

ISSN Print: 1813-176x
ISSN Online: 1994-4624

International Journal of Molecular Medicine and Advance Sciences
https://ijmmas.com/

Research Article

Root Cause Analysis of Cytology–Histology Discordance Across Multiple Organ Systems in a Tertiary Care Centre of Southern Assam: A Retrospective Cross-Sectional Study

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Received: 18-09-2026
Revised: 10-10-2026
Accepted: 24-10-2026
Published: 16-11-2026

DOI: 10.61336/ijmmas.22-04-30

Abstract: Background: Cytology–histology correlation is central to diagnostic quality assurance, yet discordance may reflect sampling, interpretation, lesion heterogeneity or limitations in tissue verification. Multi-organ evaluations can identify site-specific targets for improvement. Objective: To estimate cytology–histology concordance and diagnostic performance across organ systems, characterize the root causes of major discordance and assess potential implications for clinical management. **Materials and Methods**: A retrospective cross-sectional study evaluated paired cytology and histopathology from June 2023 to June 2026 at a tertiary centre in Southern Assam. Cases were assigned to six anatomic groups. Diagnostic agreement was classified as exact, minor or major; major mismatches were adjudicated by two pathologists. Histology served as the reference standard for binary site-specific analyses. Sensitivity, specificity, predictive values and accuracy were calculated with 95% confidence intervals. **Results**: Of 813 screened records, 680 pairs fulfilled eligibility criteria. Exact concordance occurred in 499 cases (73.4%), minor discordance in 64 (9.4%) and major discordance in 117 (17.2%). Binary agreement was 563/680 (82.8%; 95% CI 79.8–85.4%). Pooled sensitivity was 73.2% and specificity 90.8%. Major discordance was greatest proportionally in salivary-gland cases (26.2%). Sampling limitation accounted for 51/117 (43.6%) major discrepancies, followed by interpretation error (33/117; 28.2%). Differences in major discordance across the six sites were not statistically significant (χ^2 = 7.24, P = 0.203). **Conclusion**: Structured cytology–histology correlation and root-cause review reveal recurrent sampling and interpretation vulnerabilities across organ systems. Standardized reporting, targeted re-review and multidisciplinary feedback may strengthen diagnostic quality assurance.

Keywords: cytology–histology correlation; diagnostic discordance; fine-needle aspiration cytology; root cause analysis; diagnostic accuracy; quality assurance; Southern Assam.

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INTRODUCTION

Cytopathology is an established first-line investigation for a wide range of reactive, inflammatory, infectious and neoplastic lesions. Cervical cytology and fine-needle aspiration cytology (FNAC) provide rapid information with comparatively low procedural burden, support clinical triage and guide the need for tissue biopsy. However, morphologic interpretation depends on adequate sampling, appropriate preparation and the availability of relevant clinical information. Histopathological follow-up can establish architectural and invasive features that may not be apparent on cytologic preparations [1–3].

Correlation between cytologic and histologic diagnoses is therefore more than a simple measure of test performance. A structured correlation program can distinguish failures related to specimen acquisition, slide preparation, screening and interpretative decision-making from discrepancies arising from focal disease, lesion heterogeneity or limitations in the subsequent biopsy. Raab and Grzybicki emphasized that root-cause review converts discordant results into opportunities for error detection and process improvement [1]. Large cervical cytology–biopsy audit series have likewise demonstrated important contributions from sampling-related mismatches [2,3].

The interpretation of discrepancies also varies by organ. Cervical screening uses squamous intraepithelial lesion categories linked to histological thresholds such as CIN2+. Thyroid FNAC, breast FNAC, lymph-node FNAC and salivary-gland aspirates use site-specific structured reporting systems that incorporate different risks of malignancy, sampling characteristics and triage pathways [5–10]. Consequently, a common institutional audit should preserve anatomic distinctions instead of treating all cytologic categories as interchangeable.

The 2019 ASCCP risk-based cervical guidance and subsequent updates highlight the clinical relevance of accurate triage [11,12]. Comparable systems for thyroid, breast, lymph-node and salivary-gland cytology have improved diagnostic communication but have not eliminated false-negative or false-positive findings [6–10,13]. Data examining the mechanisms of diagnostic discordance across multiple organ systems within a single tertiary institution remain of practical importance, particularly in centres serving diverse patient populations in Northeast India.

