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Research Article

Evaluation of Fine-Needle Aspiration Cytology of Lymph Nodes According to the Sydney Reporting System: A 3-Year Retrospective Study at a Tertiary Care Centre

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ABSTRACT

Background: Fine-needle aspiration cytology (FNAC) is a well-established first-line investigation for evaluating lymphadenopathy. The Sydney System, proposed at the 20th International Congress of Cytology in 2019, introduced a standardised five-tier classification (L1–L5) for reporting lymph node cytopathology. However, validation data from Indian tertiary care centres remain limited.
Aim: To evaluate the applicability of the Sydney Reporting System for classification and reporting of lymph node FNAC at a tertiary care centre and to determine the distribution of lymph node lesions across diagnostic categories.
Materials and Methods: This retrospective study included 276 consecutive lymph node FNAC cases performed at the Department of Pathology, GMERS Medical College & Hospital, Dharpur, Patan, over 3 years (November 2022–October 2025). Each case was classified according to the Sydney System: L1 (Inadequate/Non-diagnostic), L2 (Benign), L3 (Atypical/AUS/ALUS), L4 (Suspicious), and L5 (Malignant). Cytomorphological features were analysed with H&E, Giemsa, and Ziehl–Neelsen staining.
Results: The age ranged from 6 to 72 years with male predominance (M:F = 1.7:1). Cervical lymph nodes were most commonly affected. The distribution across Sydney categories was: L1—42 (15.22%), L2—200 (72.46%), L3—03 (1.09%), L4—05 (1.81%), L5—26 (9.42%). Within L2, caseating granulomatous lymphadenitis was the most common diagnosis (46.50%), followed by reactive lymphadenitis (30.00%) and suppurative lymphadenitis (23.50%). L5 cases comprised metastatic squamous cell carcinoma (15/26), metastatic adenocarcinoma (02/26), Hodgkin lymphoma (01/26), and non-Hodgkin lymphoma (08/26). The benign-to-malignant ratio was 7.69:1.
Conclusion: The Sydney System provides a practical, reproducible framework for reporting lymph node FNAC. The predominance of L2 (benign) category (72.46%) with tubercular lymphadenitis as the leading diagnosis reflects the high tuberculosis burden in India. The system facilitates standardised communication and risk stratification.

Keywords*: Sydney System; Lymph node; Fine-needle aspiration cytology; FNAC; Lymphadenopathy; Granulomatous lymphadenitis; Tuberculosis; Metastatic carcinoma; Classification.*

INTRODUCTION

Fine-needle aspiration cytology (FNAC) is a simple, rapid, cost-effective, and reliable technique that serves as a first-line investigation for evaluating lymphadenopathy on a routine outpatient department (OPD) basis.[1,2] Lymphadenopathy is of great clinical significance, and the underlying cause may range from treatable infectious aetiologies to malignant neoplasms.[3] In adults, lymph nodes greater than 1–2 cm that persist or cannot be clinically explained warrant aspiration for cytological evaluation.[4] FNAC is particularly helpful in the work-up of cervical lymph nodes, where it can obviate the need for excisional biopsy in the majority of cases.[5] Despite its widespread use, lymph node FNAC has traditionally

lacked a universally accepted standardised reporting system, unlike other organ-specific cytopathology reporting systems such as the Bethesda System for thyroid cytology and the Paris System for urine cytology.[6,7] This absence of uniform terminology has limited inter-institutional comparisons and impeded evidence-based management algorithms.

