



Original Article

Diagnostic Accuracy of The Sydney System in Reporting of Lymph Node Fine Needle Aspiration Cytology

Dr. Riti Sharma¹, Dr. Kastruri Mangrulkar², Dr. Preeti Singh³

¹Assistant Professor Department of Pathology Pt. J. N. M. Medical college Raipur Chhatisgarh India

²Assistant Professor Department of Pathology Pt. J. N. M. Medical college Raipur Chhatisgarh India

³ Postgraduate student Pathology Pt. J. N. M. Medical college Raipur Chhatisgarh India.

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Corresponding Author:

Dr. Preeti Singh

Postgraduate student Pt. J. N. M.
Medical college Raipur
Chhatisgarh India

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ABSTRACT

Background: The Sydney System for Reporting Lymph Node Cytopathology was developed to standardize lymph node fine needle aspiration cytology (FNAC) reporting, improve diagnostic reproducibility, and facilitate malignancy risk stratification.

Aim: The study was conducted to evaluate the diagnostic accuracy of the Sydney System in reporting lymph node FNAC and to assess its correlation with histopathological diagnosis and risk of malignancy (ROM).

Methods: This prospective observational study was conducted over 12 months at a tertiary care center and included 63 patients with lymphadenopathy who underwent FNAC followed by histopathological examination. Cytological findings were categorized according to the Sydney System. Demographic, clinical, radiological, cytological, and histopathological parameters were analyzed using appropriate statistical tests, with $p < 0.05$ considered significant.

Results: The mean age of the study population was 36.19 ± 13.96 years, with males constituting 54.0% of cases. Cervical lymph nodes were the most common site of involvement (65.1%). Malignancy was significantly associated with increasing age, lymph node size, lymph node site, and laterality ($p < 0.05$).

Conclusion: The Sydney System demonstrated excellent concordance with histopathological diagnosis and effective risk stratification of lymph node lesions. Its routine implementation can enhance diagnostic accuracy, standardize reporting, and support evidence-based clinical management of lymphadenopathy.

Keywords: Lymph node FNAC; Sydney System; Lymphadenopathy; Cytopathology; Histopathology; Risk of Malignancy; Diagnostic Accuracy.

INTRODUCTION

Lymphadenopathy can be indicative of various underlying conditions, including infections, inflammatory diseases, and malignancies. Fine needle aspiration (FNA) cytology has become an essential diagnostic tool in evaluating lymph node pathologies due to its simplicity, minimal invasiveness, and relatively low complication rates. [1].

In order to standardize the reporting of FNA results, several systems have been proposed over time. One such system is the Sydney System, which was specifically designed to categorize lymph node FNA cytology results into distinct categories based on cytological features. [2].

The Sydney System categorizes FNA results into six categories: benign, atypical, suspicious for malignancy, malignant, insufficient, and unsatisfactory. These categories guide the next steps in patient management, including whether further diagnostic testing, such as histopathological examination or imaging studies, is necessary. [3].

Previous studies have suggested that FNAC, when combined with a structured reporting system, such as the Sydney System, can improve the diagnostic accuracy of lymph node evaluations. However, variations in the results of these studies highlight the need for further evaluation of the system's diagnostic performance.

In addition to evaluating the diagnostic accuracy of the Sydney System, this study aims to assess its sensitivity and specificity when compared with histopathological findings, which remain the gold standard. By doing so, the study will provide valuable insight into the effectiveness of the Sydney System in accurately categorizing lymph node lesions and improving patient management. Furthermore, by calculating the risk of malignancy (ROM) for each diagnostic category, the study aims to determine whether the Sydney System can help predict malignancy more reliably than traditional methods. [5,6].

MATERIALS AND METHODS

The prospective observational study was conducted at Pt. J.N.M. Medical College and Dr. B.R.A.M. Hospital, Raipur, over a period of 12 months (January to December). Using a consecutive sampling technique 63 cases fulfilling the inclusion criteria were selected for the study. Ethical Clearance was obtained from the Institutional Ethics Committee before starting the study.

Inclusion Criteria

Patients of both genders, aged one year and above, who presented with lymph node swellings in accessible regions (cervical, supraclavicular, axillary, and inguinal), who were referred for FNA cytology.

Exclusion Criteria

Patients with lymph node conditions that were not accessible for FNA sampling, inadequate or non-diagnostic FNA samples after repeated attempts, known immunodeficiency or other conditions that could confound lymph node pathology.