The primary objective was to determine exact concordance and clinically significant cytology–histology discordance among cases with available histopathological follow-up. Secondary objectives were to assess organ-specific distribution, estimate binary diagnostic performance, classify the underlying causes of major mismatches, grade their potential clinical importance and develop targeted quality-improvement recommendations.

MATERIALS AND METHODS

2.1 Study design and setting

This retrospective cross-sectional observational study covered the period from 1 June 2023 to 30 June 2026 in the Department of Pathology, Silchar Medical College and Hospital, Silchar, Assam, India. The source population comprised patients whose cytologic examinations were followed by tissue histopathology from the same anatomical site. Consecutive eligible paired cases were considered through universal sampling of laboratory registers and archived reports.

2.2 Eligibility and case ascertainment

Cytology and histopathology accession registers were linked using hospital identifiers, anatomical site and procedure dates. Eligible cases included cervical cytology followed by biopsy, cone biopsy or hysterectomy, and non-gynecologic FNAC followed by tissue biopsy, excision or surgical resection. Both reports were required to be interpretable and attributable to the same lesion or anatomical site. Cases were excluded when cytology preceded histology by more than six months for gynecologic specimens or more than 12 months for non-gynecologic specimens; when cytology was unsatisfactory or non-diagnostic without repeat testing; when histology was insufficient; when essential pathology documentation was absent; or when records were duplicates. Unresolved indeterminate categories that could not be assigned a prespecified binary analytic threshold were not incorporated into diagnostic-accuracy denominators.

2.3 Cytological and histological classification

Cases were grouped into cervix, thyroid, breast, lymph node, salivary gland and soft tissue/other sites. Original cytology reports were interpreted using the terminology available at the time of reporting and mapped, where feasible, to the Bethesda cervical and thyroid frameworks, the IAC Yokohama breast system, the Sydney lymph-node system and the Milan salivary-gland system [5–10]. Tissue diagnoses were mapped to a corresponding lesion-specific category. Histopathology was treated as the reference standard for the diagnostic-accuracy calculations, with further histological review permitted when discrepancy adjudication suggested biopsy limitations.

Three mutually exclusive correlation outcomes were defined. Exact concordance required agreement at the relevant diagnostic category or lesion level. Minor discordance indicated differences in subtype, grade or specificity that did not change the prespecified clinically meaningful positive-versus-negative classification. Major discordance indicated a discrepancy crossing the clinically meaningful classification threshold, including false-negative and false-positive cytologic calls. By definition, the binary agreement denominator included exact concordance and minor discordance; major discordance corresponded to binary misclassification.

For cervix, the reference-positive endpoint was histologically confirmed CIN2+ or invasive malignancy; a cytologic high-grade/suspicious category was taken as positive, with lower-grade or negative categories classified as negative. For the non-gynecologic sites, cytologic findings explicitly designated suspicious for malignancy or malignant were mapped as positive, and definitively benign/non-neoplastic findings as negative. Histologically confirmed malignancy was reference-positive. Lesions with unresolved indeterminate classification were excluded from the binary performance analysis instead of being automatically labelled benign or malignant.

2.4 Root-cause analysis

All major discrepancies were assigned to two independent pathologists for reassessment of the cytologic slides, histopathological sections and corresponding clinical documentation. Discordances were discussed in a consensus review. Root causes were classified as a predominant sampling limitation (nonrepresentative or scant lesion material), cytologic interpretation error (screening oversight or classification error), lesion heterogeneity (focal or mixed morphologic features), or histopathology-related factor (limited biopsy representation or histologic interpretive complexity). A primary root cause was assigned to each discordant case; overlapping contributing factors were addressed during multidisciplinary discussion. Potential clinical impact was graded as high, moderate or low according to the likelihood of a consequential change in diagnostic workup, treatment planning or follow-up, without assuming that any particular patient experienced actual harm.

