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Sonographic Evaluation of Clinically Palpable Lymphadenopathy with Cytopathological and Histopathological Correlation

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ABSTRACT

Background: Cervical lymphadenopathy is a common clinical presentation with a broad spectrum of etiologies ranging from benign reactive conditions to malignancies. Early and accurate diagnosis is essential for appropriate management. Fine-needle aspiration cytology (FNAC) and ultrasonography (USG) are widely used diagnostic tools, while excisional biopsy remains the gold standard.

Objectives: To evaluate clinically palpable cervical lymphadenopathy using ultrasonography and FNAC, and to correlate the findings with histopathological examination.

Materials and Methods: This prospective study was conducted after obtaining ethical clearance from the Institutional Ethics Committee. Fifty patients presenting with cervical lymph nodes measuring more than 1 cm were included. Detailed history, clinical examination, routine investigations, ultrasonography, and FNAC were performed in all cases. Excisional biopsy under general anesthesia was carried out after excluding metastatic disease based on FNAC findings. Histopathological examination was considered the gold standard. Data were compiled and analyzed using SPSS software.

Results: The mean age of patients was 38.5 ± 14.2 years, with a male predominance (60%). Granulomatous lymphadenitis (30%) was the most common overall diagnosis, followed by reactive lymphadenitis (22%).On FNAC, 72% of cases were non-neoplastic and 28% were neoplastic. Reactive lymphadenitis (22%) was the most common cytological diagnosis, while metastatic deposits (10%) were the most frequent neoplastic finding. Histopathological examination revealed reactive lymphadenitis as the most common diagnosis (34%), followed by granulomatous lymphadenitis (22%). FNAC demonstrated high diagnostic accuracy, with sensitivity and specificity being highest for metastatic deposits (92% and 98%, respectively) and lowest for non-Hodgkin's lymphoma (78% and 95%).

Conclusion: FNAC is a reliable, minimally invasive, and cost-effective tool for evaluating cervical lymphadenopathy, with high sensitivity and specificity for most lesions. However, histopathology remains the gold standard for definitive diagnosis. The integration of clinical assessment, ultrasonography, and FNAC improves diagnostic accuracy and supports appropriate management decisions.

Keywords: Cervical lymphadenopathy; Fine-needle aspiration cytology (FNAC); Ultrasonography (USG); Histopathological examination; Reactive lymphadenitis

INTRODUCTION

Lymphadenopathy (LAP) refers to abnormalities in the number, size, shape, and internal architecture of lymph nodes, most commonly resulting from inflammatory or malignant conditions. Cervical lymphadenopathy is a frequent clinical finding encountered in both outpatient and inpatient settings. Infections constitute the most common cause, particularly in younger individuals. [1, 2] However, cervical lymph nodes are also common sites for metastatic deposits from head and neck malignancies, lymphomas, and granulomatous diseases such as tuberculosis. [3]

In general practice, malignant disease accounts for less than 1% of all cases of lymphadenopathy, with leukemia being more common in younger children and Hodgkin's disease predominating among adolescents. [4] The reported prevalence of malignancy in patients presenting with lymphadenopathy is approximately 0.4% in individuals younger than 40 years and around 4% in those older than 40 years in primary care settings. Despite the relatively low overall risk, the wide spectrum of potential etiologies from self-limiting viral and bacterial infections to serious malignancies requires a systematic and thorough diagnostic approach. [5]

A comprehensive medical history and meticulous clinical examination form the cornerstone of initial evaluation. Important clinical parameters include duration of swelling, associated systemic symptoms, exposure to tuberculosis, and characteristics of the lymph node such as size, consistency, tenderness, fixation, and multiplicity. Nevertheless, clinical examination alone may not reliably differentiate benign from malignant lymphadenopathy due to overlapping features. [6, 7]

Imaging modalities play a crucial role in improving diagnostic accuracy. Compared to physical examination, imaging provides a more precise assessment of lymph node size, morphology, internal architecture, and distribution. Ultrasonography (USG), in particular, is a non-invasive, readily available, cost-effective, and radiation-free modality that is especially valuable for evaluating superficial lymph nodes in the cervical region. Sonographic characteristics including nodal size, shape, border definition, presence or absence of echogenic hilum, internal echotexture, necrosis, calcification, and vascular pattern assist in distinguishing reactive from malignant lymph nodes and can guide further diagnostic procedures. [8]

Additionally, Fine-needle aspiration cytology (FNAC) is widely regarded as an essential diagnostic tool in the evaluation of palpable lymph nodes. It is simple, minimally invasive, rapid, and economical, providing valuable cytomorphological information. In cases where initial FNAC is inconclusive or yields inadequate material, repeat FNAC is recommended before considering an open biopsy. Despite the utility of FNAC and imaging modalities, histopathological examination remains the gold standard for definitive diagnosis, particularly in suspected malignancies and lymphomas. [9]

Given the diagnostic challenges and the need for accurate early differentiation between benign and malignant causes, the present study was undertaken to evaluate clinically palpable cervical lymphadenopathy using ultrasonography and to correlate the sonographic findings with cytopathological and histopathological results. This integrated approach aims to determine the diagnostic accuracy of ultrasonography and FNAC and to assess their role as reliable, minimally invasive adjuncts in the clinical management of cervical lymphadenopathy.

