E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.101

**Research Article**

# Clinicopathological and Radiological Evaluation of Cervical Lymph Node Metastasis in Head & Neck Malignancies

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Received: 12.05.25, Revised: 14.06.25, Accepted: 21.07.25

**Abstract**
**Background:** Head and neck cancers, highly prevalent in Asia and India, often present with cervical lymph node metastasis, impacting prognosis. This study evaluates the diagnostic accuracy of clinical examination, CT, ultrasonography, and pathological findings in detecting nodal metastasis, emphasizing imaging's role when clinical assessment is inconclusive.
**Objectives:** The objectives are to assess the role of radiological imaging, pathological results and clinical examination in evaluating cervical lymph node metastasis and to assess the diagnostic accuracy of radiological imaging when clinical examination produces negative results
**Material methods:** This cross-sectional study, conducted over 18 months in the Department of Otorhinolaryngology, included 157 patients with suspected head and neck malignancies. Patients aged 21–80 were included based on strict criteria. Radiological imaging was assessed using standardized criteria, and statistical analysis determined diagnostic accuracy.
**Results:** In this study involving 157 patients with suspected head and neck malignancies, oral cavity carcinoma was the most common diagnosis. Cervical lymph node metastasis was evaluated using clinical examination, CT, ultrasonography, and fine needle aspiration cytology, with histopathology serving as the reference standard. USG demonstrated the highest sensitivity (93.3%) for detecting metastasis, followed by FNAC (90%) and CT (83.3%).
**Conclusion:** This study emphasizes a multidisciplinary diagnostic approach for cervical lymph node metastasis in head and neck cancers. Ultrasound showed highest sensitivity, while CT provided anatomical precision. Combining clinical examination, USG, CT, FNAC, and histopathology enhances diagnostic accuracy, improves staging, guides treatment planning, and leads to better patient outcomes and prognosis.

**Keywords:** Metastasis, Head and Neck, Cervical Lymphadenopathy.

## INTRODUCTION

Head and neck cancers is the 7th most common cancer globally.[1] In Asia, head and neck cancers are more common, accounting for up to 50% of all cancers in some regions, particularly in Southeast Asia. In contrast, in North America and Western Europe, head and neck cancers account for only 3-5% of all cancer cases and in India, it constitutes about 30% of all cancers [2] .Squamous cell carcinoma is the most common malignant tumor found in head and neck surgeries [3].

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 [4].

Presence of cervical lymph node metastasis reduces the survival rate, so the appropriate diagnosis of the presence of metastatic node is very important for the management of head and neck cancer.

### Head and Neck Cancers Include [5]:

Oral cancer
Oropharyngeal cancer
Hypopharyngeal cancer
Laryngeal cancer
Nasopharyngeal cancer
Salivary gland cancer
Nasal cavity and paranasal sinus cancer
Thyroid cancer

### Symptoms of Head and Neck Malignancies [6]

Hoarseness

Dysphagia/Odynophagia
Pain
Bleeding
Presence of mass/ulcer
Swelling in the neck due to cervical nodal metastasis

In Southeast Asia and India, head and neck cancers are alarmingly common, especially among males. In India, these cancers are among the leading causes of cancer-related deaths. Oral cavity cancers are particularly prevalent, often attributed to the use of smokeless tobacco and betel quid (paan) chewing [7] This study aimed to study the findings of clinical examination, pathological results and radiological imaging of cervical lymph node metastasis in head and neck malignancies. The objectives of the present study are to assess the role of radiological imaging by standard radiological criteria for CT and Ultrasonography, pathological results and clinical examination in evaluating cervical lymph node metastasis and to assess the diagnostic accuracy of radiological imaging when clinical examination produces negative results

## MATERIALS AND METHODS

### General Study Details

A cross sectional study was conducted in the Department of Otorhinolaryngology involving all patients of suspected Head and neck malignancies admitted over 18 months and total 157 patients were included in the study.

### Inclusion Criteria

Patients between age group of 21 to 80 years.
Suspected cases of head and neck malignancies in Otorhinolaryngology department and Oncology department.
All patients who are willing to give written informed consent.

### Exclusion Criteria

Patients with ongoing treatment for head and neck malignancies such as surgery or radiation therapy.
Patients with malignancies except head and neck.
Patients who were pregnant and lactating

### Study Methodology

After obtaining approval from the Scientific and Ethics Committee and applying inclusion/exclusion criteria, patients suspected of head and neck malignancies were enrolled. Informed consent was taken from diagnosed cases. Clinical examination for cervical lymph node metastasis was conducted, noting number, size, site, consistency, and mobility of palpable nodes. Radiological evaluation (CT and USG) followed. Suspected metastatic nodes were further assessed with FNAC, and final confirmation was done using histopathological examination (HPE).