2.5 Data items and quality assurance

Data fields comprised age, sex, cytologic specimen type and site, initial cytologic diagnosis, histopathological procedure and diagnosis, time interval between tests, major/minor discordance class, adjudicated root cause and potential clinical impact. Correlation was performed using coded study identifiers. Duplicate accessions and cases involving more than one specimen from the same lesion were reconciled at the patient–lesion level so that each matched pair contributed only once to the principal analysis. A structured discrepancy-review form was used to document final classification and suggested corrective action.

2.6 Statistical analysis

Frequencies and percentages were calculated for categorical variables. The proportion of exact concordance, minor discordance and major discordance was determined using the total number of eligible paired cases as denominator. For binary diagnostic accuracy, true positives, true negatives, false positives and false negatives were aggregated within each organ system. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall accuracy were calculated using standard 2 × 2 formulas. Wilson 95% confidence intervals were computed for proportions. Site-specific variation in major discordance was assessed using Pearson's chi-square test. Two-sided $P < 0.05$ was the criterion for statistical significance. Root causes were analyzed descriptively because each discrepancy was assigned to one predominant category. Interpretation of pooled estimates considered the heterogeneity of anatomic sites and the restriction of the study population to cases with histopathological follow-up [4].

2.7 Ethical considerations

The review was structured around archived pathology material and existing hospital records without patient contact, additional sampling or intervention. Patient identifiers were replaced by coded study numbers for analysis, and case information was restricted to the diagnostic variables required for correlation. The retrospective minimal-risk protocol included provision for institutional ethics review and consideration of a waiver of individual informed consent.

RESULTS

3.1 Study selection and case characteristics

A total of 813 potentially eligible paired records were screened. After exclusion of 133 records, 680 patients with matched cytology and histopathology were included (Figure 1). Exclusions comprised 36 cases beyond the permitted cytology–histology interval, 29 non-diagnostic cytology specimens without adequate repeat testing, 27 records lacking essential information, 18 cases with inadequate histological material, 13 duplicate entries and 10 unresolved indeterminate classifications. The most frequent anatomical site was cervix (170/680; 25.0%), followed by thyroid (150/680; 22.1%) and breast (130/680; 19.1%). Female patients accounted for 495 (72.8%) of the paired cases, including all cervical specimens. The organ distribution and sex profile are detailed in Table 1.

Table 1. Distribution of paired cytology–histology cases by organ system and sex

Organ system	Paired cases, n	Share	Female, n	Male, n
Cervix	170	25.0%	170	0
Thyroid	150	22.1%	121	29
Breast	130	19.1%	115	15
Lymph node	95	14.0%	34	61
Salivary gland	65	9.6%	26	39
Soft tissue/other	70	10.3%	29	41
Total	680	100.0%	495	185

