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ORIGINAL ARTICLE

Diagnostic Accuracy of Multislice CT Scan in the Detection of Cervical Lymph Node Metastasis in Head and Neck Cancers

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ABSTRACT

Objectives: To determine the diagnostic accuracy of multislice CT scan in the detection of cervical lymph node metastasis in head and neck cancers, taking histopathology as gold standard.
Study design: Descriptive, cross-sectional study.
Settings: Department of Radiology, Jinnah Hospital, Lahore
Study duration: 8th January 2018 to 7th July 2018
Materials & Methods: Total 95patients with squamous cell carcinoma of head and neck, 15-55 years of age of both genders were selected. All the patients with prior radiation to head and neck, already proven histopathology, CRF and claustrophobic patients were excluded. Multislice computed tomography of neck was performed on Toshiba Aquilion Multislice CT scanner before and after intravenous contrast administration. Each multislice CT scan findings were looked for malignant cervical lymph nodes. Multislice CT scan findings were compared with histopathology findings.
Results: Mean age was 43.21 ± 8.16 years. Out of these 95 patients, 54 (56.84%) were males and 41 (43.16%) were females with ratio of 1.3:1.All the patients were subjected to CT of neck and found that 48 were True Positive and 04 were False Positive. Among 43, CT negative patients, 04 (False Negative) had malignant cervical nodes on histopathology whereas 39 (True Negative) had benign cervical nodes on histopathology (p=0.0001). Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of multislice CT scan in the detection of cervical lymph node metastasis in head and neck cancers, taking histopathology as gold standard was 92.31%, 90.70%, 92.31%, 90.70% and 91.58% respectively**.**
Conclusion: This study concluded that multislice CT scan is a highly sensitive and accurate non-invasive modality for detecting cervical lymph node metastasis in head and neck cancers.
Keywords: Head and Neck Cancers, Cervical Lymph Node Metastasis, Computed Tomography.

INTRODUCTION

The oral cavity, pharynx, larynx, paranasal sinuses, salivary glands, and thyroid are all part of the head and neck area [1]. The mucosal linings of the upper aerodigestive tract (the nose, sinuses, nasopharynx, hypopharynx, larynx, and trachea) are the origin of head and neck squamous cell carcinoma (HNSCC). Among malignant tumours of the head and neck, squamous cell carcinoma (SCC) is the most common type. Incidence-wise, HNSCC ranks sixth among all cancers [2].

Incidences of more than 30 per 100,000 people in India (oral cancer), France, and Hong Kong make squamous cell cancer of the head and neck one of the most frequent cancers globally (nasopharyngeal cancer). In the United States, it accounts for around 4% of all cancer cases, while in the United Kingdom, it accounts for around 5%. There were 2,940 newly diagnosed instances of cancer in the mouth, lips, or throat in men in the United Kingdom in 1996, or an incidence of 10.2 per 100,000 people [3]. Those in their forties and fifties are particularly vulnerable. In Scotland, the incidence has increased by 19.4% in males and 28.7% in women during the past decade, resulting in a declining 3:1 ratio in prevalence between the sexes [4]. The rate of incidence and mortality from cancer of the tongue is higher in low-income areas of the United Kingdom [4].

Head and neck squamous cell carcinoma (HNSCC) is the leading cancer killer of men and the second leading cancer killer of women in Pakistan [5]. Survival rates at three and five years for people diagnosed with head and neck carcinomas have been reported to range from 46.2% to 82% [6]. It is estimated that the incidence of oral SCC is 40% higher in South-East Asia. This is the second most prevalent malignant tumour worldwide, and it affects both men and women equally [7].

One of the most significant markers of poor prognosis in head and neck malignancies is the presence or absence of lymph nodes. It has been shown that palpation-based staging of cervical lymph node metastasis is incorrect, with at least 30% of cases of cervical nodal metastases being missed due to non-visualization [8-9]. A negative predictive value (NPV) of 80% or above is required for a staging method to be useful in preventing the overtreatment of patients with histologically negative necks [10, 11]. Although enlarged cervical LNs can be detected using ultrasound, routine contrast-enhanced CT, and magnetic resonance imaging (MRI), these methods are not able to reliably differentiate between benign and malignant causes of enlargement because they rely on standard parameters (shape, size, internal architecture, extranodal invasion, and vascular features) that are not specific for malignancy [12, 13].

Today, patients with head and neck squamous cell carcinoma typically undergo CT or MR imaging to evaluate primary tumours and metastatic lymph nodes [14, 15]. One study indicated that 48.39% of cervical lymph nodes were malignant, and that multislice CT had a sensitivity of 100%, specificity of 93%, NPV of 100%, PPV of 100%, and total diagnostic accuracy of 96.21% [7]. Multislice CT was found to have a sensitivity of 16.0% and a specificity of 76.0% in detecting cancer cervical lymph nodes in a separate research [15].

Multislice CT has been shown to have a sensitivity of 52.0% and a specificity of 93.0% in detecting malignant cervical lymph nodes in a meta-analysis [16].

