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CHARACTERIZATION OF MORPHOLOGY OF CERVICAL LYMPH NODES THROUGH ULTRASONOGRAPHY-A MORPHOLOGICAL COMPARATIVE STUDY

Dental Science

KEYWORDS:

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ABSTRACT

Aims and objective: To assess cervical lymph node enlargement in patients with inflammatory diseases and oral cancer by Color Doppler and determine and compare the pattern of Color Doppler flow signals of cervical lymphadenopathy in patients with inflammatory diseases and oral cancer.

Materials & method The present study was conducted in the Dept. of Dentistry in collaboration with Dept. of Gen. Medicine and Dept. of Radio-diagnosis, G.C.R.G institute of medical sciences and hospital, Lucknow. The study groups consist of 75 patients with clinical evidence of Head and Neck lymph node enlargement and 25 age and sex matched controls. The sample will be divided into 3 groups, first group will be including oral squamous cell carcinoma cases, second group will be including inflammatory diseases and third group will be including control individuals. Explained about design of the study and taken written, well-informed & signed consent. After a detailed clinical history, clinical examination, performed color doppler ultra-sonography examination.

Statistic analysis: In statistical analysis, the data was summarized as Mean ± SD (standard deviation). The groups were compared by independent Student's t test wherever required. Groups were also compared by one way analysis of variance (ANOVA) and the F value and p-value was also calculated. Pearson correlation coefficient was calculated among the quantitative variables to see the association between the variables. A two-sided (α=2) p value less than 0.05 ($p<0.05$) was considered statistically significant. The statistical analyses were performed on SPSS software (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp)

Results: The results from all groups were tabulated and the data was analyzed. We compared each group with other three groups respectively. Ultrasonographic evaluation of lymph nodes came out to be significantly variable for all the groups.

Conclusion: The association of signs, however, produces a highly suggestive appearance in most cases, and makes of ultrasonography an extremely useful diagnostic means. Critical appraisal of gray-scale signs is crucial for an accurate diagnostic approach.

Introduction

The part of the circulatory system that is concerned especially with scavenging fluids and proteins that have escaped from cells and tissues and returning them to the blood, with the phagocytic removal of cellular debris and foreign material and with immune responses, that overlaps and parallels the system of blood vessels in function and shares some constituents with it, and that consists especially of the thymus, spleen, tonsils, lymph, lymph nodes, lymphatic vessels, lymphocytes, and bone marrow where stem cells differentiate into precursors of B cells and T cells, also called lymphoid system, lymph system. According to Drinker Yoffey, 1941, there are 800 lymph nodes in the body and around 300 in the neck and that a unilateral Radical neck surgery may require the extirpation of 150 or more Lymph nodes in the human body. According to Hellstrom 1971 and million et al, 1982 there are around 300 Lymph Nodes in the Head and Neck. Metastases in cervical lymph nodes are common in head and neck cancers. The presence of a metastatic node on one side of the neck reduces the 5-year survival rate of 50%, and the presence of a metastatic node on both sides of the neck reduces the survival rate to 25%.[1] Therefore, evaluation of cervical lymphadenopathy is important for patients with head and neck cancers as it helps the assessment of patient prognosis and the selection of treatment method. Ultrasound is a useful imaging modality in evaluation of cervical lymphadenopathy because of its high sensitivity (98%) and specificity (95%) when combined with fine-needle aspiration cytology (FNAC).[2] With the use of power Doppler sonography, the vasculature of the lymph nodes can also be evaluated which provides additional information in the sonographic examination of cervical lymph nodes. Cervical lymphadenopathy is a common presenting symptom and sign for a variety of diseases, ranging from subtle infections to life threatening Head & Neck malignancies.[3] Cervical lymph nodes are composed of lymphoid tissue and are located along the lymphatic vessels in the neck. There are about 300 lymph nodes in the neck, and the lymph nodes are embedded in the soft tissues of the neck and are either partly or completely surrounded by fat.[4,5] Metastases in cervical lymph nodes are common in head and neck cancers. The presence of a metastatic node on one side of the neck reduces the 5-year survival rate of 50%, and the presence of a metastatic node on both sides of the neck reduces the survival rate to 25%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.[6] All diagnostic ultrasound applications are based on the detection & display of acoustic energy reflected from interfaces within the body.[7]

Aims and objectives: To assess cervical lymph node enlargement in patients with inflammatory diseases and oral cancer by Color Doppler and compare the pattern of Color Doppler flow signals of cervical lymphadenopathy in patients with inflammatory diseases and oral cancer.