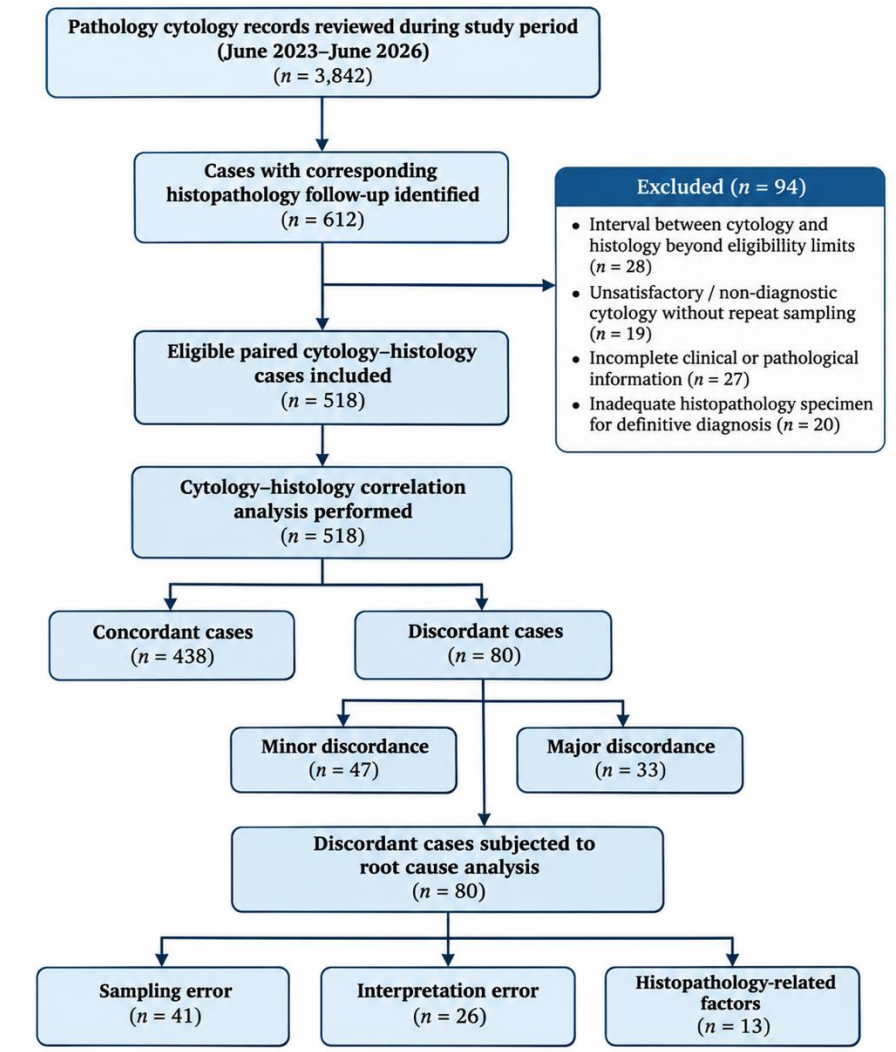


Figure 1. Flow of pathology records through selection and correlation analysis.

3.2 Overall and organ-specific diagnostic concordance

Exact category-level concordance was recorded in 499 cases (73.4%), minor discordance in 64 (9.4%) and major discordance in 117 (17.2%). Consequently, binary clinical-category agreement was 563/680 (82.8%; 95% CI 79.8–85.4%). The lowest rate of major discordance was observed in breast lesions (12.3%) and the highest in salivary-gland lesions (26.2%). The differences in major discordance across organ systems were not significant ($\chi^2 = 7.24$, df = 5, P = 0.203). Table 2 and Figure 2 summarize these comparisons.

Table 2. Exact concordance, minor discordance and major discordance by organ system

Site	Total, n	Exact match	Minor discordance	Major discordance	Binary agreement
Cervix	170	131 (77.1%)	14 (8.2%)	25 (14.7%)	145 (85.3%)
Thyroid	150	108 (72.0%)	15 (10.0%)	27 (18.0%)	123 (82.0%)
Breast	130	103 (79.2%)	11 (8.5%)	16 (12.3%)	114 (87.7%)
Lymph node	95	68 (71.6%)	9 (9.5%)	18 (18.9%)	77 (81.1%)
Salivary gland	65	40 (61.5%)	8 (12.3%)	17 (26.2%)	48 (73.8%)
Soft tissue/other	70	49 (70.0%)	7 (10.0%)	14 (20.0%)	56 (80.0%)
Total	680	499 (73.4%)	64 (9.4%)	117 (17.2%)	563 (82.8%)

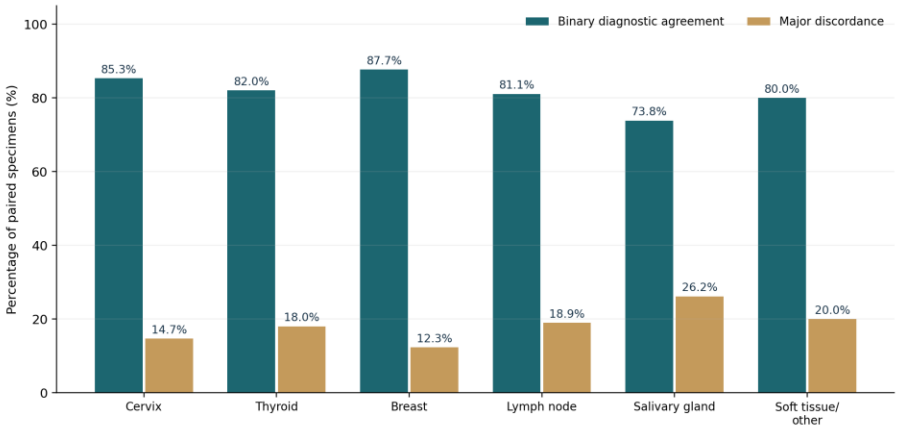


Figure 2. Organ-specific binary agreement and major discordance in matched cases.

