Clinicopathological and radiological evaluation of cervical lymph node metastasis in head and neck malignancies

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Abstract

The cervical lymphadenopathy due to metastasis carry poor prognosis. The status of cervical nodes is of critical interest to surgical, radiation and medical oncologists who manage patients with head and neck cancers. We conducted a prospective randomized study to assess the role of palpation, ultrasound and CT in detection of cervical metastasis in 25 patients presented to us with head and neck malignancy irrespective of cervical nodal status. It was observed that clinical examination was least sensitive (73.33%) when compared with computerized tomography (80%) and ultrasound (93.93%). The computerized tomography was found to be most specific (90%) when compared to clinical examination or ultrasonography (70% each).

Keywords Palpation · Ultrasonography · Computerized Tomography · Cervical lymph node · Metastasis.

Introduction

The human body has approximately 800 lymph nodes; about 300 of them are located in the neck [1]. The cervical lymphadenopathy due to metastasis, which is common in malignancies of head and neck, carry poor prognosis. The status of cervical nodes is of critical interest to surgical, radiation and medical oncologists who manage patients with head and neck cancers.

F.A. Firestone [2] was first to successfully apply the field of ultrasonic to material by an instrument named 'Reflectoscope' however Douglass H. Howry et al. [3] were first to describe the use of ultrasound waves in medicine to diagnose different pathologies in soft tissue of human body by an instrument called 'Soma scope' (tissue vision).

Ultrasound is sensitive in detecting superficial lymphadenopathy. However, differentiating between benign and malignant conditions and prediction of their pathologies is not possible based only on the ultrasound findings. Thus image-guided biopsy is required for this clinical problem. Several studies have shown that sonography has markedly higher sensitivity than palpation for the detection of enlarged lymph nodes in patients with suspected regional lymph node metastasis, particularly in presence of severe post operative scarring [5, 6].

The advent of X-ray computerized tomography in early 1970 by Godfrey Hounsfield and Allan Cormack enabled visualization of human body from inside. CT scan has been used specifically to evaluate cervical lymph nodes only since 1981. Before 1981, radiologist could offer little effective aid to the clinician evaluating the diseases of the nodes. The CT scan revolutionized the further management of head and neck diseases by its high-resolution capabilities.

Aims and Objectives:

(1) To compare the Clinical Examination with Radiological (US & CT) and Pathological diagnosis of cervical lymph node metastasis in Head and Neck malignancies. (2) To

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assess the role of CT and US in evaluating cervical lymph metastasis.

Material and Methods

This prospective study was conducted in the Departments of Otolaryngology - Head & Neck Surgery, Radiodiagnosis and Pathology from March 2004 to July 2005. Twenty-five patients with various head and neck malignancies diagnosed clinically, irrespective of cervical lymph node status were included randomly in this study. Patients with occult primary on clinical examination were excluded from the study. In all twenty-five cases informed consent was taken and an ethical committee reviewed study.

Besides systemic examination, Otorhinolaryngology - Head and Neck examination was done. The primary tumour was assessed and staged clinically. The palpable lymph nodes were documented according to the number, size, site, consistency, and mobility. The site was recorded according to levels of the lymph nodes in the neck.

After the clinical examination of cervical lymph node, patients were subjected to US examination with 7-12 MHz probe. The lymph node was diagnosed as positive for metastasis if following criteria were met:

1. Lymph node with size greater than 1cm except level II where lymph node greater than 1.5 cm was considered positive.
2. Lymph node with central necrosis and peripheral rim enhancement after intravenous contrast.
3. Three or more lymph nodes in primary drainage area.
4. Round shape.
5. Extracapsular spread of the disease.

After ultrasonography, the patients were subjected to computerized tomography. Axial sections of 3-5mm thickness were taken from base of the skull to C-6 vertebra. The patients were first subjected to plain CT and then rapid infusion of 100 ml. contrast was given and sections were taken again. Characteristics of lymph nodes found on the scan were recorded in terms of various parameters given earlier. The lymph node was diagnosed as positive for metastasis if following criteria were met:

1. Lymph node with size greater than 1cm except level II where lymph node greater than 1.5 cm was considered positive.
2. Lymph node with central necrosis and peripheral rim enhancement after intravenous contrast.
3. Three or more lymph nodes in primary drainage area.
4. Round shape.
5. Extracapsular spread of the disease.