To address this gap, the Sydney System for reporting lymph node cytopathology was proposed at the 20th International Congress of Cytology in Sydney, Australia, in 2019.[8] The system introduced a standardised five-tier classification: L1 (Inadequate/Nondiagnostic), L2 (Benign), L3 (Atypical cells of undetermined significance / Atypical lymphoid cells of uncertain significance, AUS/ALUS), L4 (Suspicious for malignancy), and L5 (Malignant).[8,9] Each category carries an implied risk of malignancy (ROM) that guides subsequent clinical management—from repeat aspiration for L1, to clinical followup for L2, to excisional biopsy for L3/L4, to definitive treatment planning for L5.[9,10]

Validation studies from multiple centres have demonstrated the applicability of the Sydney System. Caputo et al.[9] applied the system to 300 FNCs and reported L2 as the most common category (34.7%), with sensitivity of 98.47% and specificity of 95.33%. Jain et al.[10] in an Indian study of 753 cases reported L2 predominance with ROM of 4.3% for L2, 73.3% for L3, 90.6% for L4, and 100% for L5. However, data from Western India, particularly Gujarat, remain sparse. The present study was undertaken to evaluate the applicability of the Sydney System for classification and reporting of lymph node FNAC at our tertiary care centre over a 3-year period.

AIM AND OBJECTIVES

Aim: To evaluate the applicability of the Sydney Reporting System for classification and reporting of lymph node FNAC and to study the cytomorphological spectrum of enlarged lymph nodes at a tertiary care centre.

Objectives:

1. To classify lymph node FNAC cases according to the Sydney System (L1–L5).
2. To determine the distribution of cytomorphological diagnoses within each Sydney category.
3. To compare findings with published literature.

MATERIALS AND METHODS

Study Design:
Retrospective descriptive study.

Setting and Duration: Department of Pathology, GMERS Medical College & Hospital, Dharpur, Patan, Gujarat, over 3 years (November 2022–October 2025).
Participants: 276 consecutive patients of all age groups and both sexes presenting with palpable or deep lymphadenopathy who underwent FNAC. Inclusion: All age groups, all sites, all sizes. Exclusion: Inadequate sampling that could not be repeated.
Procedure: FNAC was performed using 22–24 gauge disposable needles attached to 20 cc syringes. Smears were fixed in alcohol and stained with H&E. Giemsa staining was Page 3 performed on air-dried smears. Ziehl–Neelsen (ZN) staining was done wherever granulomatous pathology was suspected.
Classification: Each case was retrospectively classified according to the Sydney System: L1—Inadequate/Non-diagnostic (acellular, obscured); L2—Benign (reactive, granulomatous, suppurative); L3—Atypical cells of undetermined significance (AUS/ALUS); L4—Suspicious for malignancy; L5—Malignant (metastatic carcinoma, lymphoma).
Statistical Analysis: Data were tabulated and expressed as frequencies and percentages.

RESULTS

A total of 276 lymph node FNAC cases were evaluated over the 3-year study period. The age of patients ranged from 6 to 72 years, with the majority in the 4th decade. A male predominance was observed (M:F = 1.7:1). Cervical lymph nodes were the most commonly affected site.

Table 1: Distribution of Cases According to Sydney System Classification (N=276)

Sydney Category	Description	n	Percentage(%)
L1	Inadequate/Non-diagnostic	42	15.22
L2	Benign	200	72.46
L3	AUS/ALUS	03	01.09
L4	Suspicious for Malignancy	05	01.81
L5	Malignant	26	09.42

Total		276	100.00

The benign category (L2) overwhelmingly predominated, accounting for nearly three-quarters of all cases (72.46%). The combined L4+L5 (suspicious + malignant) rate was 11.23%. The L1 (inadequate) rate of 15.22% is higher than some published series and may reflect the learning curve and case mix at a peripheral tertiary centre.

Figure 1: Distribution of Cases According to Sydney System Categories (N=276)

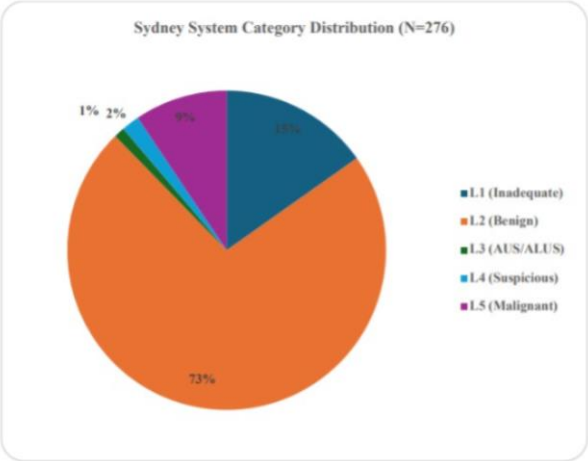


Table 2: Cytomorphological Spectrum of Benign (L2) Lymph Node Lesions (n=200)