This study was designed to determine the diagnostic accuracy of multislice CT scan in the detection of cervical lymph node metastasis in head and neck cancers, using histopathology as the gold standard. This is because there is some debate in the existing literature about the usefulness of this technique. In addition to contributing to the resolution of this debate, the findings of my study will provide a non-invasive imaging modality for routine use in our general practise for the detection of occult cervical lymph node metastasis for the selection of timely and proper treatment option in an effort to decrease the morbidity and mortality of these patients.

MATERIALS AND METHODS

This descriptive study was conducted at Department of Radiology, Jinnah Hospital, Lahore. During from the period 8th January 2018 to 7th July 2018. Total 95 patients of either gender presented with squamous cell carcinoma of head and neck were included in this study. Patients' ages ranged from 15 to 55 years at the time of the study. Patients who had histopathology that had already been proven, patients who had a history of prior irradiation, patients who had a history of hypersensitivity to iodinated contrast agent, patients who had chronic renal failure, and patients who were claustrophobic (with a fear of closed spaces) were excluded from the study because they were unable to undergo CT scanning.

Before and after intravenous contrast was administered, a multislice computed tomography scan of the patient's neck was performed on a Toshiba Aquilion Multislice CT scanner. This was done after informed consent was obtained. Following the injection of the contrast media, three different sets of pictures were taken in a craniocaudal direction at intervals of 25, 65, and 180 seconds. When you hold your breath for a single second, images will be captured. The findings of each multislice CT scan were analysed by one consultant radiologist who had at least five years of experience, and they were examined in order to seek for malignant cervical lymph nodes according to the operational criteria. After that, a biopsy of the cervical lymph node was performed on each patient in the appropriate ward. The material was then transferred to the institutional pathology laboratory for histopathology, and the consultant histopathologist was responsible for interpreting the results. The findings of a multislice CT scan were compared with the findings of a histopathological exam.

SPSS 20.0, computer software, was used to perform the analysis on the data that was collected. We determined the mean and the standard deviation for quantitative data such as age, the length of time the disease has been present, and the size of the lymph node. For qualitative variables such as gender and the presence of malignant cervical lymph nodes on multislice CT scan and histology, frequency and percentage calculations were performed. In order to determine the sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of multislice CT scan in detecting malignant cervical lymph node, a 2x2 contingency table was utilised, with histopathology serving as the gold standard.

RESULTS

Age range in this study was from 15-55 years with mean age of 43.21 ± 8.16 years. Majority of the patients 74 (77.89%) were between 36-55 years of age as shown in Table I.

Out of these 95 patients, 54 (56.84%) were males and 41 (43.16%) were females with ratio of 1.3:1 (Figure I). Mean duration of disease was 7.00 ± 1.82 months (Table II). Mean size of cervical node was 6.46 ± 1.97 cm (Table III).

All the patients were subjected to CT of neck and found that 48 were True Positive and 04 were False Positive. Among 43, CT negative patients, 04 (False Negative) had malignant cervical nodes on histopathology whereas 39 (True Negative) had benign cervical nodes on histopathology (p=0.0001) as shown in Table IV. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of multislice CT scan in the detection of cervical lymph node metastasis in head and neck cancers, taking histopathology as gold standard was 92.31%, 90.70%, 92.31%, 90.70% and 91.58% respectively.

Table-1: Distribution of patients according to Age.

Age (years)	No. of Patients	%age
15-35	21	22.11
36-55	74	77.89
Total	95	100.0

Mean ± SD = 43.21 ± 8.16 years

Figure-1: Distribution of patients according to Gender (n=95).

Table-2: Distribution of patients according to duration of disease.

Duration of disease	No. of Patients	%age
≤6 months	38	40.0
>6 months	57	60.0
Total	95	100.0

Mean ± SD = 7.00 ± 1.82 months

Table-3: Distribution of patients according to size of cervical nodes.

Size of cervical nodes (cm)	No. of Patients	%age
≤5	31	32.63
>5	64	67.37
Total	95	100.0

Mean ± SD = 6.46 ± 1.97 cm

Table-4: Diagnostic accuracy of multislice CT scan in the detection of cervical lymph node metastasis in head and neck cancers, taking histopathology as gold standard.

	Positive result on Histopathology	Negative result on Histopathology	P-value
Positive result on CT	48 (TP)	04 (FP)	0.0001
Negative result on CT	04 (FN)	39 (TN)	

Sensitivity: 92.31%, Specificity: 90.70%, Positive Predictive Value (PPV): 92.31%, Negative Predictive Value (NPV):90.70%, Diagnostic Accuracy: 91.58%

DISCUSSION

The most prevalent form of cancer in the head and neck is squamous cell carcinoma (SCC). It's responsible for 5% of all cancerous tumours in the world [17]. In a meta-analysis, Dünne et al. [18] found that patients with SCC who also had metastases in their cervical nodes had a 5-year survival rate of between 17% and 55.8%, while those without such metastases had a survival rate of 44.6-76%. It is thought that a poorer prognosis is associated with the discovery of numerous metastatic lymph nodes (LNs) [19]. Metastasis to the cervical lymph nodes is an extremely useful prognostic indicator and a major factor in the selection of therapy for head and neck SCC. The definitive way for distinguishing benign from metastatic LNs is node sample; however, biopsy methods are invasive, operator dependent, and yield a high rate of false-negative results [20, 21]. Several noninvasive imaging approaches have emerged in recent years, with the potential to distinguish between benign and metastatic LNs in head and neck SCC, obviating the need for biopsy collection and the risks it entails [22].