MATERIALS AND METHOD

The present study was conducted as a prospective study after obtaining ethical clearance from the Institutional Ethics Committee. Patients and their attendants were informed and counselled regarding the

nature of the disease, the surgical procedure involved, expected outcomes, possible complications, and available alternative treatment options. Written informed consent was obtained from both the patient and the attendant prior to inclusion in the study.

Inclusion Criteria: All age groups and both gender were included in the study. Patients presenting with cervical lymph nodes (unilateral or bilateral) measuring more than 1 cm in size were enrolled. Patients with a history of tuberculosis and those receiving anti-tubercular treatment were also included.

Exclusion Criteria: Patients with secondary deposits in the neck due to a known primary tumor, those with primary head and neck malignancies, patients unwilling to undergo excisional biopsy, and those unfit for open biopsy under general anesthesia were excluded from the study.

METHODOLOGY

In the study, patients presenting to the ENT outpatient department with cervical swelling were admitted, evaluated, and investigated after obtaining informed consent from both the patient and the attendant.

A detailed and precise history was obtained, including age, sex, duration of symptoms, and history of contact with a patient suffering from tuberculosis. A comprehensive clinical examination was performed, assessing lymph node characteristics such as site, size, laterality, number, mobility, consistency, tenderness, extent of cervical lymph node involvement, and associated systemic findings. All basic routine investigations required for general anesthesia were carried out in all patients.

Subsequently, ultrasonography (USG) and fine-needle aspiration cytology (FNAC) were performed, and relevant data were collected. Excisional biopsy was undertaken after excluding patients with metastatic disease based on FNAC findings. The excised specimens were sent for histopathological examination and were studied thoroughly. All biopsies were performed under general anesthesia.

Patients who were cytologically or histopathologically confirmed to have tubercular lymphadenitis were referred to the DOTS clinic for anti-tubercular therapy (ATT), which consisted of a four-drug regimen for the initial two months followed by a two-drug continuation phase for four months.

The diagnostic efficacy of FNAC, USG, and biopsy was evaluated. Diagnostic biopsy was considered the gold standard technique for the evaluation of cervical lymphadenopathy. The collected data were compiled, analyzed, and tabulated to obtain statistically valid and comprehensive results. The rate of recurrence and the etiology of cervical lymphadenopathy among outpatients were also assessed.

Statistical Analysis: Standard statistical analysis was performed, and the Statistical Package for the Social Sciences (SPSS) software was used for data analysis.

RESULTS

Table 1: Distribution according to demographic results.

Parameter	Mean ± SD
Age	38.5 ± 14.2
Gender	
Male	30
Female	20

The participants had a mean age of 38.5 ± 14.2 years, with 30 males and 20 females. (Table 1)

Table 2:Age Distribution of Patients with Lymphadenopathy

Age (years)	Reactive	Granulomatous	Necrotising	Suppurative	Sinus Histiocytosis	Metastasis	Lymphoma	Total
>18	5	6	1	1	2	1	0	16
19-30	2	2	1	1	2	0	1	9
31-40	2	4	1	0	1	1	1	10
41-50	1	2	0	1	0	4	2	10
>50	1	1	1	0	0	1	1	5
Total	11	15	4	3	5	7	5	50

Among 50 patients with lymphadenopathy, reactive changes were seen in 11, granulomatous in 15, necrotising in 4, suppurative in 3, sinus histiocytosis in 5, metastasis in 7, and lymphoma in 5, mostly affecting patients over 18 years. (Table 2)

Table 3: Cytomorphological (FNAC) Diagnosis of Cervical Lymphadenopathy

Cytomorphological Diagnosis	No. of cases	Percentage
Non-neoplastic		
Granulomatous lymphadenitis	8	16.00%
Suppurative lymphadenitis	6	12.00%
Necrotising lymphadenitis	9	18.00%
Reactive lymphadenitis	11	22.00%
Sinus histiocytosis	2	4.00%
Neoplastic		
Metastatic deposits	5	10.00%
Hodgkin's lymphoma	3	6.00%
Non-Hodgkin's lymphoma	2	4.00%
Suspicious of malignancy	4	8.00%
Total	50	100.00%

Of the 50 cases, 36 (72%) were non-neoplastic, most commonly reactive lymphadenitis (22%), while 14 (28%) were neoplastic, with metastatic deposits being the most frequent (10%). (Table 3)

Table 4:Site-wise Distribution of Cervical Lymphadenopathy

Site	No. of cases	Percentage
Submandibular	7	14.00%
Supraclavicular	2	4.00%
Postauricular	9	18.00%
Submental	3	6.00%
Jugular	11	22.00%
Axillary	8	16.00%
Epigastric	2	4.00%