Cytomorphological Diagnosis	n	% of L2	% of Total
Caseating Granulomatous Lymphadenitis	93	46.50	33.70
Reactive Lymphadenitis	60	30.00	21.74
Suppurative Lymphadenitis	47	23.50	17.03
Total L2	200	100.00	72.46

Caseating granulomatous lymphadenitis was the most common benign diagnosis (46.50% of L2), reflecting the high tuberculosis burden in India. ZN staining was performed in all granulomatous cases. Reactive lymphadenitis was the second most common (30.00%), predominantly in children and young adults. Suppurative lymphadenitis accounted for 23.50%.

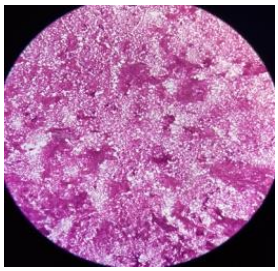


Image1: Caseousnecrosis—L1. H&E (x400)

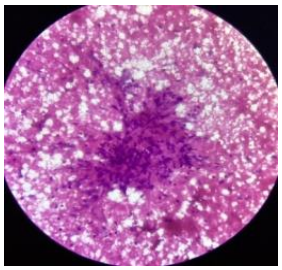


Image2: Granulomatous lymphadenitis—L2. H&E (x400)

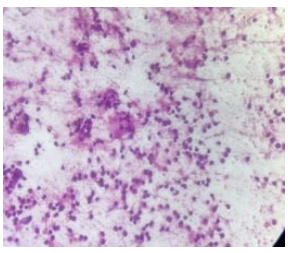


Image3: Reactive lymphadenitis—L2. H&E (x400)

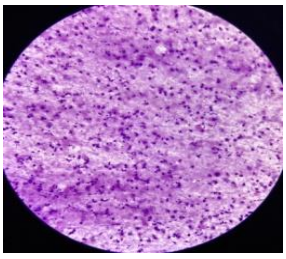


Image4: Suppurative lymphadenitis—L2. H&E(x400)

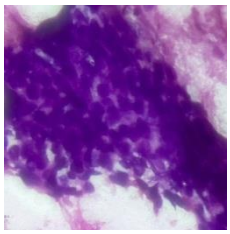


Image5: SCC metastasis—L5. H&E (x400)

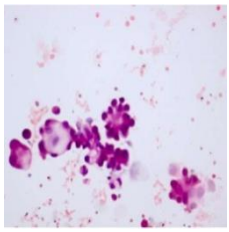


Image6: Metastatic adenocarcinoma—L5. H&E(x200)

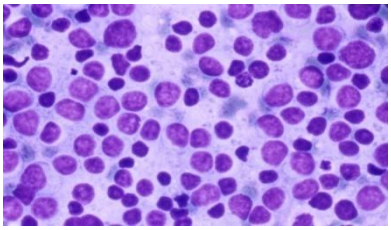


Image7: Non-HodgkinLymphoma—L5.H&E (x400)

Table 3: Breakdown of Malignant (L5) Category (n=26)

Diagnosis	n	% of L5	% of Total
Metastatic Squamous Cell Carcinoma	15	57.69	05.43
Non-Hodgkin Lymphoma	08	30.77	02.90
Metastatic Adenocarcinoma	02	07.69	00.72
Hodgkin Lymphoma	01	03.85	00.36
Total L5	26	100.00	09.42

Metastatic carcinomas (17/26, 65.38%) outnumbered primary lymph node malignancies (9/26, 34.62%). Squamous cell carcinoma metastasis was the most common malignant diagnosis (57.69% of L5), consistent with the high prevalence of head-and-neck squamous cell carcinomas in the Indian population.