### Statistical Analysis

All statistical analysis were performed in SPSS/ Microsoft Excel.

## RESULTS

A total of 157 patients (mean age 49.25 ± 13.18 years) were included, with a male predominance (74.5%). High prevalence of substance use was noted, including smoking (39.49%), tobacco chewing (6.36%), and combined habits. Common presenting complaints were oral cavity growth (29.93%), throat pain with dysphagia (25.47%), and neck swelling (16.56%). The most frequent provisional diagnosis was oral cavity carcinoma (29.93%), followed by oropharyngeal (25.47%) and thyroid carcinoma (16.56%).

Clinically, 26 patients (16.56%) had palpable lymph nodes, most commonly at level II. Hard consistency (80.76%), mobility (61.53%), and round shape (14.64%) were common features. On correlation with histopathology (HPE), clinical examination showed 26 positives, of which 23 were true positives and 3 false positives. Among 19 clinically negative cases, 7 were false negatives. HPE confirmed 30 positive and 15 negative cases, indicating limited sensitivity of clinical palpation alone in detecting cervical lymph node metastasis.

| Palpation | Pathological Report | | Total |
|---|---|---|---|
| | Positive | Negative | |
| Positive | 23 | 3 | 26 |
| Negative | 7 | 12 | 19 |
| Total | 30 | 15 | 45 |

Table 1. Comparison of Clinical examination with Pathological Results (HPE)

| Metric | Value (%) |
|---|---|

| | |
|---|---|
| Sensitivity | 78.6 |
| Specificity | 80 |
| Positive Predictive Value (PPV) | 88.4 |
| Negative Predictive Value (NPV) | 63.15 |

Table 2. Statistical Results of Clinical Evaluation Findings.

Clinical examination showed a sensitivity of 78.6% and specificity of 80% in detecting lymph node involvement, with a PPV of 88.4% and NPV of 63.15%, indicating good accuracy but highlighting the risk of missed cases without pathological confirmation. CT imaging detected metastasis in 27 cases (17.19%), with predominant involvement at levels II (74.07%) and III (70.37%). Comparison with HPE showed 25 true positives and 3 false positives among CT-positive cases, while 5 of 17 CT-negative cases were false negatives. These findings support the diagnostic value of CT but reaffirm the necessity of histopathological confirmation.

| **CT** | **Pathological Report** | | **Total** |
|---|---|---|---|
| | **Positive** | **Negative** | |
| Positive | 25 | 3 | 28 |
| Negative | 5 | 12 | 17 |
| Total | 30 | 15 | 45 |

Table 3. Comparison of CT with Pathological Results (HPE)

The statistical analysis of CT findings in comparison with histopathological examination (HPE) is presented. The sensitivity of CT in detecting lymph node metastasis was 83.3%, indicating a high ability to correctly identify true positive cases. The specificity was 80%, showing a reliable capacity to detect true negatives. The positive predictive value (PPV) was 89.2%, suggesting that a majority of lymph node metastases identified by CT were confirmed on HPE. The negative predictive value (NPV) stood at 70.5%, reflecting that while CT was effective in ruling out metastasis, a proportion of false negatives still existed. These findings support the utility of CT imaging as a valuable diagnostic tool, though.

| **Metric** | **Value (%)** |
|---|---|
| Sensitivity | 83.3 |
| Specificity | 80 |
| Positive Predictive Value (PPV) | 89.2 |
| Negative Predictive Value (NPV) | 70.5 |

Table 4. Statistical Results of CT Findings.

The comparison between ultrasonographic (USG) findings and histopathological examination (HPE) outcomes is illustrated. Out of 32 cases that were positive for lymph node metastasis on USG, 28 were confirmed as true positives, while 4 were false positives. Among the 13 cases reported as negative on USG, 2 were found to be false negatives, and 11 were true negatives. Based on these comparisons, the sensitivity of USG in detecting metastatic lymph nodes was 93.3%, indicating a high accuracy in identifying true positive cases. The specificity was 73.3%, while the positive predictive value (PPV) was 87.5%, and the negative predictive value (NPV) was 84.6%. These results highlight the effectiveness of USG as a reliable, non-invasive tool for initial screening and evaluation of cervical lymph node metastases, though confirmatory pathological assessment remains critical for accurate diagnosis.

| **USG** | **Pathological Report** | | **Total** |
|---|---|---|---|
| | **Positive** | **Negative** | |
| Positive | 28 | 4 | 32 |
| Negative | 2 | 11 | 13 |
| Total | 30 | 15 | 45 |

Table 5. Comparison of USG with Pathological Results (HPE)

| Metric | Value (%) |
|---|---|
| Sensitivity | 93.3 |
| Specificity | 73.3 |
| Positive Predictive Value (PPV) | 87.5 |
| Negative Predictive Value (NPV) | 84.6 |

Table 6. Statistical Results of USG Findings.

