspiration cytology. Laryngoscope 1999;28:225-230.
41. Merritt RM, Williams MF, James TH, Porubsky ES. Detection of cervical metastasis. A meta-analysis comparing computed tomography with physical examination. Arch Otolaryngol Head Neck Surg 1997;123:149-52.
42. Micheal TC Ying, Anil T Ahuja. Thesis prepared by Department of optometry and radiography, The Hong Kong Polytechnic University,Hong Kong, 2006.
43. Nicholas J Screaton. Head and Neck Lymphadenopathy. Evaluation with US guided cutting Needle biopsy. Br J Oral Maxillofac Surg 2001.

44. Patkar D, Yanamandala R, Lawnde M. Imaging in head and neck cancers, Otorhinolarnyngology clinic: An International Journal. 2010;2(1):15-23.
45. Patra A.K, Nanda B.K, Mohapatra B K, Panda A. Diagnosis of lymphadenopathy by fine needle aspiration cytology. Ind J Pathol & Microbiol, 1983;26:273-278
46. Pedro Weslley Souza Rosario, Sergio de Faria. Ultrasonographic differentiation between metastatic and benign lymph node in patient with papillary thyroid carcinoma. J Ultrasound Med 2005;24: 1385-1389.
47. Rajalakshmi C, Sudhakara rao M, Ravikiran A, Sathish S, Bhavana S. Evaluation of reliability of Ultrasonographic parameters in differentiating benign and metastatic cervical group of lymph nodes. Journal of ISRN otolaryngology 2014 ID 238740.
48. Rassekh CH, Johnson JT, Myers EN. Accuracy of intraoperative staging of the NO neck in squamous cell carcinoma. Laryngoscope 1995;105:1334-6.
49. Righi PD, Kopecky KK, Caldemeyer KS, Ball VA, Weisberger EC, Radpour S. Comparison of ultrasound-fine needle aspiration and computed tomography in patients undergoing elective neck dissection. Head Neck. 1997 Oct;19(7):604-10.
50. Robert J. Baatenburg de Jong, Robert J. Rongen, Johan S. Laméris, Machiel Harthoorn, Carel D. A. Verwoerd, Paul Knegt. Metastatic Neck

Disease: Palpation vs Ultrasound Examination. Arch Otolaryngol Head Neck Surg. 1989;115(6):689-90.

51. Rouviere H.Anatomy of the human lymphatic system. British Journal of surgery 1939; 27(105):194-196.
52. Russell RC, William NS. Lymphatic system. 23rd ed International student Publication, 2000: p 256-257.
53. Sako K, Pradier R.N, Marchetta F.C. Fallibility of Palpation in the diagnosis of Metastasis to Cervical Nodes. SurgGynecolObstet1964;118:989-90.
54. Shozushima M, Suzuki M, Nakasima T, Yanagisawa Y,Sakamaki K, Takeda Y. Ultrasound diagnosis of lymph node metastasis in head and neck cancer. Dentomaxillofac Radiol 1990;19:165.
55. Som PM. Lymph nodes of the neck. Radiology.1987; 165: 593–600.
56. Thakur JS, Sharma ML, Mohan C, Mohindroo N.K, Kaushik N.K. Clinicopathological and radiological evaluation of cervical lymph node metastasis in head and neck malignancies. Indian Journal of Otolaryngology and Head ad Neck Surgery.2007;59:327-31.
57. Toriyabe Y, Nishimura T, Kita S, Saito Y, Miyokawa N. Differentiation between benign and metastatic cervical lymph nodes with ultrasouns. Clinical Radiology 1997;52(12):927-932.