Materials and method: 75 Subjects were selected from our departmental OPD, Department of Dentistry, GCRG institute of medical sciences and hospital, Lucknow, aged between 20-75 years were selected for the study that were follow our study criteria as mention inclusion and exclusion details. The subjects were divided into three groups, group I (Control Group), group II (Oral cancer) and group III (Infectious disease group). The subjects were randomly selected from our departmental OPD and diagnosed with Oral Cancer and infectious disease on the basis of complete clinical and histological examination. After clinical and histo-pathological examination, ultra-sonographic examination was done of cervical lymph nodes with the help of Color Doppler Ultra-sonographic Machine and evaluate on the basis of size, shape and vascularity of

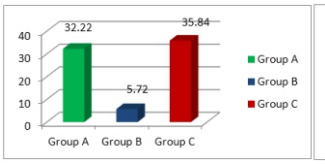
lymph nodes at Department of Radio-diagnosis, GCRG Medical College, Lucknow, U.P. All potential participants were explained the need and design of the study and the benefits of undergoing clinical and ultra-sono-graphical investigations. Individuals who agreed to undergo these procedures were instructed to read and signed the consent form. We were included those Patient which was clinically and histo-pathologically diagnosed with oral squamous cell carcinoma and inflammatory disease with cervical. Cases in which cervical lymph nodes not involved and Treated cases were excluded. In this study, The Color Doppler ultra-sonograph used for sono-graphical analysis with the specification of High resolution real time multi-planner diagnostic ultrasound system "LOGIQ- P5" using high frequency 5-11 MHz Transducer and lubricating media that was ULTRASOUND GEL- MEDI-CHEM. During Ultra-sonography, patient positioned should be correct. Patients placed on side bed USG System and explained complete procedure, ask to letdown as supine position then after soft pillow placed under patient's neck for extended of neck position that very helpful and convenience for sono-graphical examination. Patient positioning along with extended neck. After proper patient's position and completion of lubricant media application (Medi-chem) then used transducer. Firstly transducer placed longitudinal on skin surface of cervical region and evaluate and captured interested region picture followed by transverse position. Patient was made to lie supine with neck slightly flexed and rotated towards the opposite side. The neck was then examined longitudinally and transversely in a continuous sweep technique, covering the neck region from the thoracic outlet cervical region. In the entire study the transducer was gently placed so that any changes induced mechanically were avoided. 2-D Real-Time B-Mode Ultrasonographic examinations were performed using high frequency (5MHz-11MHz) LINEAR TRANSDUCER WITH COLOR DOPPLER. Blood flow was studied using Duplex sonography, in which Gray scale 2D sonography is combined with Pulsed Doppler. With Color Doppler imaging, the Pulsed Doppler information was encoded for flow direction and mean flow velocity. Power Doppler showed the intensity of flow, which is proportional to the square of the amplitude of the Doppler signal. Color Doppler Imaging was used to examine intravascular flow, while the more sensitive Power Doppler was used to detect parenchymal flow. The resistance to perfusion was measured by the pulsatility and resistivity index. The neck was examined longitudinally and transversely in continuous sweep technique covering the neck region bilaterally from the thoracic outlet and scaleneus muscles to the sub-mental and retroparotideal regions. The lymph nodes thus obtained surgically were subjected to histopathological examination for presence of metastasis and compared with the Ultrasonographic and Doppler findings to cross check for True Positive and True Negative results. The influence of the Color Doppler findings on the predictive value of Ultrasonographic examination was estimated. The Categorical data are presented as number and percentages. Spectral Doppler sonogram showing measurement of the resistive index (RI), and pulsatility index (PI) of a metastatic lymph node. Measurement of the peak systolic velocity (PSV) and end diastolic velocity (EDV) is also demonstrated. Note the measurements are obtained from three consecutive waveforms. Diagnostic validity of High resolution Pulsed and Color Doppler Ultrasonography was done by assessing the sensitivity and specificity. The data was analyzed using Statistical Package for Social Science (SPSS).