Ultrasonography (USG) showed high diagnostic performance in detecting lymph node metastasis, with a sensitivity of 93.3%, specificity of 73.3%, PPV of 87.5%, and NPV of 84.6%, underscoring its reliability, particularly for identifying true positives. FNAC identified metastasis in 32 cases (20.38%) and was negative in 13 cases (8.28%), while HPE confirmed 30 positive (19.10%) and 15 negative (9.55%) cases. However, both FNAC and HPE were not performed in 112 cases (71.33%) due to non-operability or clinical decisions, highlighting the diagnostic value of pathology and the limitations in its application across all cases.

The comparison between fine needle aspiration cytology (FNAC) and histopathological examination (HPE) findings is summarized. Among the 32 cases that were positive on FNAC, 27 cases were confirmed as true positives by HPE, while 5 cases were false positives. Of the 13 cases reported as negative by FNAC, 3 cases were found to be false negatives and 10 cases were true negatives based on HPE findings. This comparison underscores the diagnostic utility of FNAC in evaluating lymph node metastasis, although a few discrepancies with HPE were noted, reaffirming the role of histopathological confirmation in establishing a definitive diagnosis.

The diagnostic accuracy of fine needle aspiration cytology (FNAC) was assessed and is presented. FNAC demonstrated a sensitivity of 90%, indicating a strong ability to correctly identify true positive cases of lymph node metastasis. The specificity was measured at 66.6%, reflecting a moderate capability in detecting true negative cases. The positive predictive value (PPV) was 84.3%, suggesting that the majority of FNAC-positive results were confirmed on histopathological examination (HPE). Meanwhile, the negative predictive value (NPV) was 76.9%, showing that most FNAC-negative results corresponded with negative HPE findings. Overall, FNAC proved to be a highly sensitive and reasonably specific tool for preliminary evaluation of metastatic involvement.

| FNAC | Pathological Report | | Total |
|---|---|---|---|
| | Positive | Negative | |
| Positive | 27 | 5 | 32 |
| Negative | 3 | 10 | 13 |
| Total | 30 | 15 | 45 |

Table 7. Comparison of FNAC with pathological results (HPE)

| Metric | Value (%) |
|---|---|
| Sensitivity | 90 |
| Specificity | 66.6 |
| Positive Predictive Value (PPV) | 84.3 |
| Negative Predictive Value (NPV) | 76.9 |

Table 8. Statistical Results of FNAC Findings.

## DISCUSSION

The findings of this study provide valuable insights into the clinicopathological and radiological evaluation of cervical lymph node metastasis in head and neck malignancies**. Iyer et al. (2007)** and **Bray et al. (2018)** highlight that the demographic profile of the study population revealed a mean age of 49.24 ± 13.18 years, with a significant male predominance (74.5%) compared to females (25.5%). This aligns with global epidemiological patterns, where men have a higher incidence of head and neck cancers due to risk factors such as tobacco use, alcohol consumption, and occupational exposures [7, 8].

In terms of clinical presentation, the most common complaint was throat pain with difficulty in swallowing (25.5%), consistent with

symptoms commonly associated with malignancies of the pharynx and larynx **(Smith et al., 2016; Johnson et al., 2015)** [9,10]. Other frequently reported symptoms included midline neck swelling (16.6%) and oral cavity growth (15.9%), indicating a high prevalence of malignancies originating from the oral cavity, oropharynx, and larynx **(Jones et al., 2019; Patel et al., 2017)** [11,12]. Less frequent complaints such as nasal obstruction with epistaxis (1.3%) and mouth breathing (0.6%) suggest that sinonasal involvement was relatively uncommon in this cohort **(Sharma et al., 2020)** {13].

The provisional diagnoses reinforced the predominance of oral cavity (29.9%) and oropharyngeal (25.5%) carcinomas—subtypes known for early cervical lymphatic spread (**Thompson et al., 2015; Williams et al., 2018**) [14,15]. Notably, thyroid carcinomas accounted for 16.6% of the cases, consistent with literature indicating frequent metastasis to lateral cervical lymph nodes in such cases (**Lee et al., 2017; Gupta et al., 2016)** [16,17]. These findings underscore the importance of meticulous evaluation of cervical nodes, especially in these primary tumor locations.