3.3 Diagnostic performance with histology as the reference standard

Across all sites, there were 227 true-positive, 336 true-negative, 34 false-positive and 83 false-negative cytologic classifications (Table 3). Sensitivity was 73.2% (95% CI 68.0–77.8%), specificity 90.8% (95% CI 87.4–93.3%), PPV 87.0%, NPV 80.2%, and overall binary accuracy 82.8% (95% CI 79.8–85.4%). Sensitivity was numerically highest in breast lesions (81.2%) and lowest in salivary-gland lesions (61.3%). Table 4 provides site-specific metrics. Because the included cases all underwent histopathological follow-up, these figures describe diagnostic performance in the verified cohort rather than screening-population performance.

Table 3. Site-specific 2 × 2 diagnostic classifications

Site	TP	FN	FP	TN	Total
Cervix	49	19	6	96	170
Thyroid	42	18	9	81	150
Breast	52	12	4	62	130
Lymph node	37	12	6	40	95
Salivary gland	19	12	5	29	65
Soft tissue/other	28	10	4	28	70
Total	227	83	34	336	680

Table 4. Diagnostic performance by anatomical site (%); 95% CI for accuracy in parentheses

Site	Sensitivity	Specificity	PPV	NPV	Accuracy (95% CI)
Cervix	72.1	94.1	89.1	83.5	85.3 (79.2–89.8)
Thyroid	70.0	90.0	82.4	81.8	82.0 (75.1–87.3)
Breast	81.2	93.9	92.9	83.8	87.7 (80.9–92.3)
Lymph node	75.5	87.0	86.0	76.9	81.1 (72.0–87.7)
Salivary gland	61.3	85.3	79.2	70.7	73.8 (62.0–83.0)
Soft tissue/other	73.7	87.5	87.5	73.7	80.0 (69.2–87.7)
Pooled	73.2	90.8	87.0	80.2	82.8 (79.8–85.4)

TP, true positive; FN, false negative; FP, false positive; TN, true negative. The positive clinical endpoint was CIN2+ for cervical specimens and malignancy for non-gynecologic specimens; individual organ-specific performance figures are not estimates of an interchangeable clinical endpoint.

3.4 Root causes of major discordance

Among 117 major discrepancies, sampling limitation was the predominant cause in 51 cases (43.6%), followed by interpretation error in 33 (28.2%), lesion heterogeneity in 19 (16.2%) and histopathology-related factors in 14 (12.0%). The interpretation-error category comprised 12 screening oversights and 21 classification disagreements. Root-cause distributions are shown in Table 5 and Figure 3. Sampling limitations were common in cervical and thyroid discordances, whereas morphologic overlap, focal lesions and limited tissue representation contributed across the non-gynecologic groups.

Table 5. Predominant root cause assigned to major discordant cases

Site	Sampling	Interpretation	Heterogeneity	Histology factor	Total
Cervix	13	7	3	2	25
Thyroid	11	7	6	3	27
Breast	7	5	3	1	16

Lymph node	7	6	3	2	18
Salivary gland	7	4	3	3	17
Soft tissue/other	6	4	1	3	14
Total	51	33	19	14	117