Images taken by ultrasonography and computed tomography were assessed by the radiologist without the knowledge of the histopathology.

Table 1 Comparison of clinical examination with pathological results

Palpation	Pathological Report		Total
	Positive	Negative	
Positive	22 (78.57%)	6 (21.43%)	28 (56%)
Negative	8 (36.36%)	14 (63.64%)	22(44%)
Total	30	20	50

Table 2 Statistical results of clinical examination

Sensitivity	73.33%
Specificity	70%
Positive predictive value	78.57%
Negative predictive value	63.63%
Accuracy	72%

Table 3 Comparison of Ultrasonography of neck nodes with pathological results

Ultrasound	Pathological Report		Total
	Positive	Negative	
Positive	28 (82.35%)	6 (17.65%)	34 (68%)
Negative	2 (12.5%)	14(87.5%)	16 (32%)
Total	30	20	50

Table 4 Statistical results of ultrasonography.

Sensitivity	93.93%
Specificity	70%
Positive predictive value	82.35%
Negative predictive value	87.5%
Accuracy	84%

Table 5 Comparison of CT for neck nodes with pathological results

Ultrasound	Pathological Report		Total
	Positive	Negative	
Positive	24 (92.3%)	2 (7.7%)	26 (52%)
Negative	6 (25%)	18 (75%)	24 (48%)
Total	30	20	50

Table 6 Statistical results of computerized tomography

Sensitivity	80%
Specificity	90%
Positive predictive value	92.3%
Negative predictive value	75%
Accuracy	84%

Fig. 1 Comparison of statistical results of diagnostic modalities: clinical examination, ultrasonography and computerized tomography

In palpable lymph nodes FNAC was done and nonpalpable lymph nodes were subjected to either US-FNAC or CT-FNAC. In this study, nine patients underwent US-FNAC while one patient was subjected to CT-FNAC as routine FNAC was either inconclusive or lymph node was detected on radiological examination only. One patient was subjected to lymph node excision after FNAC for histopathological diagnosis.

The results were calculated in terms of sensitivity, specificity, positive predictive value, negative predictive value and accuracy for each modality used.

Observations and Results

Comparison of clinical examination with pathological results

We divided the neck into two sides; therefore in 25 patients 50 sides were examined. Out of these 50 sides, 28 sides (56%) were found positive on palpation but only 22 (78.57%) were true positive and rest 6 (21.43%) were false negative. 22 sides (44%) were found negative on palpation. Out of these, 14 sides (63.64%) were found true negative and 8 sides (36.36%) were false negative, which were detected on clinical examination (Table 1). The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of clinical examination was found to be 73.33%, 70%, 78.57%, 63.63% and 72% respectively (Table 2).

Comparison of ultrasound examination of neck with pathological results

Out of 50 sides examined in 25 patients, 34 sides (68%) were reported positive for metastases. On histopathology, only 28 sides (82.35%) were found positive i.e. true positive and rest 6 sides (17.65%) were found false positive. 16 sides (32%) were reported negative by ultrasonography but only 14 sides (87.5%) were true negative and rest 2 sides (12.5%) were false negative (Table 3). The sensitivity, spec-

Fig. 2 Ultrasonography of neck showing lymph node with central necrosis

Fig. 3 Contrast ct of neck showing lymph node with central necrosis and peripheral enhancement

ificity, positive predictive value, negative predictive value and accuracy of ultrasound was 93.93%, 70%, 82.35%, 87.5% and 84% respectively (Table 4).

Comparison of computerized tomography with pathological results

CT detected 26 sides (52%) of neck as positive for metastasis in 25 patients. Out of which, 24 sides (92.3%) were found true positive while 2 sides (7.7%) were false positive. 24 sides (48%) were reported as negative on CT. Out of these, only 18 side (75%) were true negative and 6 sides (25%) were false negative (Table 5). The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of computerized tomography was 80%, 90%, 92.3%, 75% and 84% respectively (Table 6).