After obtaining informed consent, patients were enrolled, and lymph node FNA was performed under either direct palpation or imaging guidance (e.g., ultrasound) based on the location of the lymph node. The procedure involved aspirating the lymph node using a fine needle, and the aspirate was then smeared onto glass slides. The wet slides were stained with Hematoxylin and Eosin (H&E) stain, and the dry slides were stained with May-Grunwald Giemsa (MGG) stain. Zeihl-Neelsen staining was performed for suspected cases of tuberculosis. The slides were then reviewed by pathologists, who categorized the samples according to the Sydney System. For cases with inconclusive FNA results, further histopathological analysis was carried out to confirm the diagnosis.

Data collection was comprehensive, involving the recording of patient demographics, clinical findings, FNA cytology results, and histopathological findings (where applicable) and was entered into Microsoft Excel.

Statistical analysis was conducted using the SPSS 25.0 version. Continuous variables, such as lymph node size, were summarized using means and standard deviations. Statistical significance was set at a p-value of <0.05.

RESULT

34 people (54.0%) were in the age range of 21 to 30 years old, which made up the bulk of participants. With 22 instances (34.9%), participants over 50 made up the second-largest group. There were very few younger participants in the study—just two people (3.2%) were under the age of twenty.

Table 1: Association between Sydney system category and final FNAC diagnosis

Sydney system category	FNAC final impression: Benign n (%)	FNAC final impression: Malignant n (%)	Total n (%)
L2	34 (100.0)	0 (0.0)	34 (100.0)
L4	0 (0.0)	6 (100.0)	6 (100.0)
L5	0 (0.0)	23 (100.0)	23 (100.0)
Total	34 (54.0)	29 (46.0)	63 (100.0)

$\chi^2 = 63.000, df = 2, p < 0.001$

One hundred and ten percent of the cases that were categorized as L2 using the Sydney approach had a benign FNAC final impression. On the other hand, no benign results were found in any of the cases in the L4 and L5 groups, which all displayed malignant FNAC impressions. Benign FNAC impressions made up 54.0% of the study population, whereas malignant impressions made up 46.0%. The Sydney system category and FNAC final impression were shown to be statistically significantly correlated ($\chi^2 = 63.000, df = 2, p < 0.001$).

Table 2: Association between FNAC final impression and histopathological diagnosis

Final HPE impression	FNAC final impression: Benign n (%)	FNAC final impression: Malignant n (%)	Total n (%)
Benign	34 (100.0)	0 (0.0)	34 (100.0)
Malignant	0 (0.0)	29 (100.0)	29 (100.0)
Total	34 (54.0)	29 (46.0)	63 (100.0)

$\chi^2 = 63.000, df = 1, p < 0.001$

In this category, all cases (100.0%) with a benign final HPE impression also had benign FNAC final impressions. Likewise, malignant FNAC final impressions were completely consistent with malignant HPE final impressions in every patient. This result shows that the study population's final HPE impression and FNAC final impression are in full accord. The final HPE impression and the FNAC final impression were shown to be statistically significantly correlated ($\chi^2 = 63.000$, $df = 1$, $p < 0.001$).

Table 3: Association between Sydney system category and final histopathological impression

Sydney system category	Final HPE impression: Benign n (%)	Final HPE impression: Malignant n (%)	Total n (%)
L2	34 (100.0)	0 (0.0)	34 (100.0)
L4	0 (0.0)	6 (100.0)	6 (100.0)
L5	0 (0.0)	23 (100.0)	23 (100.0)
Total	34 (54.0)	29 (46.0)	63 (100.0)
$\chi^2 = 63.000$, $df = 2$, $p < 0.001$			

One hundred and ten percent of the cases that were categorized as L2 under the Sydney approach had a benign final HPE impression. On the other hand, every instance classified as L4 or L5 had final HPE impressions that were completely consistent with malignancy. In terms of histopathological result, this distribution shows a distinct division between lower and higher Sydney system groups. The end HPE impression and Sydney system categorization were shown to be statistically significantly correlated ($\chi^2 = 63.000$, $df = 2$, $p < 0.001$).