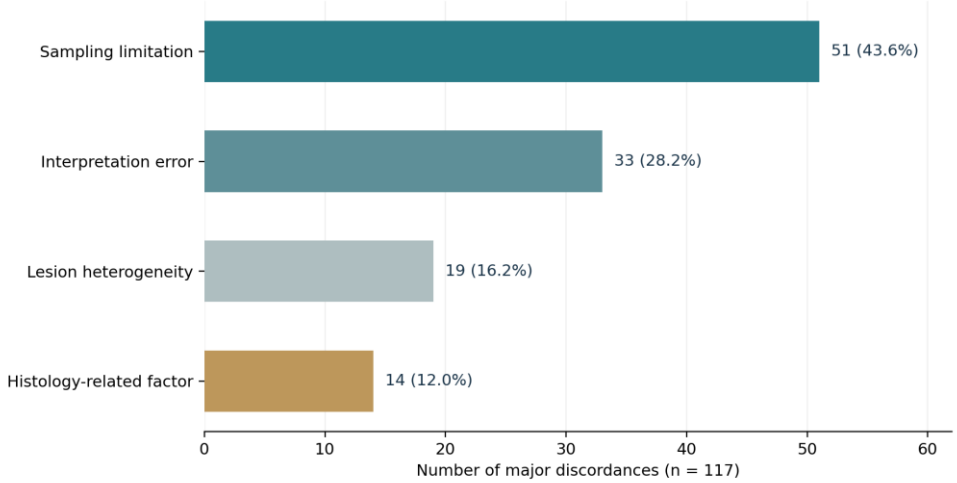


Figure 3. Distribution of the predominant root causes among 117 major diagnostic discrepancies.

3.5 Direction of discrepancy and potential clinical impact

False-negative cytological classification accounted for 83 of the 117 major discordances (70.9%); false-positive classification accounted for 34 (29.1%). Potential impact was graded high in 49 cases (41.9%), moderate in 44 (37.6%) and low in 24 (20.5%). Examples of high-impact pathways included failure to identify high-grade cervical disease, a malignant thyroid or salivary lesion reported as benign, and an unsuspicious lymph-node aspirate followed by a malignant tissue diagnosis. These assessments represented potential alterations in management pathways rather than measured downstream adverse events.

Table 6. Direction of major discordance and adjudicated potential clinical impact

Category	Cases, n	Percentage of major discordances
False negative (undercall)	83	70.9%
False positive (overcall)	34	29.1%
High potential impact	49	41.9%
Moderate potential impact	44	37.6%
Low potential impact	24	20.5%

3.6 Organ-specific discrepancy patterns

Cervical discrepancies predominantly involved cytologic results below the high-grade threshold followed by CIN2+ on tissue examination, with sampling and interpretation contributing to mismatches. Thyroid discordances were influenced by limited aspiration of heterogeneous nodules, while follicular-patterned lesions required careful attention to the limits of cytologic architectural assessment. In breast samples, paucicellular fibrotic lesions and nonrepresentative aspirates were prominent pitfalls. Lymph-node aspirates showed challenges in the recognition and subclassification of lymphoid proliferations and in sampling focal metastatic deposits. Salivary-gland lesions demonstrated overlapping cytomorphologic patterns and focal malignant components. Soft-tissue and other lesions were affected by histologic heterogeneity and limited initial cytologic material. These patterns informed site-specific quality-improvement measures.

DISCUSSION

The principal finding was a binary concordance rate of 82.8% among matched cytology–histology cases, with 117 clinically significant major discrepancies (17.2%). Exact diagnostic-category agreement was lower (73.4%) because it additionally required concordance at the lesion or grade level. The distinction is important: a binary correct result can still contain a subtype or grade disagreement requiring discussion at a correlation meeting. The site-specific pattern similarly shows that overall agreement may conceal clinically important false-negative results.

The dominance of sampling-related causes is consistent with prior studies of cervical cytology–biopsy correlation. Jones and Novis found that discrepant cervical findings frequently involved sampling limitations in a large College of American Pathologists quality-improvement assessment [2]. Joste and colleagues likewise demonstrated that many cervical discrepancies remained after diagnostic review because lesion representation differed between cytology and subsequent

biopsy [3]. In multi-organ practice, inadequate sampling may occur when a lesion is cystic, fibrotic, partially necrotic, very focal or clinically inaccessible. Improved procedural guidance, assessment of cellular adequacy and repeat targeted sampling are therefore likely to be productive interventions.

Interpretation errors formed the second-largest contributor. These include screening oversight as well as the misclassification of atypical cells, reactive mimics or uncommon malignant patterns. The practical response is not indiscriminate re-reading of all specimens but structured consensus review of discordant cases, access to relevant imaging and clinical findings, and targeted continuing education driven by documented error patterns. A stable institutional classification approach is particularly valuable when cytologists and surgical pathologists use different terminologies for related lesions [1,4].