Standard parameters (shape, size, internal architecture, extranodal invasion, and vascular features) are not specific for malignancy [24-25], so while ultrasound, routine contrast-enhanced CT, and magnetic resonance imaging (MRI) can detect enlarged cervical LNs, they cannot reliably differentiate between benign and malignant causes of enlargement [23]. This study was

performed to evaluate the diagnostic accuracy of multislice CT scan for the detection of cervical lymph node metastases in head and neck malignancies, with histopathology serving as the gold standard.

The participants in my study had a wide age distribution, ranging from 15 to 55 years old with a mean age of 43.21 8.16 years. Seventy-four (73.89%) of the patients fell between the age range of 36 to 55. There were 95 patients in all, 54 (56.84%) of whom were male and 41 (43.16%) of whom were female, for a female-to-male ratio of 1.3:1. In the end, CT of the neck was performed on all of the patients, revealing 48 True Positives and 4 False Positives. Four of the 43 CT-negative patients (False Negative) had malignant cervical nodes on histology, while all 39 CT-negative patients (True Negative) had benign cervical nodes (p0.0001). Using histopathology as the gold standard, multislice CT scan had a sensitivity of 92.31%, a specificity of 90.70%, a positive predictive value of 92.31%, a negative predictive value of 90.70%, and an overall diagnostic accuracy of 91.58% when detecting cervical lymph node metastasis in head and neck cancers. One study indicated that 48.39% of cervical lymph nodes were malignant, and that multislice CT had a sensitivity of 100%, specificity of 93%, NPV of 100%, PPV of 100%, and total diagnostic accuracy of 96.21% [7]. Multislice CT was found to have a sensitivity of 16.0% and a specificity of 76.0% in detecting cancer cervical lymph nodes in a separate research [15]. Multislice CT has been shown to have a sensitivity of 52.0% and a specificity of 93.0% in detecting malignant cervical lymph nodes in a meta-analysis [16].

Four-millimeter axial CT sections were taken at 5-millimeter intervals in a 1991 research by Carvalho et al [26]. Six of these people were already radiation therapy veterans. The presence of uneven boundaries, invasion of neighbouring structures, disappearance of surrounding fat planes, and thickening of nearby fascia were all imaging criteria for ECS. A single pathologist examined and characterised each lymph node separately. They found that CT could detect ECS with a sensitivity of 62.5% and a specificity of 60%.

Only one study evaluating CT's diagnostic accuracy for ECS has been published in the English-language literature in the previous 20 years. Souter et al. [27] analysed 149 neck dissections performed in 2009 using CT scans with a thickness of 3 and 5 mm. Some imaging investigations avoided using iodinated contrast material whereas others routinely used it. Enhancing nodal margins, changes in surrounding fat, and loss of margin definition were imaging criteria for ECS. There was an effort to match up nodes on radiology scans with their histopathology diagnoses. Two observers assessed ECS with a sensitivity of 66% and an 80% specificity, respectively.

In a short study [28], 17 patients were analysed to compare CT and MR imaging for the identification of ECS. CT showed a poor sensitivity of 65% but a high specificity of 93%. Three- to five-millimeter collimation was used in helical CT scans of the patients. An effort was made to identify each node for pathologic-radiologic connection. Foggy borders, asymmetrical increase of the capsular structures, and extracapsular extension were radiographic hallmarks of ECS.

When comparing palpation with CT scan, Merritt et al. [29] found that palpation had a sensitivity of 75% and a specificity of 83%, while CT scan had a sensitivity of 81% and a specificity of 83%. A study by Giancarlo et al. [30] examined the diagnostic efficacy of palpation and ultrasonography and found no significant difference between the two. Clinical assessment prior to surgery does not aid in the detection of affected cervical lymph nodes, as demonstrated by Kassekh et al [31]. Palpation has been reported in the literature to have an accuracy of 60-80% in detecting cervical lymph node involvement [32].

CONCLUSION

This study concluded that themultislice CT scan is a highly sensitive and accurate non-invasive modality for detecting cervical lymph node metastasis in head and neck cancers, and has not only dramatically improved our ability of accurate detection of cervical lymph node metastasis in head and neck cancers patients but also improved patient care by pre-operatively planning of the proper management of patients. So, we recommend that multislice CT scan should be used routinely as a prime modality for accurate detection of cervical lymph node metastasis in head and neck cancers which will result in proper pre-operative planning for these particular patients.

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