Table 4: Association between Sydney system category and ROM category (N = 63)

Sydney system category	ROM category: High n (%)	ROM category: Low n (%)	Total n (%)
L2	2 (5.9)	32 (94.1)	34 (100.0)
L4	5 (83.3)	1 (16.7)	6 (100.0)
L5	21 (91.3)	2 (8.7)	23 (100.0)
Total	28 (44.4)	35 (55.6)	63 (100.0)
$\chi^2 = 44.606$, $df = 2$, $p < 0.001$			

Within this Sydney system category, the Low ROM category accounted for 94.1% of cases classified as L2. The L4 and L5 categories, on the other hand, had the highest ROM category, accounting for 83.3% and 91.3% of instances, respectively. In total, 55.6% of the study population fell into the low ROM category and 44.4% into the high ROM category. The Sydney system category and the ROM category were shown to be statistically significantly associated ($\chi^2 = 44.606$, $df = 2$, $p < 0.001$).

Table 5: Association between lymph node size and malignancy

Size category (cm)	FNAC final impression: Benign n (%)	FNAC final impression: Malignant n (%)	Total n (%)
<2	0 (0.0)	1 (100.0)	1 (100.0)
2–4	32 (88.9)	4 (11.1)	36 (100.0)
>4	2 (7.7)	24 (92.3)	26 (100.0)
Total	34 (54.0)	29 (46.0)	63 (100.0)
$\chi^2 = 41.256$, $df = 2$, $p < 0.001$			

The majority of lymph nodes with benign FNAC final impressions (88.9%) were between 2 and 4 cm in size. 92.3% of cases, on the other hand, showed a high percentage of malignant FNAC impressions in lymph nodes larger than 4 cm. A malignant FNAC impression was seen on the lone lymph node, which was less than 2 cm in size. There was a statistically significant correlation between the FNAC final impression and the lymph node size category ($\chi^2 = 41.256$, $df = 2$, $p < 0.001$).

PHOTOMICROGRAPHS

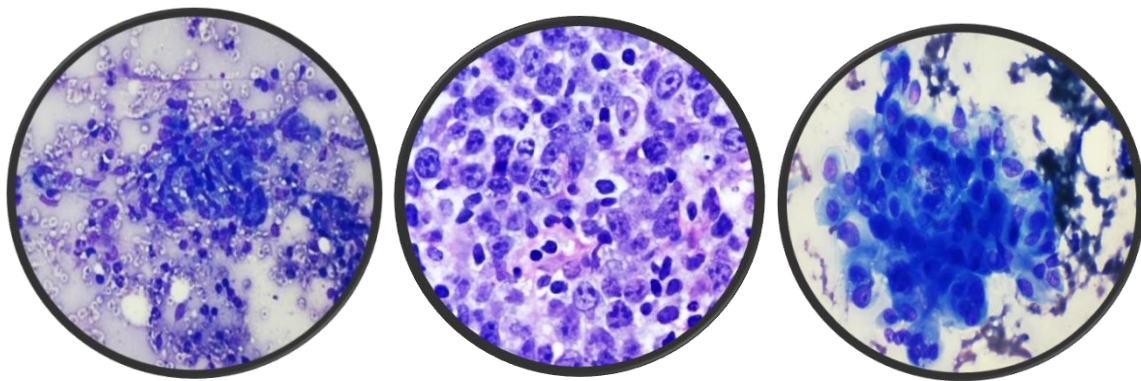


Figure 1. Granulomatous Lymphadenitis, Figure 2. (40x) Cytopathology:- Hodgkin Lymphoma, Figure 3. (40x) Cytopathology:- Metastatic Deposits,

DISCUSSION

The aim of the present study was to evaluate lymph node lesions using fine needle aspiration cytology and to assess the diagnostic utility of the Sydney system in categorizing lymph node aspirates into clinically meaningful risk groups.

Despite the predominance of younger adults in the study population, malignant lesions were significantly more frequent among older individuals. Participants aged >50 years exhibited a malignancy rate of 90.9%, whereas 91.2% of those aged 21–30 years demonstrated benign FNAC findings. Furthermore, the mean age of patients with malignant lesions was significantly higher than that of patients with benign lesions (44.48 ± 13.95 vs. 29.12 ± 8.02 years; $t = -5.456$, $p < 0.001$). A progressive increase in mean age was also observed across Sydney System categories, rising from 29.12 ± 8.02 years in L2 to 36.17 ± 21.79 years in L4 and 46.65 ± 10.78 years in L5. This trend was further supported by a significant positive correlation between age and Sydney category ($r = 0.611$, $p < 0.001$), indicating that advancing age is associated with higher-risk cytomorphological classifications and an increased likelihood of malignancy. These findings are consistent with previous studies by Caputo et al. and Vigliar et al., Gupta et al., Pandya et al.

