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Diagnostic Accuracy of Computed Tomography (CT) in Patients with Neck and Mediastinal Lymphoma and Correlate with Gold Standard Histopathology Results

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ABSTRACT

Objective: To determine the diagnostic accuracy of Computed Tomography (CT) in patients with neck and mediastinal lymphoma and correlate with gold standard histopathology results. **Period:** This study was conducted during six months period extended from March 2013 to September 2013. **Setting:** Department of diagnostic radiology, Dr. Ziauddin University Hospital, Karachi. **Methodology:** A total of 366 patients presenting with sign and symptoms such as fever, night sweats, weight loss or having any swelling in the cervical region were included and CT was performed; regardless of scan result suggestive of either presence or absence of lymphoma; patients were followed and histopathological findings of each patient was collected and recorded on Performa. Other demographic variables were also obtained and data were analyzed by Statistical Package for the Social Sciences (SPSS) -17. **Results:** Sensitivity, specificity, positive and negative predictive value as well as accuracy of computed tomography in the detection of neck &mediastinal lymphoma were found to be 75%, 89.9%, 59.2, 94.8% and 87.4% respectively. For patients with ≤10 months duration of disease and for patients with>10 months duration of disease, the accuracy of CT scan was observed as 84.7% and 93.6% respectively. **Conclusion:** CT scan is cross-section modality of choice for evaluating patients with suspected malignant tumors. CT is readily available and has high accuracy in distinguishing a mass compared with other tumors.

Keywords: Mediastinal lymphoma, Computed Tomography, Malignant tumors

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INTRODUCTION

Lymphomas are described as a group of blood tumors which results in malignant procreation of cells native to lymphoid tissues. The two major types of lymphomas includes; Hodgkin's Lymphoma and Non Hodgkin Lymphoma representing a diverse group of disease of either B Cell (80-85%), T Cell(15-20%) or natural killer lymphocytes.[1,2] Lymphomas commonly present as an enlargement of one or group of lymph nodes causing painless rubbery lumps under the skin. Abdomen and mediastinum are most frequent sites of involvement; however, many other organs can be involved.[3]

The accelerated rate at which lymphomas grow often mandates emergency therapeutic measures. Mediastinal tumors may cause compression of great vessels in chest (Superior vena cava Syndrome) with plethora, swelling of face, neck and upper extremities. Esophageal compression may lead to dysphagia.[3]

Several imaging modalities like plain radiograph, computed tomography (CT), magnetic resonance imaging can be used for detection of lymphoma. Castellino et al found that computed tomography demonstrates abnormal lymph nodes more readily than conventional X-Ray techniques within the thorax.[4] Yousum et al found that the sensitivity of magnetic resonance imaging for detection of central necrosis within the node was 50% whereas for computed tomography it was upto 100%.[5] This low sensitivity of magnetic resonance imaging is due to the fact that the cervical lymphnodes are embedded in the fat and high T1 signal intensity of the fat obscures much nodal detail.[6]

The typical computed tomography appearance in a patient with lymphoma is a homogenous soft tissue mass with sharply defined and often lobulated borders, the center of which contains an area of low attenuation due to necrosis.[7] The lymph nodes on computed tomography larger than 1cm are interpreted as being involved.[7] Sensitivity and specificity of computed tomography for evaluation of lymph node involvement is 88% and 86% respectively.[8] In another study conducted by Totanarungroj K. et al demonstrated the sensitivity and specificity of computed tomography for evaluation of lymph node as 75% and 93% respectively.[9]

The objective of this study was to determine the diagnostic accuracy of Computed Tomography of neck and mediastinal lymphoma taking histopathology as the gold standard.

METHODOLOGY

Period: This study was conducted during March 2013 to September 2013.

Setting: Department of diagnostic radiology, Dr. Ziauddin University Hospital North Nazimabad campus, Karachi, Pakistan. Ethical approval was taken from the ethical board of the respective medical University.

Inclusion criteria: Included patients of either sex in age group 18- 60 years presenting with sign and symptoms of fever, night sweats, weight loss or having any swelling in the cervical region.