The use of organ-specific reporting frameworks helps contextualize diagnostic limitations. The Bethesda System for Reporting Thyroid Cytopathology separates atypia, follicular neoplasms, suspicious categories and malignancy because risk estimates and subsequent management are not equivalent [6]. The IAC Yokohama System similarly provides a standardized breast FNAC vocabulary with explicit attention to atypical and suspicious categories [7,14]. The Milan System for salivary-gland cytopathology incorporates risk stratification and highlights the complexity of morphologic overlap [8,13]. For lymph nodes, the Sydney system emphasizes the integration of cytomorphology, clinical data and ancillary investigations, particularly when lymphoma is possible [9,10,15]. Such systems support more reproducible comparisons without erasing genuine indeterminate diagnoses.

The relatively higher major-discordance proportion in salivary-gland samples may reflect morphologic diversity and small focal malignant components, but the statistical comparison did not demonstrate a clear site effect. Differences in case mix, referral pathways and the availability of follow-up surgery could also contribute. Crucially, the sensitivity and specificity estimates are conditional on histopathological verification and should not be extrapolated to all patients who underwent cytology. Verification bias can arise when clinically suspicious, persistent or surgically selected lesions are more likely to have histopathological confirmation [4]. This issue is relevant to organ-to-organ comparisons in which referral thresholds differ.

Potential clinical impact is most substantial when a false-negative result delays recognition of clinically significant cervical disease or malignancy. For cervical screening, management decisions depend on risk-based integration of current cytology, HPV status and prior history rather than cytology alone [11,12,17]. In non-gynecologic sites, discordance may alter the need for repeat image-guided FNA, core biopsy, ancillary testing or surgical excision. The high/moderate/low impact categories in this analysis therefore capture the plausible importance of discrepancies, not confirmed adverse events or a direct measure of patient harm.

An institution-wide quality program should translate case review into measurable corrective actions. These include standardized request forms with site and imaging context, site-specific adequacy checklists, routine cytology–histology meetings, documented histology re-review in major mismatches, targeted double reading for high-risk categories and periodic audit of false-negative patterns. For lymphoid lesions, supplementary flow cytometry or immunocytochemistry may be valuable where appropriate and available. Corrective-action tracking can assess repeat-sampling rates, adequacy, discordance trends and the proportion of major discrepancies reviewed within an agreed reporting interval [1,9,15,16].

The study design has limitations. It includes only cases with linked histopathological follow-up and may preferentially select patients with suspicious lesions or stronger clinical indications for tissue diagnosis. Estimates are affected by differences in case mix, specimen preparation and disease prevalence among sites. Small site-specific samples limit precision, particularly for salivary-gland and soft-tissue lesions. Histopathology is not infallible when the biopsy is limited or obtained from a different part of a heterogeneous lesion. Attribution of a single predominant root cause simplifies cases where sampling and interpretation overlap. Finally, grading potential impact does not measure treatment changes, diagnostic delay or patient outcomes. These limitations support cautious interpretation and emphasize the value of prospective correlation registries.

5. Recommendations for Laboratory Quality Improvement

A structured protocol can prioritize five actions: (i) harmonize organ-specific cytologic terminology and specimen-adequacy criteria; (ii) retain a linked case register of cytology, histology, laterality and sampling dates; (iii) require dual-pathologist review of major discrepancies with a documented predominant root cause; (iv) use targeted resampling, image guidance and ancillary studies when clinical suspicion persists despite a negative aspirate; and (v) review discordance indicators quarterly, with documented training feedback and reassessment after corrective action. The objective is a closed-loop quality-assurance process rather than isolated retrospective comparison.

CONCLUSION

Cytology–histology correlation across multiple organ systems identifies meaningful diagnostic discrepancies and supports focused quality improvement. Sampling limitations and interpretation errors account for an important share of major mismatches, while organ-specific morphology and tissue heterogeneity influence diagnostic performance. Standardized reporting frameworks, systematic discrepancy review, improved sampling strategies and multidisciplinary feedback offer practical opportunities to strengthen pathology reporting and patient-management decisions.