Comparison of results of diagnostic modalities: clinical examination, ultrasonography and computerized tomography (Fig. 1)

We found that clinical examination was least sensitive (73.33%) when compared with computerized tomography (80%) and ultrasound (93.93%). The computerized tomography was found to be most specific (90%) as compared to clinical examination (70%) or ultrasound (70%). The computerized tomography had highest positive predictive value (92.3%) when compared with clinical examination (78.57%) and ultrasound (82.35%). The negative predictive value of clinical examination was found to be least (63.63%) as compared to CT (75%) and ultrasound (87.5%). The accuracy of clinical examination was also found to be least (72%) as compared to ultrasound (84%) or CT (84%).

Discussion

On comparing the results of the three diagnostic modalities clinical examination, ultrasound and computerized tomog-

raphy; we found that both ultrasound and computerized tomography were better than clinical examination for the assessment of cervical lymph node metastasis. The overall accuracy of the clinical examination in our study was 72% as compared to 84% accuracy of ultrasound. The results matched with those of Robert J. Baatenburg de Jong et al. [7] who reported accuracy of 83.3% for ultrasound as compared to accuracy of 70.8% for palpation. These results were also fairly in tune with Lucas Prayer et al. (1990) [8] who reported the accuracy of 97% for US and 86% for clinical examination.

D.G. John et al. [9] compared the results of the clinical examination and simple ultrasound examination of the neck in 18 patients with proven head and neck primary tumours and palpable cervical lymphadenopathy. They concluded that ultrasound did not add significantly to the information obtained by the simple neck palpation.

The accuracy of computerized tomography in our study was 84% as compared to 72% of clinical examination. These results were comparable to the study by M. Lenz et al. [10] who found the accuracy of 72% for palpation and 89% for computed tomography. Our study agrees with Michael Friedman et al. [11], Peter J. Hillsamer et al. [12], J.C. Watkinson et al. [13] and M.W.M van den Brekel et al. [14] who reported computerized tomography superior to the palpation in detecting cervical lymph node metastasis.

The reliability of palpation in cervical lymph node metastasis depends on the experience of the examiner and the anatomy of the individual neck. Reliability of palpation also depends upon the fat and muscle present above the lymph node. Some times the bone e.g. mandible present above the lymph node also influences the palpation. It was observed that palpation could not be relied upon for diagnosis, as it has low sensitivity, specificity and accuracy.

There were certain advantages of ultrasound in this study which include low cost as compared to computerized tomography, minimal stress to the patient, ease of application and repetition without radiation hazards. As stated by Jean N. Bruneton et al. (1984)⁶, we also felt that ultrasound provided information of an anatomic nature including the detection of subclinical lymph nodes, volumetric evaluation and determination of vascular connections, particularly detection of internal jugular venous thrombosis. As observed by Carl C. Reading et al. [15], we also found that sonographically guided biopsies were highly accurate and safe procedure to establish the diagnosis.

In review of literature, a lot of variation was seen in the results of computerized tomography. These variations were due to the use of different parameters to consider a node positive for metastasis, difference in the thickness of section and amount or methods of contrast infusion i.e. bolus or continuous.

M. Lenz et al. [10] concluded that with CT examination, the primary tumour is demonstrated simultaneously although problems arise in the mouth (metal artefacts) and

with small tumours (no contrast enhancement). We agree to that but computed tomography had disadvantages of high cost, radiation exposure and no enhancement of small metastatic nodes.

Conclusion

It is concluded that out of three diagnostic modalities used in this study, ultrasound had highest sensitivity, which was followed by computed tomography. The accuracy of ultrasound was equal to the computed tomography. Clinical examination alone, appeared inaccurate and inadequate method for the diagnosis of metastatic neck node. Clinical examination had low sensitivity, accuracy and high false positive and false negative values when compared to ultrasound and computed tomography. Ultrasound appeared the best investigating modality. It had highest sensitivity, lowest false positive and false negative results when compared to clinical examination and computed tomography. It also had the advantage of low cost, ease of application, non-invasive nature and is without any radiation exposure.