Figure 2: Distribution of Cytomorphological Diagnoses Within L2 (Benign) Category

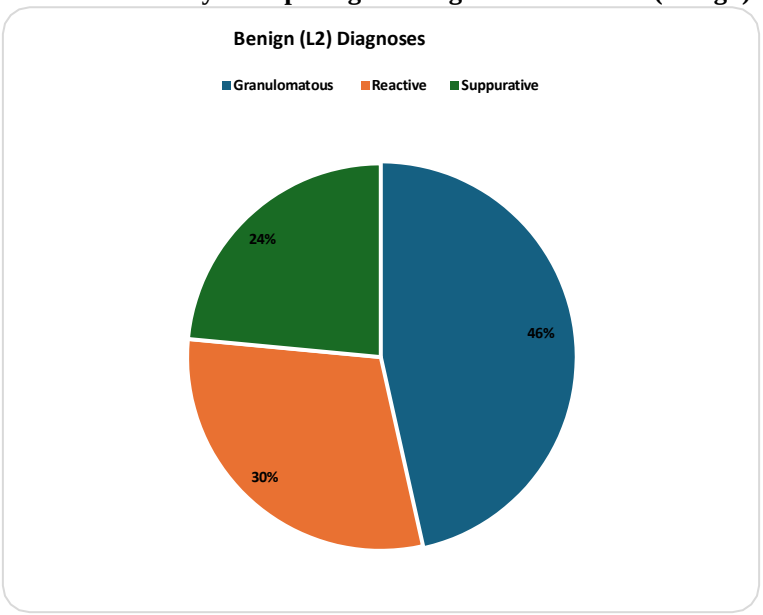
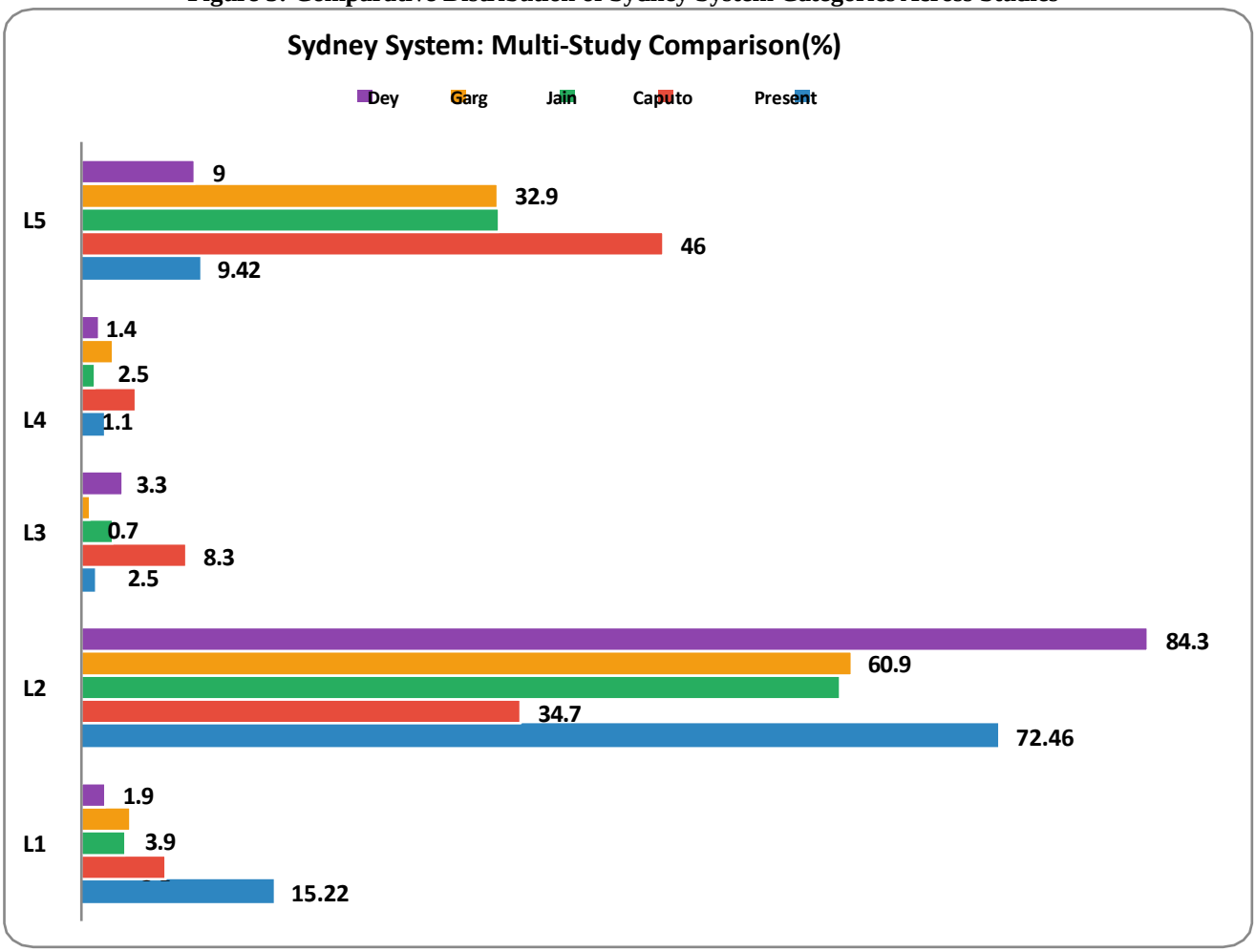