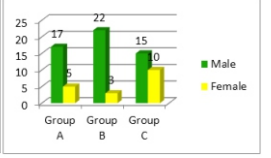
Statistical analysis and results: In statistical analysis, the data was summarized as Mean ± SD (standard deviation). The groups were compared by independent Student's t test wherever required. Groups were also compared by one way analysis of variance (ANOVA) and the F value and p- value was also calculated. Pearson correlation coefficient was calculated among the quantitative variables to see the association between the variables. A two-sided (α=2) p value less than 0.05 ($p<0.05$) was considered statistically significant. The statistical analyses were performed on SPSS software (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). The present study evaluates comparison and correlation, morphologically cervical lymph nodes in oral squamous cell carcinoma, infectious diseases and normal individuals. A total of 75 subjects, 20 to 75 yrs aged either male or female both included for the study. After clinical, histo-pathological and USG examination done and evaluate on the basis of morphologically shape and size, vascularity. The frequency distribution of cervical lymph nodes in group 1 (control), group 2 (oral cancer) and group 3 (infectious group) of subjects are summarized in Table 1. In the present study the total number of subjects was divided in three groups. Table 1 shows that the distribution of age and sex in three different groups. The one way ANOVA shows that there is a significant difference in age ($F=35.63, p=0.0001$) and distribution of gender (Chi square $=5.31, p=0.07$) in three groups. Furthermore, post hoc test for age shows Group 1 Vs Group 2 is significant ($p<0.001$), Group 2 vs Group 3 is significant ($p<0.001$) but Group 1 Vs Group 3 is not Significant. The table 2 depicts the comparison of number of lymph node in different groups. Lymph node number is observed maximum in group 3 (4.28±0.89).The difference in mean number of lymph node among three group is statistically significant ($F=8.60, p=0.0001$) The table 4 depicts the Comparison of Vascular Pulsatility Index in different groups. Vascular Pulsatility Index is observed maximum in group 2 (1.52±0.21).The difference in mean Vascular Pulsatility Index among three group is statistically significant ($F=77.71, p=0.0001$). Table 5 reveals the comparison of Vascular Resistive Index in different groups. The resistive index was observed in group 2.The one way analysis of variance (ANOVA) shows that difference of mean vascular resistive index in three groups is statistically significant ($F=87.72, p=0.0001$). Table 6 depicts the distribution of patients on the basis of lymph shape in three groups. The distribution of lymph shape is statistically significant (Chi square =60.89, $p<0.0001$).Oval shape was found in most frequent in group 1 & group 3. However round shape was found in group 2 & group 3. Table 7 shows the distribution of patients on the basis of nodal boarder types in three groups. Well type of nodal border is found in group 1 & group 2.However, unsharpe nodal boarder was seen in group three. The distribution of types of nodal border is statistically significant (Chi square =60.89, $p<0.0001$) Table 8 shows the distribution of patients on the basis of Vascular Pattern in three groups. Vascular pattern were categorized in central, Hillar, Mixed & Peripheral. The chi square test reveals that the distribution of vascular pattern is in different groups is statistically significant (Chi square =62.87, $p<0.0001$).Tables show that mixed type of vascular pattern was seen common. Table 9 depicts the distribution of study subjects on the basis of calcification in three groups. Chi square test show that the distribution patients on the basis of calcification in three groups is statistically significant (Chi square = 72.0, $p<0.001$). The table 10 shows association among variables under study. Since the variables under study are quantitative so the Karl Pearson correlation coefficient were calculated. Table 10 shows the correlation matrix among different variables. The negative correlation shows the negative association between the variables while the positive correlation shows the negative association. Age is found to be positively correlated with number of lymph, Size, RI& PI. Size was positively correlated with number of Lymph,PI & I.PI is positively correlated with RI.

Table 1: Personal Characteristics of study subjects in different groups

Characteristics	Group 1 N=22	Group 2 N=25	Group 3 N=25	Significance
Age	32.22±6.86	50.72±9.31	35.84±7.68	F=35.63,p=0.0001
Gender (M/F)	17/5	22/3	15/10	Chi square =5.31,p=0.07

Post hoc test for Age: Group 1 Vs Group 2 is significant ($p<0.001$),Group 2 vs Group 3 is significant ($p<0.001$) but Group 1 Vs Group 3 is not Significant.