In this study, computed tomography had certain advantages over other two modalities used. The computed tomography not only diagnosed metastatic lymph nodes but it also gave the extent of primary tumour and distant metastasis. Although computed tomography in this study, had accuracy equal to the ultrasound but it had disadvantage of high cost, radiation exposure, and risk of anaphylaxis due to intravenous contrast.

It is concluded that in the evaluation of cervical metastasis, clinical examination must be supplemented with ultrasound and computed tomography

References

1. Som PM. (1987) Lymph nodes of the neck. *Radiology*. 165: 593–600
2. Firestone FA. (1946) The Supersonic Reflectoscope, an instrument for inspecting the interior of solid parts by means of sound waves. *J Acous Soc America* 17:287–299
3. Howry DH, Bliss WR. (1952) Ultrasonic visualization of soft tissue structures of the body. *J Lab and Clinical Medicine* 40:579–592
4. Sako K, Pradier RN, Marchette FC, Pickern JW. (1964) Falsibility of palpation in the diagnosis of metastasis to cervical nodes. *Surg Gynecol Obstet* 118:989–990
5. Bruneton JN, Roux P, Caramella E, Demard F, Vallicioni J, Chauvel P. (1984) Ear, Nose and Throat Cancer: Ultrasound diagnosis of metastasis to cervical lymph nodes. *Radiology* 152:771–773
6. Hajek PC, Salomonowitz E, Turk R, Tscholakoff D, Kumpan W, Czembirek H. (1986) Lymph nodes of the neck: Evaluation with US. *Radiology* 158:739–742
7. Baatenburg de Jong RJ, Rongen RJ, Lameris JS, Harthoorn M, Verwoerd CDA, Knecht P. (1989) Metastatic neck disease: Palpation vs. Ultrasound examination. *Arch Otolaryngol Head and Neck Surg* 115:689–690
8. Prayer L, Winkelbauer, Gritzmanner N, Winkelbauer F, Helmer M, Pehamberger H. (1990) Sonography versus palpation in the detection of regional lymph node metastases in patients with malignant melanoma. *Eur J Cancer* 26: 827–830
9. John DG, Williams SR, Ahuja A, Evans R, King WWK, van Hasselt CA. (1993) Palpation compared with ultrasound in the assessment of malignant cervical lymph nodes. *The Journal of Laryngology and Otology* 107:821–823
10. Lenz M, Sommerhoff BK, Gross M. (1993) Diagnosis and treatment of the N₀ neck in carcinomas of the upper aerodigestive tract: Current status of diagnostic procedures. *Eur Arch Otorhinolaryngol* 250:432–438
11. Friedman M, Mafee MF, Pacella BL Jr, Strorigl RNTL, Dew LL, Toriumi DM. (1990) Rational for elective neck dissection in 1990. *Laryngoscope* 100:54–59
12. Hillsamer PJ, Schuller DE, McGhee RB, Chakeres D, Young DC. (1990) Improving diagnostic accuracy of cervical metastases with computed tomography and magnetic resonance imaging. *Arch Otolaryngol Head Neck Surg* 116: 1297–1301
13. Watkinson JC, Todd CEC, Paskin L, Rankin S, Palmer T, Saheem OH, Clarke SEM. (1991) Metastatic carcinoma in the neck: a clinical, radiological, scintigraphic and pathological study. *Clin Otolaryngol* 16:187–192
14. van den Brekel MWM, Castelijns JA, Stel HV, Golding RP, Meyer CJL, Snow GB. (1993) Modern imaging techniques and US guided aspiration cytology for the assessment of neck node metastasis: A prospective comparative study. *Eur Arch Otorhinolaryngol* 250:11–17
15. Reading CC, Charbonneau JW, James EM, Hurt MR. (1988) Sonographically guided percutaneous biopsy of small (3cm or less) masses. *AJR* 151:189–192