Table 4: Comparative Analysis of Sydney System Distribution Across Published Studies

Category	Present Study (n=276)	Caputo et al. (n=300)	Jain et al. (n=753)	Garg et al. (n=279)	Dey et al. (n=632)
L1 (%)	15.22	06.70	03.50	03.90	01.90
L2 (%)	72.46	34.70	60.00	60.90	84.30
L3 (%)	01.09	08.30	02.50	00.70	03.30
L4 (%)	01.81	04.30	01.10	02.50	01.40
L5 (%)	09.42	46.00	33.00	32.90	09.00

The L2 predominance (72.46%) in our study is consistent with Indian studies by Jain et al. (60%) and Garg et al. (60.9%), reflecting the high burden of infectious lymphadenopathy in the Indian subcontinent. Western studies (Caputo et al.) show higher L5 rates (46%), reflecting referral patterns for malignant lymphadenopathy.

Figure 3: Comparative Distribution of Sydney System Categories Across Studies



DISCUSSION

The present study evaluated 276 lymph node FNAC cases over a 3-year period using the Sydney Reporting System at GMERS Medical College, Dharpur, Patan, Gujarat. The findings are discussed below.

Demographics and Site Distribution

The age range of 6 to 72 years with peak incidence in the 4th decade and male predominance (M:F = 1.7:1) is consistent with Chaudhary et al.[11] and Ashwini et al.[1] Cervical lymph nodes were the most commonly affected site, consistent with the findings of Alam et al.[5] and Badge et al.[12] The cervical predilection reflects the drainage of the head, neck, and

oropharyngeal regions, which are the most common sites for infections and squamous cell carcinomas in the Indian population.