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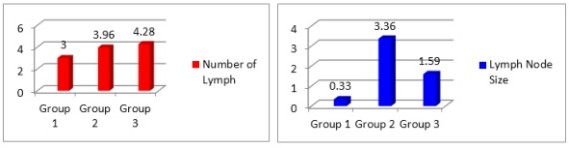
Graph 1& 2: Distribution of Age in different group, Distribution of Gender in different Groups

In the present study the total number of subjects was divided in three groups. Table 1 shows that the distribution of age and sex in three different groups. The one way ANOVA shows that there is a significant difference in age (F=35.63,p=0.0001) and distribution of gender (Chi square =5.31,p=0.07) in three groups. Furthermore, post hoc test for age shows Group 1 Vs Group 2 is significant (p<0.001), Group 2 vs Group 3 is significant (p<0.001) but Group 1 Vs Group 3 is not Significant.

Table2: Comparison of number of lymph in different groups

Characteristics	Group 1 N=22	Group 2 N=25	Group 3 N=25	Significance
Number of Lymph	3.00±1.34	3.96±1.01	4.28±0.89	F=8.60,p=0.0001

Post hoc test for number of Lymph: Group 1 Vs Group 2 is significant (p<0.001), Group 2 vs Group 3 is not significant and Group 1 Vs Group 3 Significant (p<0.001)



Graph 3&4: Comparison of number of lymph and lymph node size in different groups

The table 2 depicts the comparison of number of lymph node in different groups. Lymph node number is observed maximum in group 3 (4.28±0.89).The difference in mean number of lymph node among three group is statistically significant (F=8.60, p=0.0001)

Table3: Comparison of lymph node size in different groups

Characteristics	Group 1 N=22	Group 2 N=25	Group 3 N=25	Significance
Lymph node Size	0.33±0.16	3.36±1.50	1.59±0.34	F=65.49,p=0.0001

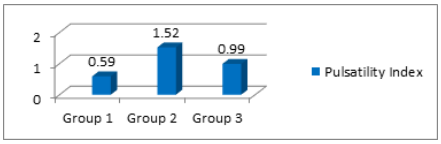
Post hoc test for size of Lymph node: Group 1 Vs Group 2 is significant (p<0.001),Group 2 vs Group 3 is significant (p<0.001)and Group 1 Vs Group 3 Significant (p<0.001)

The table 3 depicts the comparison of lymph node size in different groups. Lymph node size is observed maximum in group 2 (3.36±1.50).The difference in mean of lymph node size among three group is statistically significant (F=65.49, p=0.0001)

Table 4: Comparison of Vascular Pulsatility Index in different groups

Characteristics	Group 1 N=22	Group 2 N=25	Group 3 N=25	Significance
Pulsatility Index	0.59±0.30	1.52±0.21	0.99±0.25	F=77.71,p=0.0001

Post hoc test for Resistive Index : Group 1 Vs Group 2 is significant (p<0.001),Group 2 vs Group 3 is significant (p<0.001)and Group 1 Vs Group 3 Significant (p<0.001)



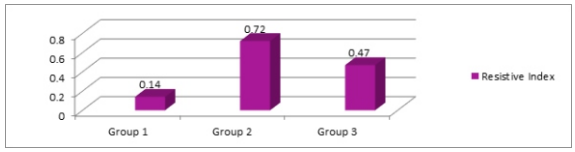
Graph 5: Comparison of Vascular Pulsatility Index

The table 4 depicts the Comparison of Vascular Pulsatility Index in different groups. Vascular Pulsatility Index is observed maximum in group 2 (1.52±0.21).The difference in mean Vascular Pulsatility Index among three group is statistically significant (F=77.71,p=0.0001)

Table 5: Comparison of Vascular Resistive Index in different groups

Characteristics	Group 1 N=22	Group 2 N=25	Group 3 N=25	Significance
Pulsatility Index	0.14±0.07	0.72±0.18	0.47±0.16	F=87.72,p=0.0001

Post hoc test for Resistive Index : Group 1 Vs Group 2 is significant (p<0.001),Group 2 vs Group 3 is significant (p<0.001)and Group 1 Vs Group 3 Significant (p<0.001)