On clinical examination, lymph nodes were palpable in only 16.6% of patients. Among these, Levels III (7.5%) and II (5.6%) were most commonly involved, which concurs with the expected anatomical drainage patterns of head and neck malignancies (**Patel et al., 2018; Kumar et al., 2019)** [18,19]. However, in 81.5% of patients, lymph nodes were non-palpable, indicating the limitation of clinical examination in detecting subclinical or deeper nodal metastases. This highlights the need for adjunctive radiological methods such as ultrasonography and cross-sectional imaging (**Sharma et al., 2020; Gupta et al., 2017**) [13,20].

Ultrasound examination detected cervical lymph node metastasis in 28% of the participants, with the highest frequency at Level III (14.64%) and Level II (13.13%). These results align with prior studies suggesting these nodal levels are the most common sites of metastasis in head and neck cancers (**Patel et al., 2017; Thomas et al., 2021**) [18,21]. The accuracy of ultrasonography in detecting metastatic nodes supports its role as a non-invasive and readily available diagnostic tool in the initial assessment of cervical lymphadenopathy (**Zhang et al., 2018; Kumar et al., 2020**) **[22]**.

Fine needle aspiration cytology (FNAC) confirmed metastatic involvement in 25.5% of cases, demonstrating high diagnostic value in the evaluation of cervical lymphadenopathy. FNAC continues to be a cornerstone in the diagnostic workup of head and neck malignancies due to its minimally invasive nature, low complication rate, and high diagnostic yield (**Singh et al., 2019; Patel et al., 2018**) [24, 25].

Histopathological examination (HPE), considered the gold standard, showed metastatic involvement in 28% of patients. These findings validate the accuracy of ultrasound and FNAC, emphasizing their utility in preoperative staging and planning. The concordance between radiological and pathological findings further strengthens the reliability of these methods in evaluating cervical lymph nodes (**Rao et al., 2016; Gupta et al., 2017**) [26,27].

Overall, the clinicopathological and radiological findings in this study highlight the complex nature of cervical lymph node metastasis in head and neck malignancies. The high frequency of nodal involvement in oral cavity, oropharyngeal, and thyroid cancers underscores the need for a comprehensive, multimodal approach that includes clinical examination, imaging, cytology, and histopathology. This integrated strategy ensures more accurate detection, staging, and management of metastatic cervical lymphadenopathy, thereby optimizing therapeutic outcomes (**Wani et al., 2018; Sood et al., 2015**) [28, 29].

## CONCLUSION

The clinicopathological and radiological findings from this study highlight the complex and multifactorial nature of cervical lymph node metastasis in head and neck malignancies. A high prevalence of lymph node involvement was observed among patients with oral cavity, oropharyngeal, and thyroid cancers, reflecting their tendency for aggressive regional spread. Although most cases initially presented with non-palpable lymph nodes, advanced diagnostic tools were pivotal in uncovering occult metastases. Ultrasound (USG) demonstrated the highest sensitivity, making it an excellent initial screening tool, while CT imaging showed greater specificity, providing more precise anatomical details. FNAC and histopathological examination further supported definitive diagnosis and staging. For the best diagnostic outcome, a combined

approach using both USG and CT along with FNAC should be employed, maximizing both sensitivity and specificity in detecting cervical lymph node metastases in head and neck cancers.

The study highlights the importance of a multi-disciplinary diagnostic approach. Combining clinical examination with ultrasonography, FNAC, and HPE significantly enhances the sensitivity and specificity of metastasis detection. Levels II and III were the most commonly involved nodal sites, consistent with established metastatic patterns in head and neck cancers. This integrated approach not only improves diagnostic precision but also aids in accurate staging and treatment planning.

Clinical examination alone appeared inaccurate and inadequate as a method for the diagnosis of metastatic neck nodes. Clinical examination had low sensitivity, accuracy, and high false positive and false negative values when compared to ultrasound and computed tomography.

By incorporating such a comprehensive evaluation protocol, clinicians can ensure early detection of lymph node metastasis, optimize therapeutic decisions, and ultimately improve prognosis and clinical outcomes for patients with head and neck malignancies.

**Key Findings**

High Prevalence of Substance Use and Male Dominance

Oral Cavity as the Most Common Primary Site

Level II and III Nodes Most Commonly Involved in Metastasis

Ultrasonography (USG) Outperformed Clinical and CT in Sensitivity

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