58. Toru Chikui K,Koichi Yonetsu Y, Takashi Nakamura. Multivariate feature analysis of sonographic findings of metastatic cervical lymph nodes: contribution of blood flow features revealed by power Doppler sonography for predicting metastasis. J Ultrasound Med 2000;15:431-436.
59. Turner RR. Histopathologic assessment of the sentinel lymph node in breast cancer. Ann Surg Oncol 2001;8:56-59.
60. Tytor M, Olofsson J. Prognostic factors in oral cavity carcinoma. Acta Otolaryngol1992.(Suppl 492):75–8.
61. Ustun M, Risberg B,Davidson B,Berner A. Cystic change in metastatic lymph node: a common diagnostic pitfall in fine needle aspiration cytology. J diagn cytopathol. 2002;27(6):387-92.
62. Van der Brekel MW, Castelijns JA, Stel HV, Golding RP, Meyer CJ, Snow GB. Modern imaging techniques and ultrasound-guided aspiration cytology for the assessment of neck node metastases: a prospective comparative study. Eur Arch Otorhinolaryngol 1993;250:11-7.
63. Vasallo P, Wernecke K, Roos N, Peters PE. Differentiation of benign from malignant superficial lymphadenopathy: The role of high resolution US. Radiology 1992;183:215-220.
64. Vincent Chong. Cervical lymphadenopathy: what radiologists need to know? Cancer Imaging 2004;4:116–20.

65. Westhofen M. Ultrasound B scans in the follow up of head and neck tumors. Head Neck Surg 1987;9:272-278.
66. Woolgar JA. The topography of cervical lymph node metastases revisited: the histological findings in 526 sides of neck dissection from 439 previously untreated patients. Int J Oral MaxillofacSurg 2007;36(3):219–25.
67. Ying M, Ahuja A, Brook F. Greyscale and power doppler sonography of normal cervical lymph nodes comparison between Chinese and white subjects. Journal of ultrasound in Medicine 2002; 21(1):59-65.
68. Ying M, Ahuja A, Brook F. Accuracy of sonographic vascular features in differentiating different causes of cervical lymphadenopathy. Ultrasound Med Biol. 2004; 30(4):441-7.
69. Ying M, Ahuja A. Sonography of neck lymph nodes. I. Normal lymph nodes. Clin Radiol 2003;58:351-358.
70. Yusha H. Power doppler ultrasonographic differentiation of benign and metastatic cervical lymph node. J Ultrasound Med 1999;12:948-51.

# *Annexures*

**ANNEXURE – I**

**PROFORMA**

Op no:
Date:

Patient name:

Age:

Gender:

Address:

phone no:

CHIEF COMPLAINT:

HISTORY OF PRESENTING ILLNESS:

PAST MEDICAL HISTORY:

PAST DENTAL HISTORY:

FAMILY HISTORY:

PERSONAL HISTORY:

GENERAL EXAMINATION:

Height :

Weight:

Built:

Pallor :

Icterus:

Cyanosis:

Clubbing:

Pedal oedema:

Lymphadenopathy:

CLINICAL EXAMINATION:

Temperature:

Respiratory rate:

Pulse rate:

Blood pressure:

Local examination

EXTRA ORAL EXAMINATION:

Face:

Lip :

TMJ:

| Lymph node examination: | Right | Left |
|---|---|---|
| 1. Submandibular lymph node | ☐ | ☐ |
| 2. Sublingual lymph node | ☐ | ☐ |
| 3. Submental lymph node | ☐ | ☐ |
| 4. Parotid lymph node | ☐ | ☐ |
| 5. Upper deep cervical lymph node | ☐ | ☐ |
| 6. Middle deep cervical lymph node | ☐ | ☐ |
| 7. Lower deep cervical lymph node | ☐ | ☐ |
| 8. Supra clavicular lymph node | ☐ | ☐ |

| Texture of lymph node: | Right | Left |
|---|---|---|
| 1. Soft | ☐ | ☐ |
| 2. Firm | ☐ | ☐ |
| 3. Rubbery | ☐ | ☐ |
| 4. Stony hard | ☐ | ☐ |

| Nature of lymph node: | Right | Left |
|---|---|---|
| 1. Mobile | ☐ | ☐ |
| 2. Fixed | ☐ | ☐ |
| 3. Tender | ☐ | ☐ |
| 4. Non-tender | ☐ | ☐ |

INTRA ORAL EXAMINATION

Mouth opening:

Jaw movements:

HARD TISSUE EXAMINATION:

Decayed teeth –

Missing teeth –

Filled teeth –

Mobility –

Root stump –

Involved tooth no.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |

SOFT TISSUE EXAMINATION:

Labial mucosa:

Buccal mucosa:

Alveolar mucosa:

Gingiva:

Hard and soft palate:

Uvula:

Pillar of fauces and tonsils:

Tongue:

Floor of the mouth:

PROVISIONAL DIAGNOSIS:

INVESTIGATIONS:

Hematological:

Ultrasonography:

Greyscale ultrasonography:

FNAC:

INTERPRETATION:

Sonography impression:

FNAC:

**ANNEXURE - II**

**CONSENT LETTER**

I_____ the undersigned hereby give my consent for the performance of diagnostic tests on myself for "**Diagnostic efficacy of Grey Scale Ultrasonography in the differentiation of reactive and metastatic cervical lymph nodes**" being conducted by Dr. A Priyadharshini under the guidance of Dr. S. Kailasam, Professor, Head of the Department of Oral Medicine, Diagnosis and Radiology at Ragas Dental College and hospital, Chennai. I have been informed and explained about the status of my disease, investigation procedure, the proposed treatment procedure, risk involved and likelihood of success. I also understand and accept that as a part of this study protocol, thereby voluntarily, unconditionally, freely give my consent without any fear or pressure in mentally sound and conscious state to participate in the study.

Witness/Representative: Patient's Signature

Date:

**ஒப்புதல் கடிதம்**

நான் _____ என்னுடைய முழு ஒத்துழைப்பை திருமதி அ. பிரியதர்ஷினி அவர்கள் மற்றும் திரு s கைலாசம் தலைமை பேராசிரியர், வாய் மருத்துவம் மற்றும் வாய்நோய் அறிதல் கதிர் வீச்சுத் துறை ராகாஸ் பல் மருத்துவ முதுநிலை படிப்பிற்கான என்னுடைய நின நீர் கட்டிகளில் உள்ள நோயின் அறிகுறிகளை அறிய பயன்படுத்தப்படுகின்ற நுண்ணிய ஒலி அதிர்வு படப்பிடிப்பு கருவி மற்றும் கூர் ஊசி உறிந்து செல் அறிதல் முறையிலான பரிசோதனைகள் செய்யவும் அதனால் என்ன நோய் என்று கண்டறிந்து அதை குணப்படுத்தும் முறைகளை கண்டறிவதற்க்கான விளக்கங்களை மருத்துவர் சொல்ல நான் என் முழு சுயநினைவில் யாருடைய வற்புறுத்தல் இல்லாமல், யாருடைய கட்டுப்பாட்டிற்கு கீழ் பணியாமலும் என்னுடைய முழு ஒத்துழைப்பையும் எந்த மருத்துவ ஆராய்ச்சிக்காக ஒப்புதலை அளிக்கின்றேன்.

சாட்சிகள்: கையொப்பம்

தேதி:

**ANNEXURE – III**

**Evaluation of cervical lymph node in Group I healthy individuals**

| S. no | Patient name | Age | Sex | Lesions present | Lymph node | Site of lymph node | Shape | Consistency | Fixity | USG hilum | USG shape | USG border | USG echo -genicity | USG Intra nodal necrosis | FNAC Reactive | FNAC metastatic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Karthik | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | Priya | 26 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 3 | Kavitha | 21 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 0 |
| 4 | Ramya | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 5 | Vishnu | 24 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 6 | Lakshmi | 36 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 |
| 7 | Perumal | 25 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 8 | Viji | 23 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 9 | Arjun | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 10 | Rajesh | 27 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |

**ANNEXURE – IV**

**Evaluation of reactive cervical lymph nodes in Group II patients with head and neck infections**

| S. no | Patient name | Age | Sex | Lesions present | Lymph node | Site of lymph node | Shape | Consistency | Fixity | USG hilum | USG shape | USG border | USG echo -genicity | USG Intra nodal necrosis | FNAC Reactive | FNAC metastatic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ram Kumar | 29 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 2 | Kamal | 28 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 3 | Dinesh | 35 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 0 |
| 4 | Arun | 37 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 5 | Sakthi | 36 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 |
| 6 | Sathish | 39 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 |
| 7 | Vijaya | 40 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 0 |
| 8 | Rajeswari | 42 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 0 |
| 9 | Kamala | 39 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 10 | Shivakumar | 44 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |

**ANNEXURE – V**

**Evaluation of metastatic cervical lymph nodes in Group III patients with head and neck malignancies**

| S. no | Patient name | Age | Sex | Lesions present | Lymph node | Site of lymph node | Shape | Consistency | Fixity | USG hilum | USG shape | USG border | USG echo -genicity | USG Intra nodal necrosis | FNAC Reactive | FNAC metastatic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Shankar | 42 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 | 0 | 1 |
| 2 | Ramakrishnan | 45 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 | 0 | 1 |
| 3 | Sivakumar | 51 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |
| 4 | Janaki raman | 58 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 2 | 2 | 2 | 0 | 0 | 1 |
| 5 | Gopalsamy | 57 | 1 | 1 | 1 | 2 | 2 | 4 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |
| 6 | Ravi | 42 | 1 | 1 | 1 | 1 | 2 | 4 | 1 | 0 | 2 | 2 | 2 | 0 | 0 | 1 |
| 7 | Rajagopalan | 84 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |
| 8 | Rajkumar | 73 | 1 | 1 | 1 | 1 | 2 | 4 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |
| 9 | Mohan | 68 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |
| 10 | Perumalsamy | 75 | 1 | 1 | 1 | 1 | 2 | 4 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 1 |

**ANNEXURE – VI**

**Scoring of evaluation of cervical lymph nodes in Group I, II, III patients**

| Gender | Lesions | Lymph node | Site | Shape | Consistency | Fixity | USG hilum | USG shape | USG border | USG echogenicity | Nodal necrosis | FNAC reactive | FNAC metastatic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Male -1 | Present – 1 | Present – 1 | Unilateral- 1 | Oval – 1 | Soft – 1 | Present - 1 | Present – 1 | Oval – 1 | Smooth – 1 | Hypo echogenicity - 1 | Present – 1 | Present – 1 | Present – 1 |
| Female - 2 | Absent - 0 | Absent - 0 | Bilateral - 2 | Round - 2 | Firm – 2 | Absent – 0 | Absent - 0 | Round – 2 | Sharp - 2 | Hyper echogenicity - 2 | Absent – 0 | Absent – 0 | Absent – 0 |
| | | | Absent - 0 | Absent - 0 | Rubbery – 3 | | | | | | | | |
| | | | | | Stony hard – 4 | | | | | | | | |
| | | | | | Absent – 0 | | | | | | | | |

**ANNEXURE – VII**

**RAGAS DENTAL COLLEGE & HOSPITAL**
(Unit of Ragas Educational Society)
Recognized by the Dental Council of India, New Delhi
Affiliated to The Tamilnadu Dr. M.G.R. Medical University, Chennai
2/102, East Coast Road, Uthandi, Chennai - 600 119. INDIA.
Tele : (044) 24530002, 24530003-06. Principal (Dir) 24530001 Fax : (044) 24530009

**TO WHOMEVER IT MAY CONCERN**

Date: 24.01.2018

Place: Chennai

From

The Institutional Review Board,

Ragas Dental College and Hospital,

Uthandi,

Chennai – 600119.

The dissertation topic titled "**DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES**" submitted by **Dr. A. PRIYADHARSHINI** has been approved by the Institutional Review Board of Ragas Dental College and Hospital.

**Dr. N. S. AZHAGARASAN M.D.S.,**

Member secretary,

Institution Ethics Board,

Ragas Dental College and Hospital,

Uthandi, Chennai – 600119.

RAGAS DENTAL COLLEGE Chennai

**ANNEXURE – VIII**

URKUND

## Urkund Analysis Result

| | |
|---|---|
| Analysed Document: | DIAGNOSTIC EFFICACY OF GREYSCALE ULTRASONOGRAPHY IN THE DIFFERENTIATION OF REACTIVE AND METASTATIC CERVICAL LYMPH NODES.docx (D35070968) |
| Submitted: | 1/27/2018 7:28:00 AM |
| Submitted By: | apriya.omdr@gmail.com |
| Significance: | 4 % |

Sources included in the report:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4040195/

Instances where selected sources appear:

18