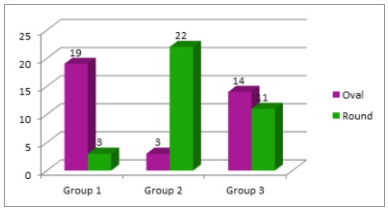
Graph 6: Comparison of Vascular Resistive Index

Table 5 reveals the comparison of Vascular Resistive Index in different groups. The resistive index was observed in group 2.The one way analysis of variance (ANOVA) shows that difference of mean vascular resistive index in three groups is statistically significant (F=87.72,p=0.0001)

Table 6 : Distribution of patients on the basis of lymph shape in three groups

Shape	Group 1	Group 2	Group 3
Oval	19	3	14
Round	3	22	11

Chi square =26.43,p<0.0001



Graph 7:: Distribution of patients on the basis of lymph shape

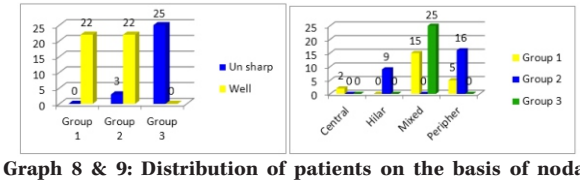
Table 6 depicts the distribution of patients on the basis of lymph shape in three groups. The distribution of lymph shape is statistically significant (Chi square =60.89, p<0.0001).Oval shape was found in most frequent in group 1 & group 3.However round shape was found in group 2 & group 3.

Table 7: Distribution of patients on the basis of nodal boarder in three groups

Nodal Boarder	Group 1	Group 2	Group 3
Un sharp	0	3	25
Well	22	22	0

Chi square =60.89, p<0.0001

Table 7 shows the distribution of patients on the basis of nodal boarder types in three groups. Well type of nodal border is found in group 1 & group 2. However, un-sharpe nodal boarder was seen in group three. The distribution of types of nodal border is statistically significant (Chi square =60.89, p<0.0001)



Graph 8 & 9: Distribution of patients on the basis of nodal boarder and Vascular Pattern

Table 8: Distribution of patients on the basis of Vascular Pattern in three groups

Vascular Pattern	Group 1	Group 2	Group 3
Central	2	0	0
Hilar	0	9	0

Mixed	15	0	25
Peripher	5	16	0

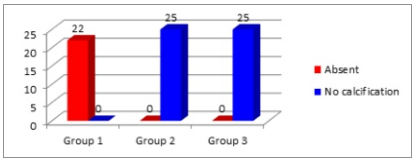
Chi square =62.87, p<0.0001

Table 8 shows the distribution of patients on the basis of Vascular Pattern in three groups. Vascular pattern were categorized in central, Hillar, Mixed & Peripher .The chi square test reveals that the distribution of vascular pattern is in different groups is statistically significant (Chi square =62.87, p<0.0001).Tables show that mixed type of vascular pattern was seen common.

Table 9: Distribution patients on the basis of calcification in three groups

Calcification	Group 1	Group 2	Group 3
Absent	22	0	0
No calcification	0	25	25

Chi square =72.00, p<0.0001



Graph 10: Distribution patients on the basis of calcification

Table 9 depicts the distribution of study subjects on the basis of calcification in three groups. Chi square test show that the distribution patients on the basis of calcification in three groups is statistically significant (Chi square = 72.0,p<0.001)

Table10: Correlation coefficients among variable under study.

		Age	Number of Lymph	Size	PI	RI
Age	Pearson Correlation	1	.274(*)	.728(**)	.503(**)	.570(**)
	Sig. (2-tailed)	.	.020	.000	.000	.000
	N	72	72	72	72	72
Number of Lymph	Pearson Correlation	.274(*)	1	.308(**)	.187	.116
	Sig. (2-tailed)	.020	.	.008	.116	.333
	N	72	72	72	72	72
Size	Pearson Correlation	.728(**)	.308(**)	1	.655(**)	.678(**)
	Sig. (2-tailed)	.000	.008	.	.000	.000
	N	72	72	72	72	72
PI	Pearson Correlation	.503(**)	.187	.655(**)	1	.747(**)
	Sig. (2-tailed)	.000	.116	.000	.	.000
	N	72	72	72	72	72
RI	Pearson Correlation	.570(**)	.116	.678(**)	.747(**)	1
	Sig. (2-tailed)	.000	.333	.000	.000	.
	N	72	72	72	72	72

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

The table 10 shows association among variables under study. Since the variables under study are quantitative so the Karl Pearson correlation coefficient were calculated. Table 10 shows the correlation matrix among different variables. The negative correlation shows the negative association between the variables while the positive correlation shows the negative association. Age is found to be positively correlated with number of lymph, Size, RI& PI. Size was positively correlated with number of Lymphs, PI & I.PI is positively correlated with RI.