Exclusion criteria: However patients who were already diagnosed with lymphoma, patients with post radiation and post chemotherapy history and non consenting patients were excluded from the study. Oral and written consent was obtained from the participants before the start of the study. Patients with clinical sign and symptoms of fever, night sweats, weight loss, failure to thrive or any swelling in the cervical region were referred to the radiology department of Dr. Ziauddin Hospital for Computed Tomography of neck and chest. Computed Tomography(CT) Scan was performed on Toshiba AsteionMultisliceCTscanner both before and after intravenous contrast administration. Non-ionic iodinated contrast was given at a dose of 1.5-2.0 ml/kg with power injector @ 2.0 ml/sec. The scanning protocols were 3mm section thickness, 3mm reconstruction interval, scan delay 80 seconds, 450 mAs and 100 to 150 KV.

Images were analyzed by a senior radiologist having at least five years post fellowship experience. Relevant patient data was collected on the Performa. Regardless of scan result suggestive of either presence or absence of lymphoma patients were followed and histopathological findings of each patient whether positive or negative was collected and recorded on performa by the researcher.

The data was analyzed through statistical package for social sciences (SPSS) version 17. Male to female ratio for gender and mean ± SD for age and duration of symptoms were computed. A 2x2 table was constructed and sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Computed Tomography in detecting lymphoma by taking histopathology as the gold standard was calculated. Stratification was done with regards to age, gender and duration of symptoms to see the effect of these on outcome, through chi-square test taking P value <0.05 as significant.

RESULTS

A total of 366 patients presenting with sign and symptoms like fever, night sweats, weight loss or having any swelling in the cervical region were included in the study, with an average age of 39.75±12.28 years. Overall 196(53.55%) were male and 170(46.45%) female. The average duration of disease was 8.8±3.75 months (Table 1).

Table 1: descriptive statistics of the patients (n=366)

Variables	Age (Years)	Duration of symptoms (months)
Mean ± SD	39.75±12.28	8.8±3.75
95% confidence Interval	38.49 to 41.01	8.5 to 9.27
Median (IQR)	40(20)	9(5)
Max – Min	60-18	18-2

Diagnostic accuracy of computed tomography of neck and mediastinal lymphoma taking histopathology as the gold standard (table 2a). Neck and mediastinal lymphoma were 16.4% (60/366) of the cases. Sensitivity, specificity, positive predictive value(PPV)and negative predictive value (NPV) as well as accuracy of computed tomography in the detection of neck and mediastinal lymphoma were

found to be 75%,89.9%, 59.2,94.8% and 87.4% respectively.

Table 2 (a): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma taking histopathology as the gold standard

CT	Histopathology		Total
	Positive	Negative	
Positive	45 (TP)	31 (FP)	76 (20.8%)
Negative	15 (FN)	275 (TN)	290 (79.2%)
Total	60 (16.4%)	306 (83.6%)	366

Sensitivity = 75.0%, specificity = 89.9%, PPV= 59.2%, NPV =94.8%, accuracy=87.4%

Table 2 (b): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma taking histopathology as the gold standard for male

CT	Histopathology		Total
	Positive	Negative	
Positive	38 (TP)	25 (FP)	63(32.1%)
Negative	7 (FN)	126 (TN)	133(67.9%)
Total	45(23%)	151(77%)	196

Sensitivity = 84.4%, Specificity = 83.4%, PPV= 60.3%, NPV =94.7%, Accuracy=83.7%
Chi-square=73.25 p=0.0005

Table 2(c): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma taking histopathology as the gold standard for female

CT	Histopathology		Total
	Positive	Negative	
Positive	7 (TP)	6 (FP)	13(7.6%)
Negative	8 (FN)	149 (TN)	157(92.4%)
Total	15(8.8%)	155(91.2%)	170

Sensitivity = 46.7%, Specificity = 96.1%, PPV= 53.8%, NPV =94.9%, Accuracy=91.7%
Chi-square=35.46 p=0.0005

Accuracy of CT in detection lymphoma was 83.7% in male cases and 91.7% for female cases (table 4).

Similarly with respect to age groups accuracy of CT was above 70% for below and equal to 30 years of age and above 30 years of age as presented (table 2 d & e). With respect to duration of symptoms accuracy was also high, for patients with ≤10 months duration of disease = 84.7%, and for patients with>10 months duration of disease accuracy was 93.6% (Table 2 f & g).