The present study demonstrated a **highly significant association between Sydney System category and final FNAC diagnosis** ($\chi^2 = 63.000$, $df = 2$, $p < 0.001$), with complete concordance between cytological categorization and benign–malignant outcomes. These findings indicate that the Sydney System provides excellent diagnostic stratification of lymph node lesions. Similar observations have been reported by Caputo et al. [7], who demonstrated improved FNAC classification and diagnostic concordance in a large cohort of lymph node aspirates. Vigliar et al. [8] further highlighted its value in enhancing diagnostic accuracy and malignancy risk assessment, particularly in indeterminate cases. Comparable improvements in malignancy stratification, diagnostic performance, and histopathological concordance have been reported by Gupta et al. [9] and Pandya et al. [10]. Additional studies by Newaskar et al. [11], Shankar et al. [12], confirmed that the Sydney System improves reproducibility, minimizes diagnostic misclassification, and facilitates standardized risk-based reporting in routine cytopathology practice. Collectively, these findings support the strong correlation between higher Sydney categories and malignant cytological diagnoses observed in the present study.

A major finding of the present study was the **complete concordance between FNAC final impression and histopathological diagnosis**, with a **highly significant association** observed between the two modalities ($\chi^2 = 63.000$, $df = 1$, $p < 0.001$). Notably, all L2 cases corresponded to benign histopathology, whereas all L4 and L5 cases were confirmed as malignant, demonstrating excellent cytohistopathological correlation. These findings are consistent with those of Pandya et al. [10], who reported high concordance between Sydney System-based FNAC diagnoses and histopathological outcomes. Similar observations were made by Kanhe et al. [13], who demonstrated improved diagnostic sensitivity and specificity with strong cytological–histopathological agreement. Caputo et al. [7] also reported enhanced diagnostic concordance in a large cohort of 1458 cases, while Alqaidy et al. [14] highlighted the clinical utility of the Sydney System in malignancy risk stratification and routine diagnostic practice. Collectively, these findings reinforce the value of Sydney System-based FNAC reporting as a reliable predictor of final histopathological diagnosis.

The present study demonstrated a **highly significant association between Sydney System category and risk of malignancy (ROM) category** ($\chi^2 = 44.606$, $df = 2$, $p < 0.001$). Lower Sydney categories were predominantly associated with low ROM, whereas higher categories showed a strong association with high ROM, highlighting the system's effectiveness in malignancy risk stratification and clinical decision-making. These findings are consistent with Gupta et al. [9], who reported that the Sydney System provides more reliable malignancy risk assessment than conventional reporting methods, particularly in suspicious and non-diagnostic cases. Similarly, Vigliar et al. [8] demonstrated improved risk stratification for indeterminate lesions, while Robert and Saldanha emphasized its role in reducing diagnostic ambiguity.

and enhancing estimation of malignancy risk [15]. The present findings further validate the strong correlation between Sydney System categorization and ROM assessment reported in previous studies.

Lymph node size showed a **significant association** with malignancy in the present study. Most lymph nodes measured 2–4 cm (57.1%), followed by >4 cm (41.3%). Among nodes measuring 2–4 cm, 88.9% were benign, whereas 92.3% of nodes >4 cm were malignant. The association between lymph node size and FNAC final impression was highly significant ($\chi^2 = 41.256$, $p < 0.001$), indicating that larger lymph nodes, particularly those exceeding 4 cm, are strongly associated with malignant pathology.

A major strength of the present study is its comprehensive evaluation of lymph node lesions by integrating clinical, cytological, radiological, and histopathological parameters within a single framework. Overall, the study provides robust pathology-based evidence supporting the effectiveness of structured FNAC reporting in routine diagnostic practice.

The present study was limited by its relatively small sample size and single-center design, which may restrict the generalizability of the findings. Unequal distribution of cases across certain age groups and Sydney System categories may have affected subgroup analyses. Additionally, advanced diagnostic performance measures and long-term clinical follow-up were not evaluated, limiting assessment of prognostic outcomes and broader clinical applicability.

CONCLUSION

Overall, the study establishes that the Sydney system is a robust and practical framework for lymph node FNAC reporting, with excellent concordance with final histopathology and strong association with key clinicopathological variables. The findings support the routine use of structured FNAC reporting in the assessment of lymphadenopathy, as it improves diagnostic clarity, enhances risk estimation, and facilitates timely and appropriate clinical decision-making.

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