Discussion: Oral cancers comprises of 30% of all malignant tumors of the head and neck. Nearly 95% of these are squamous cell carcinoma. Worldwide, head and neck cancer is the sixth most common human cancer. In Southeast Asia and particularly in India cancer of the oral cavity does the most common cancer comprise 35% of all cancer in men and 18% in women [2] Inflammatory diseases causes lymph nodes enlargement and inflamed. The patients included in this study were selected at random and divided into three groups. Group 1 consist control group in which male subject 17 and female 5 and mean age 32.22±6.86 (Table 1). Group 2 consist oral cancer (Squamous cell carcinoma) in which sex distribution, female 3 and male 22, mean age 5.72±9.31(Table 1), findings in this study also correlate with the previously mentioned literature and are in contradiction with the global pattern of incidence of oral cancer.[1] Group 3 consist infectious disease group in which male subject male 15 and female 10 and mean age 35.84±7.68 (Table 1).These high incidences of cancer are attributed largely to the chewing of betel quid, tobacco and pan a very common practice in north India .[2] Although no specific etiology has been established as yet; numerous risk factors contribute to the genesis of oral cancer. Certain patients have a high genetic and familial predisposition to the development of cancer. However the exceedingly strong influence of tobacco and alcohol exposure on the genesis of cancer of the upper aero digestive tract obscures the underlying genetic predisposition that may be exist.[1] Dietary factors do not play a direct role in the genesis of cancer of oral cavity. However, alcohol is a risk factor and nutritional deficiency commonly is associated with severe alcohol consumption. Other dietary deficiencies such as Iron deficiency are associated with Plummer-Vinson syndrome, where cancer of the hypo-pharynx and oral cavity frequently occurs. Social factors and life style habit have a major impact on development of oral cancer. Poor Oral hygiene is associated with a higher incidence of oral cancer.

Ultrasound is reported to be superior to palpation in detecting lymph node metastasis and inflamed lymph nodes. Whereas some authors report it to be superior to contrast enhanced CT and MRI imaging, others found similar accuracy.8 In this study we assessed 75 patients with palpable cervical lymph nodes by using various Ultrasound parameters like Gray Scale, Color Flow Imaging, Power Doppler and Pulse Doppler on the bases of shape, size, vascularity and borders. The results of these Ultrasound findings were compared. Palpation was the earliest tool used in evaluating the neck for metastatic spread to the cervical lymph nodes. A review of literature shows that palpation has a false positive rate of 15 to 65% (average of 20 to 28%) and false negative rate between 10 to 15%. Thus, a neck without palpable nodes is at risk of harboring occult metastasis. Due to the fall ability of palpation it is widely accepted to treat the neck electively.[9] Ultrasonography was clinically introduced by Dussik in 1942. Since then the application of Ultrasonography has been extended to various fields of clinical practice as an imaging method.[5] Many different Gray scale Ultrasound criteria have been used to assess the presence or absence of metastatic cervical lymph nodes. These include the maximal axial diameter, the minimal axial diameter, the shape, irregular enhancement due to tumor necrosis and the grouping of nodes.[10] For evaluating lymph nodes Ultrasonographic scanning has one particular advantage over all other axial methods in that it allows free rotation of the scanning plane and easy measurement of the largest or smallest diameter of a node. The largest or smallest diameter of a node has been an objective criterion for characterizing lymphadenopathy.[11] Studies have drawn a contrasting picture regarding the validity of the size criteria as a parameter for predicting lymph node metastasis. The long axis was considered to be an indicator[11,12,13,14,15] while other studies validated the better predictive value of the nodal short axis[16].More recent studies concluded that the size criteria is inaccurate to accurately predict metastasis as the phenomenon of micro metastasis with extra capsular spread has been demonstrated in nodes as small as 2mm in diameter.[17]