Table 2(d): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma for the ≤ 30 years of age

CT	Histopathology		Total
	Positive	Negative	
Positive	30 (TP)	19 (FP)	49(46.2%)
Negative	5 (FN)	52 (TN)	57(53.8%)
Total	35(33%)	71(67%)	106

Sensitivity = 85.7%, Specificity = 73.2%, PPV= 61.2%, NPV =91.2%, Accuracy=77.3%
Chi-square=73.16 p=0.0005

Table 2(e): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma for the>30 years of age

CT	Histopathology		Total
	Positive	Negative	
Positive	15 (TP)	12 (FP)	27(10.4%)
Negative	10 (FN)	223 (TN)	233(89.6%)
Total	25(9.6%)	235(90.4%)	260

Sensitivity = 66.7%, Specificity = 84.8%, PPV= 66.7%, NPV =84.8%, Accuracy=79.2%
Chi-square=12.7 p=0.0005

Table 2(f): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma for patients with ≤10 months duration of disease

CT	Histopathology		Total
	Positive	Negative	
Positive	40 (TP)	24 (FP)	64(25%)
Negative	15 (FN)	177 (TN)	192(75%)
Total	55(21.5%)	201(78.5%)	256

Sensitivity = 72.7%, Specificity = 88.1%, PPV= 62.5%, NPV =92.2%, Accuracy=84.7%
Chi-square=85.1 p=0.0005

Table 2(g): Diagnostic accuracy of computed tomography of neck & mediastinal lymphoma for patients with>10 months duration of disease

CT	Histopathology		Total
	Positive	Negative	
Positive	5 (TP)	7 (FP)	12(10.9%)
Negative	0(FN)	98 (TN)	98(89.1%)
Total	5(4.5%)	105(95.5%)	110

Sensitivity = 100%, specificity = 93.3%, PPV= 41.7%, NPV =100%, accuracy=93.6%
Chi-square=42.77 p=0.0005

DISCUSSION

The current evidence based interventions are based on the imperative investigations which certainly aid for building up diagnosis. Advances in methods to image the human body over the past two decades are the product of technologic advancements that has led to new approaches for acquiring medical images. These advances have improved medical diagnosis and contributed substantially to the precision of radiation therapy, pharmaceutical treatment, and surgical intervention. CT is used most often to evaluate the anterior mediastinum whenever a definite or possible abnormality gets detected on chest radiography. Usually the abnormality is either diffuse widening of the mediastinum or a focal bulge or mass. There has been rapid and vigorous growth of medical technologies over the past decades with radiological imaging being one of the most visible of the technology-intensive fields in medicine. These advances have improved medical diagnosis and contributed substantially to the precision of medical and surgical treatments.[10, 11]

CT improves diagnostic accuracy in determining whether a real abnormality is present in the body. CT also often can show the exact nature and extent of masses. A second common indication for CT is to search for an abnormality that is clinically suspected but is not shown on radiographs.

CT scan imaging is frequently requested for the investigation of compression and paraneoplastic symptoms in patients with mediastinal symptoms. Nonetheless asymptomatic patients or patients with other unrelated symptoms are also been accidently identified of having tumors when CT is used for screening purposes. However staging is also done with the help of CT and hence predict the survival of the disease.[12,13]

In our study, diagnostic accuracy of computed tomography in neck & mediastinal lymphoma was 83.7% in male cases and 91.7% for female cases which is supported by the results of different studies showing accuracy of CT 78%,76%and 73% respectively.[14,15] Buchmann et al[16] estimated the accuracy of CT scan using ROC curve to be 92%, 92%, 90% and 95%for lymphnodes, extranodal, supradiaphragmatic and infradiaphragmatic respectively. However Mikhaeel et al, found CT to be accurate in 58% of patients with NHL.[17]

Zinzani et al assessed 59 patients with NHL with abdominal involvement and CT scan was performed at the diagnosis and two years follow-up. The accuracy of Scan was diminished by the large number of false positives, which may resulted from CT's limitation to demarcate the active disease and the treated patients' fibrotic changes.[18]

CONCLUSION

Our study indicates that CT is an accurate method of diagnosing neck & mediastinal tumors. It is cross-section modality of choice for evaluating patients with suspected malignant tumors. CT is readily available and precise to an extent in distinguishing a mass compared with other tumors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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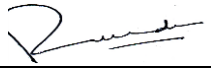
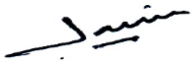
Dr. Sadia Rashid	Concept & Design of Study	
Dr. Jaideep Darira	Data Analysis	
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