Sydney System Category Distribution

The predominance of L2 (benign) category at 72.46% is consistent with Indian studies: Jain et al.[10] (60.0% of 753 cases), Garg et al.[13] (60.9% of 279 cases), and Dey et al. [14] (84.3% of 632 cases). In contrast, Western studies report lower L2 rates: Caputo et al.[9] reported L2 in only 34.7% of 300 Italian cases, with L5 predominating at 46.0%. This disparity reflects the fundamentally different epidemiological profile—Indian centres encounter a high proportion of tubercular and reactive lymphadenopathy, while Western centres receive more referrals for suspected lymphoma and metastatic disease.The L1 (inadequate) rate of 15.22% in our study is higher than Caputo et al.[9] (6.7%), Jain et al.[10] (3.5%), and Dey et al.[14] (1.9%). This may reflect the inclusion of deep-seated lymph nodes aspirated without ultrasound guidance, as well as the learning curve associated with the initial implementation period. The proposed Sydney System recommends that L1 rates should ideally be below 10%.[8]

The combined L4+L5 rate of 11.23% is comparable to Dey et al.[14] (10.4%) and lower than Caputo et al.[9] (50.3%) and Jain et al.[10] (34.1%). The low L3 (AUS/ALUS) rate of 1.09% is consistent with Garg et al.[13] (0.7%) and lower than Caputo et al.[9] (8.3%), suggesting that most cases could be definitively categorised as benign or malignant without diagnostic ambiguity.

Cytomorphological Spectrum

Within L2, caseating granulomatous lymphadenitis was the most common diagnosis (46.50%), consistent with Chaudhary et al.[11] (35.58%), Ashwini et al.[1] (44%), and Badge et al.[12] In developing countries, tubercular lymphadenitis is one of the most significant health problems. Among screening tests for tuberculosis—CBNAAT, FNAC, and imaging—FNAC is cost-effective and efficient in arriving at an early diagnosis. Reactive lymphadenitis was the second most common diagnosis (30.00%), consistent with Vimal et al.[3] (33.69%) who reported reactive lymphadenitis as the most frequent finding in their series. Suppurative lymphadenitis (23.50%) was comparable to Chaudhary et al.[11] (18.72%).

Among L5 cases, metastatic squamous cell carcinoma predominated (57.69%), consistent with Chaudhary et al.[11] and reflecting the high incidence of head-and-neck malignancies in the Indian population. The detection of metastatic deposits on FNAC is critical as it can identify occult primary tumours. Non-Hodgkin lymphoma (30.77%) was the most common primary lymph node malignancy.

Clinical Implications of the Sydney System

The Sydney System provides a structured risk-stratification framework that guides clinical management. The implied ROM for each category enables evidence-based decisionmaking: L1 cases warrant repeat aspiration preferably under image guidance; L2 cases can be managed conservatively with clinical follow-up; L3 (AUS/ALUS) cases require close monitoring and consideration of excisional biopsy; L4 and L5 cases necessitate definitive tissue diagnosis and treatment planning.8–10 The low L3 rate (1.09%) in our study suggests that the system can be applied effectively even in resource-limited settings with minimal diagnostic ambiguity. The standardised terminology also facilitates inter-institutional comparison and audit, which is essential for quality improvement in cytopathology practice.

CONCLUSION

The Sydney Reporting System provides a practical, reproducible, and clinically relevant framework for classification and reporting of lymph node FNAC. In our 3-year Page 8 retrospective analysis of 276 cases, the benign (L2) category predominated (72.46%), with caseating granulomatous lymphadenitis as the leading diagnosis (46.50% of L2), reflecting the high tuberculosis burden in India. The malignant (L5) category constituted 9.42%, with metastatic squamous cell carcinoma as the most common malignant diagnosis. The system facilitates standardised communication between cytopathologists and clinicians, enables risk stratification, and supports evidence-based management algorithms. FNAC remains the most suitable first-line diagnostic method for lymphadenopathy, and the adoption of the Sydney System will enhance diagnostic consistency and quality across centres.

LIMITATIONS

1. Retrospective design with inherent selection bias.
2. Histopathological correlation was not available for all cases, precluding formal ROM calculation.
3. Single-centre study from a peripheral tertiary centre in Gujarat.
4. Higher L1 rate (15.22%) may reflect early learning curve.

DECLARATIONS

Ethics Approval: The study was conducted after institutional approval. Being retrospective and involving review of existing cytological data, individual patient consent was waived. Patient confidentiality was maintained throughout.

Conflict of Interest: None.
Funding: None.

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