The criteria of shape or the Roundness Index, which is the ratio of the long axis diameter divided by the short axis diameter (L/S), was the next parameter that was studied for. The roundness index, which can be assessed without limitation by Ultrasound, showed the tendency for benign nodes to be oval and malignant nodes to be round

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(L/S<2).[7, 9, 18, 19] In this study we found that of the metastatic nodes 98.4% had a (L/S) value of <2.00 and 1 node (1.6%) had a value 2.00. The metastatic nodes had an overall mean L/S ratio of 1.390 with a maximum of 2.00 and a minimum of 1.00. Among the 62 non-metastatic nodes 18(29.0%) had a ratio of < 2.00 and 44 (71%) had a ratio of 2.00. The non-metastatic nodes had an overall mean L/S ratio of 2.162 with a maximum of 6.00 and a minimum of 1.00. Hence we conclude that with a Specificity of 70.6%, Sensitivity of 98.4%, Positive Predictive Value of 77.5% and Negative Predictive Value of 97.7% L/S ratio was more useful as a screening tool as it was more sensitive in ruling out if a node was metastatic but was not sufficiently specific to be dependable. Our findings reiterate that while an oval node is almost always benign, a round node may be metastatic only 3/4th of the times we were confronted with such a situation. Our findings are consistent with those of other authors.[22,23,24,25,26] Gritzmann N, Hollerweger A, Macheiner P27 state that the ratio less than two suggests malignant condition of the node. Saleh28 states that ratio less than two indicates spherical shape raising suspicion of metastasis but this criterion is not reliable for nodes smaller than one centimeter, because the measurement error is too large. Metastatic nodes smaller than one centimeter or larger than four centimeter are frequently non-spherical. The value of the roundness index was also questioned by certain studies.1

In this study 44.4% of cancerous nodes had poorly defined boundaries and 55.6% of cancerous nodes had well defined boundaries. Among the non-cancerous nodes 78% had poorly defined boundaries and 22% had well defined boundaries. Normal lymph nodes have poorly defined boundaries. Lymph nodes that have been challenged by infection develop a well-defined boundary. This occurs due to lymphocyte proliferation within the lymphoid follicles and sinusoidal enlargement and margination with macrophages.[29] Persistent infection will stimulate development of new germinal centers, which will further alter the sono-morphology of the node. Metastatic nodes were attributed to have well defined boundaries.[10] Chronically inflamed nodes also develop well defined boundaries.[29] Normal lymph nodes have poorly defined boundaries, so also would nodes with extracapsular spread[30]. Hence with such overlapping parameters delineation of the node is not a dependable parameter to be acceptable.[24] In the present study, 49.2% of nodes involved metastases from Squamous cell carcinomas were hypoechoic (heterogenous) and 50.8% of them were normoechoic (homogenous). Of the nonmetastatic nodes, 6.5% were hypoechoic (heterogenous) and 93.5% were normoechoic (homogenous). The results obtained in this study were similar to those obtained by other researchers.[31,32,26,3,33] Hence necrosis and its subsequent appearance as hypoechoic on Ultrasonographic examination is a biologically late event in the evolution of tumor within a lymph node[3]. This coupled with a high prevalence of Tuberculosis in the Indian subcontinent; make intranodal necrosis and its subsequent hypoechogenicity on Ultrasonographic examination an inaccurate diagnostic tool.

In our study- Metastatic nodes from squamous cell carcinomas showed peripheral parenchymal flow in 79.4% and hilar pattern in 20.6%. Non-metastatic nodes showed predominantly (93.5%) a hilar pattern of vascularity and the rest of the non-metastatic nodes (9.7%) had a peripheral parenchymal flow. These findings were consistent with those of other researchers.[28, 29, 30, 31, 25, 24, 32] Gosselin BJ, Lydiatt WM, Talavera F32 stated that there is a clear correlation between tumor angiogenesis and nodal metastases. Literature notes conflicting reports regarding micro vessel density and nodal metastases in head and neck squamous cell carcinomas. Tumor sites of varying origins with different vascularization patterns at their primary sites may behave differently.