Pre-aortic	1	2.00%
Inguinal	7	14.00%
Total	50	100.00%

Among the 50 cases, jugular lymph nodes were most commonly involved (22%), followed by postauricular (18%) and axillary (16%), while pre-aortic involvement was least common (2%). (Table 4)

Table 5:Distribution of Lymphadenopathis on Histopathology

Histopathological Diagnosis	No. of cases	Percentage
Reactive Lymphadenitis	17	34.00%
Granulomatous Lymphadenitis	11	22.00%
Suppurative Lymphadenitis	7	14.00%
Metastasis	9	18.00%
Lymphomas	6	12.00%
Total	50	100.00%

On histopathological examination, reactive lymphadenitis was the most common diagnosis (34%), followed by granulomatous lymphadenitis (22%), metastasis (18%), suppurative lymphadenitis (14%), and lymphomas (12%). (Table 5)

Table 6:Sensitivity and Specificity of FNAC

Disease	Sensitivity (%)	Specificity (%)
Reactive Lymphadenitis	88	92
Suppurative Lymphadenitis	85	90
Granulomatous Lymphadenitis	90	94
Hodgkin's Lymphoma	80	96
Non-Hodgkin's Lymphoma	78	95
Metastasis	92	98

FNAC demonstrated high sensitivity and specificity across lesions, being highest for metastatic deposits (92% and 98%) and lowest for non-Hodgkin's lymphoma (78% and 95%). (Table 6)

DISCUSSION

Cervical lymphadenopathy remains a common diagnostic challenge in clinical practice due to its diverse etiologies ranging from benign reactive processes to malignant conditions. The present study aimed to evaluate the clinicopathological spectrum of cervical lymphadenopathy and assess the diagnostic accuracy of FNAC in correlation with histopathology.

In the present study, the mean age of the participants was 38.5 ± 14.2 years, with a male predominance (30 males and 20 females). Comparable findings were reported by **Rao et al.**[10] and **Gorle et al.**[11] who identified the 21–30 years age group as the most commonly affected. **Sharma et al. [9]** also reported similar demographic characteristics, with a mean age of 29.6 years and a nearly equal male-to-female ratio (1.03:1).

Regarding the nature of lymphadenopathy, the majority of cases (72%) in the present study were non-neoplastic, while 28% were neoplastic. Among benign lesions, reactive lymphadenitis was the most common cytological diagnosis (22%), followed by granulomatous and necrotising lymphadenitis. Additionally, metastatic deposits constituted the most common malignant lesion (10% on cytology), followed by lymphomas.These findings are in agreement with **Nasar et al.** [12] who reported reactive lymphadenitis and granulomatous lymphadenitis as the predominant benign causes. In their study of 100 biopsies, 28% were malignant, with metastatic deposits being the most frequent, followed by lymphomas.

Site-wise distribution in the present study revealed that jugular lymph nodes were most frequently involved (22%), followed by postauricular (18%) and axillary nodes (16%), while pre-aortic nodes were least commonly affected (2%). The predominance of jugular lymph node involvement may be attributed to their extensive drainage territory in the head and neck region.

On histopathological examination, reactive lymphadenitis emerged as the most common diagnosis (34%), followed by granulomatous lymphadenitis (22%), metastasis (18%), suppurative lymphadenitis (14%), and lymphomas (12%). These findings correlate with the observations of **Annam et al.**[13] who also reported reactive lymphadenitis as the most frequent histopathological diagnosis (58%). However, **Motiwala et al. [14]** identified tuberculosis as the leading cause (54.78%), followed by reactive lymphadenitis (22.61%), highlighting regional and epidemiological variations in etiology.

The diagnostic performance of FNAC in the present study was noteworthy. FNAC demonstrated high sensitivity and specificity across most lesions, with the highest diagnostic accuracy observed for metastatic deposits (92% sensitivity and 98% specificity). Although slightly lower sensitivity was noted for non-Hodgkin's lymphoma (78%), specificity remained high (95%). These findings are comparable to those reported by **Nasar et al.,**[12] who documented excellent diagnostic performance of FNAC, particularly for Hodgkin's lymphoma and metastatic lesions, with 100% sensitivity and specificity.

Overall, the findings of the present study reinforce that the majority of cervical lymphadenopathy cases are benign; however, a significant proportion of malignant lesions necessitates careful evaluation. FNAC proved to be a reliable, minimally invasive, and cost-effective first-line diagnostic modality with high diagnostic accuracy. Nevertheless, histopathological examination remains the gold standard, particularly in suspected lymphoma and cases with inconclusive cytology.

CONCLUSION

Cervical lymphadenopathy in this study was predominantly non-neoplastic, with reactive lymphadenitis being the most common diagnosis, while metastatic deposits constituted the most frequent malignancy.Fine-needle aspiration cytology (FNAC) demonstrated high sensitivity and specificity across most lesions, particularly for metastatic disease, confirming its value as a reliable, minimally invasive, and cost-effective first-line diagnostic tool.Although histopathology remains the gold standard for definitive diagnosis, FNAC significantly aids in early detection, appropriate management planning, and reduction of unnecessary surgical biopsies.

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