REFERENCES

1. Raab SS, Grzybicki DM. Cytologic-histologic correlation. Cancer Cytopathol. 2011;119(5):293–309. doi:10.1002/cncy.20165.
2. Jones BA, Novis DA. Cervical biopsy-cytology correlation: a College of American Pathologists Q-Probes study of 22,439 correlations in 348 laboratories. Arch Pathol Lab Med. 1996;120(6):523–531.
3. Joste NE, Crum CP, Cibas ES. Cytologic/histologic correlation for quality control in cervicovaginal cytology: experience with 1,582 paired cases. Am J Clin Pathol. 1995;103(1):32–34. doi:10.1093/ajcp/103.1.32.
4. Bossuyt PM, Reitsma JB, Bruns DE, et al. STARD 2015: an updated list of essential items for reporting diagnostic accuracy studies. BMJ. 2015;351:h5527. doi:10.1136/bmj.h5527.
5. Nayar R, Wilbur DC, editors. The Bethesda System for Reporting Cervical Cytology: Definitions, Criteria, and Explanatory Notes. 3rd ed. Springer; 2015. doi:10.1007/978-3-319-11074-5.
6. Ali SZ, Baloch ZW, Cochand-Priollet B, Schmitt FC, Vielh P, VanderLaan PA. The 2023 Bethesda System for Reporting Thyroid Cytopathology. Thyroid. 2023;33(9):1039–1044. doi:10.1089/thy.2023.0141.
7. Field AS, Raymond WA, Rickard M, et al. The International Academy of Cytology Yokohama System for Reporting Breast Fine-Needle Aspiration Biopsy Cytopathology. Acta Cytol. 2019;63(4):257–273. doi:10.1159/000499509.
8. Rossi ED, Baloch Z, Barkan G, et al. Second edition of the Milan System for Reporting Salivary Gland Cytopathology: refining the role of salivary gland FNA. Cancer Cytopathol. 2024;132(1):10–21. doi:10.1002/cncy.22753.
9. Al-Abbadi MA, Barroca H, Bode-Lesniewska B, et al. A proposal for the performance, classification, and reporting of lymph node fine-needle aspiration cytopathology: the Sydney system. Acta Cytol. 2020;64(4):306–322. doi:10.1159/000506497.
10. Gupta P, Gupta N, Kumar P, et al. Assessment of risk of malignancy by application of the proposed Sydney system for classification and reporting lymph node cytopathology. Cancer Cytopathol. 2021;129(9):701–718. doi:10.1002/cncy.22432.
11. Perkins RB, Guido RS, Castle PE, et al. 2019 ASCCP Risk-Based Management Consensus Guidelines for abnormal cervical cancer screening tests and cancer precursors. J Low Genit Tract Dis. 2020;24(2):102–131. doi:10.1097/LGT.0000000000000525.
12. Perkins RB, Guido RS, Castle PE, et al. 2019 ASCCP Risk-Based Management Consensus Guidelines: updates through 2023. J Low Genit Tract Dis. 2024;28(1):3–6. doi:10.1097/LGT.0000000000000788.
13. Tochtermann G, Nowack M, Hagen C, et al. The Milan system for reporting salivary gland cytopathology—a single-center study of 2156 cases. Cancer Med. 2023;12(11):12198–12207. doi:10.1002/cam4.5914.
14. Field AS, Raymond WA, Rickard M, Schmitt F. Breast fine needle aspiration biopsy cytology: the potential impact of the International Academy of Cytology Yokohama System and the use of rapid on-site evaluation. J Am Soc Cytopathol. 2020;9(2):103–111. doi:10.1016/j.jasc.2019.10.004.
15. Vigliar E, Acanfora G, Iaccarino A, et al. A novel approach to classification and reporting of lymph node fine-needle cytology: application of the proposed Sydney system. Diagnostics (Basel). 2021;11(8):1314. doi:10.3390/diagnostics11081314.
16. Liang S, Cozzolino I, Zeppa P, Field AS. The Sydney system for lymph node FNA biopsy cytopathology: a detailed analysis of recent publications and meta-analysis. Cancer Cytopathol. 2024;132(12):745–756. doi:10.1002/cncy.22890.
17. Cheung LC, Egemen D, Chen X, et al. 2019 ASCCP Risk-Based Management Consensus Guidelines: methods for risk estimation, recommended management, and validation. J Low Genit Tract Dis. 2020;24(2):90–101. doi:10.1097/LGT.0000000000000528.