In this study, on the bases of resistance to perfusion, most of nodes with metastases from squamous cell carcinomas had a P.I. around 1.7 and ranged from 0.93-1.97. The non metastatic nodes had a mean P.I. of 1.15 and ranged from 0.56-1.82. In this study the mean resistivity index (R.I.) value of the metastases of squamous cell carcinomas it was 0.96 and ranged from 0.78-1.97. Non-metastatic nodes had a mean R.I. of 0.67 and ranged from 0.41-0.86. The findings of this study compare favorably with those of other researchers.[3,33,34, 30, 22, 35, 24, 27] The changes in size, shape (L/T ratio), echogenicity, and morphology of the nodal hilum or cortex have been suggested as sonographic criteria for differentiation of benign from malignant nodes. Even though benign and malignant nodes were significantly different according to the morphologic criteria on Grayscale sonograms, the morphologic criteria are not very helpful as shown in this and other studies.[10,20] The morphologic criteria for differentiating malignant from benign reactive nodes on Gray-scale sonograms have been based on the differences in histological findings between the two. In malignant nodal disease, the infiltration of the node by malignant tissue changes the shape and echogenicity of the node and deforms the normal echogenic hilum on Grayscale sonograms.[31] In benign reactive nodes the diffuse nature of the process usually preserves the normal nodal shape and echogenic hilar structure. However, if the inflammatory stimuli persist, unusual morphologic changes in nodal shape and in the echogenic hilum can be seen on sonograms.[31] These various morphologies of benign reactive nodes make it difficult to differentiate benign from malignant nodes with the previously reported criteria (size. shape. and morphology of the echogenic hilum) on Gray-scale sonograms.[27] The lymph node has both arterial and venous systems.[31] The arterial system consists of a hilar nodal artery, smaller arteries or arterioles in the medulla and trabecular structures, and sinuous capillaries in the cortex branched from arterioles entering the cortex. A few arterioles reach the capsule via trabecular structures. The veins generally parallel the arteries. This histologic vascular anatomy of the lymph node explains the normal pattern of nodal vascularity that appears as a radial and longitudinal configuration with symmetric distribution on Color Doppler sonograms. In reactive nodal disease, the diffuse nature of the histologic process occurring within the node is more likely to preserve the normal vascularity pattern. In malignant disease however, the changes in nodal vascular structures are somewhat different. First, the changes in nodal architecture caused by infiltrating tumor cells distend and destroy the preexisting nodal vascular structure and the degree of changes may be dependent on the extent of tumor infiltration. Second, neo-vascularization by infiltrating tumor induces aberrant feeding vessels in the periphery of tumor nests by tumor angiogenesis and sinusoid neo-vascularity within the tumor nests. This different change in nodal vessels in malignant nodes provides the criteria for the diagnosis of malignant lymphadenopathy by means of Color Doppler sonography.[31] Other studies[28, 29] reported that reactive nodes showed increased central perfusion of the hilum and metastatic nodes also tended to show increased peripheral perfusion. In our study, the pattern of hilar vascularity was dominant in benign reactive nodes, whereas the most common pattern was the peripheral parenchymal vascularity pattern in malignant nodes. Our study of Doppler waveforms supports the results of several previous reports[22,24,27,30,3,33,34,35] malignant nodes tend to have higher RI and PI values than benign nodes. Knowledge of invasion of the walls of the cervical vessels by tumour is of great clinical importance before surgery.[12] Ultrasound can provide vital information regarding proximity of the lymph nodes to vital structures. Relationship of the nodes to the Internal Jugular Vein, Common Carotid, Internal and External carotid arteries can be assessed which would help us plan the surgery in advance, as involvement of these structures would warrant a more radical approach. Planning can be done of both extent and duration of surgery, which would help us in anticipating complications and preparing patients towards the same. Information obtained from the Ultrasound examination has helped us to modify the treatment plan in 8 cases with all of them undergoing a more radical procedure. No significant additional information could be obtained by the use of Color or Pulsed Doppler.

Conclusion: We conclude that ultra-sonographic examination of cervical lymph nodes can yield important information regarding the diagnosis in inflammatory as well as malignant condition. In malignant conditions, no single US sign is absolutely accurate in diagnosing peripheral lymph node malignancy. The association of

signs, however, produces a highly suggestive appearance in most cases, and makes of ultra-sonography an extremely useful diagnostic means. Critical appraisal of gray-scale signs is crucial for an accurate diagnostic approach. Doppler contributes to the diagnostic confidence. New techniques are on the way to further enhance the applications of ultra-sonography in peripheral lymph node disease.

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