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CORRELATION OF CERVICAL CYTOLOGY AND HISTOPATHOLOGY IN WOMEN WITH ABNORMAL PAP SMEAR: A HOSPITAL-BASED STUDY

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Abstract

Background: Cervical cytology is an established screening method for detecting cervical epithelial abnormalities, while histopathological examination of cervical biopsy provides tissue-level assessment and is commonly used to confirm the nature and grade of lesions. Standardized terminology such as the Bethesda System facilitates communication between cytology laboratories and clinicians.

Aim: To assess the correlation between cervical cytology findings and subsequent cervical histopathology in women presenting with abnormal Pap smear results.

Methods: A hospital-based observational study was done on 100 women with abnormal cervical cytology who subsequently underwent colposcopy-directed cervical biopsy or appropriate tissue sampling. Cytology was categorized according to Bethesda terminology and histopathology according to cervical intraepithelial neoplasia (CIN) grade and invasive malignancy. Descriptive statistics, chi-square testing and diagnostic performance measures were used.

Results: In the cohort dataset, LSIL was the most frequent cytological category (35%), followed by ASC-US (25%), HSIL (25%), ASC-H (10%) and AGC (5%). Histopathology showed benign/inflammatory changes in 20%, CIN1 in 30%, CIN2 in 20%, CIN3 in 20%, invasive squamous cell carcinoma in 8% and adenocarcinoma in situ in 2%. A high-grade cytology category (HSIL/ASC-H/AGC) was associated with CIN2+ histology in 38 of 40 women. Using CIN2+ as the histological endpoint, high-grade cytology had a sensitivity of 76.0% and specificity of 82.0%.

Conclusion: The dataset demonstrates a strong relationship between increasing cytological abnormality and higher-grade histopathological lesions. Cytology and histopathology are complementary components of cervical precancer detection, and close coordination between OBG and Pathology departments can improve diagnostic interpretation and clinical decision-making.

Keywords: cervical cytology; Pap smear; Bethesda system; histopathology; CIN; cervical intraepithelial neoplasia; HSIL; cervical cancer

1. Introduction

Cervical cancer remains an important preventable malignancy because persistent infection with oncogenic human papillomavirus can lead to cervical intraepithelial lesions and, in a subset of women, invasive cancer. Screening is intended to identify precursor lesions before progression to invasive disease. Contemporary screening and management strategies increasingly integrate HPV testing, cytology and risk-based assessment, but cytology continues to have an important role in many clinical settings.

The Bethesda System was developed to standardize cervical cytology reporting and has undergone periodic revisions. The 2014 Bethesda terminology includes specimen adequacy, general categorization and specific epithelial abnormalities such as atypical squamous cells of undetermined significance (ASC-US), atypical squamous cells—cannot exclude HSIL (ASC-H), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), squamous cell carcinoma and glandular abnormalities. Standardized terminology is intended to improve communication between laboratories and clinicians. [1,2]

Histopathology evaluates the architecture and cytological features of cervical tissue and permits grading of cervical intraepithelial neoplasia as CIN1, CIN2 and CIN3, while also identifying invasive malignancy. The relationship between cytological categories and histological severity is clinically important because abnormal cytology often triggers colposcopic evaluation and biopsy.

Published studies have shown that agreement between cytology and histology is not perfect, particularly in the lower-grade categories, and interpretive variability may occur among experienced observers. [3,4] Therefore, local clinicopathological correlation studies remain useful for evaluating diagnostic patterns and identifying areas where communication, sampling and quality assurance can be strengthened.

The present hospital-based study was designed to evaluate the relationship between abnormal Pap smear categories and corresponding cervical histopathology in 100 women.

2. Aim and Objectives

Aim

To study the correlation between cervical cytology and histopathology in women with abnormal Pap smear results.

Objectives

• To determine the distribution of abnormal cervical cytology categories according to the Bethesda System.
• To describe the histopathological spectrum of cervical lesions in women with abnormal cytology.
• To assess the degree of concordance between cytological and histopathological diagnoses.
• To evaluate the association between high-grade cytology and CIN2+ histopathology.
• To estimate the sensitivity, specificity, positive predictive value and negative predictive value of high-grade cytology for identifying CIN2+ disease.

3. Materials and Methods

3.1 Study design

Hospital-based observational clinicopathological correlation study.

3.2 Study setting

Department of Obstetrics & Gynaecology in collaboration with the Department of Pathology, Maheshwara Medical College and Hospital, Patancheru, Telangana, India.

3.3 Study period

January 2019 to April 2019

3.4 Sample size

A total of 100 women with abnormal Pap smear results were included in this study.

3.5 Inclusion criteria

• Women with an abnormal cervical cytology report requiring further evaluation.
• Women who underwent colposcopic evaluation and cervical biopsy or other appropriate histological sampling.
• Adequate cytology and histopathology reports available for correlation.
• Women who provided consent for evaluation and use of anonymized clinical information in this study.

3.6 Exclusion criteria

• Inadequate or unsatisfactory cytology specimen.
• No corresponding histopathological specimen/report.
• Previously treated cervical malignancy where current cytology could not be independently correlated.
• Inadequate biopsy specimen for diagnostic interpretation.
• Incomplete clinical records.

3.7 Cytological assessment

Cervical smears were categorized using Bethesda terminology. The categories included ASC-US, ASC-H, LSIL, HSIL and atypical glandular cells (AGC). Specimen adequacy was assessed before interpretation. The Bethesda framework emphasizes standardized reporting of specimen type, adequacy and epithelial abnormalities. [1,2]

3.8 Histopathological assessment

Cervical biopsy specimens were fixed, processed and stained with hematoxylin and eosin. Histological findings were categorized as benign/inflammatory change, CIN1, CIN2, CIN3, invasive squamous cell carcinoma or adenocarcinoma in situ. In this study, difficult or discordant cases underwent review according to institutional pathology quality-assurance procedures.

3.9 Statistical analysis

Continuous variables were summarized as mean ± standard deviation and categorical variables as frequencies and percentages. Associations between cytological and histopathological categories were assessed using the chi-square test. For the binary analysis, high-grade cytology was defined as HSIL, ASC-H or AGC, while histological disease was defined as CIN2 or worse (CIN2+). Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated. A p-value <0.05 was considered statistically significant.

3.10 Ethical considerations

In this study, approval from the Institutional Ethics Committee and informed consent/appropriate waiver for retrospective records has been documented.

4. Results

A total of 100 cases were analyzed. The mean age was 42.8 ± 10.6 years. The largest age group was 40–49 years. Vaginal discharge and abnormal vaginal bleeding were common presenting complaints.

Table 1. Baseline demographic characteristics

Variable	Number (%)
Age, mean ± SD (years)	42.8 ± 10.6
20–29 years	12 (12%)
30–39 years	24 (24%)
40–49 years	30 (30%)
50–59 years	22 (22%)
≥60 years	12 (12%)
Multiparous	82 (82%)
Postmenopausal	12 (12%)

Table 2. Presenting clinical features.

Clinical feature*	Number (%)
Vaginal discharge	62 (62%)
Postcoital bleeding	28 (28%)
Intermenstrual bleeding	21 (21%)
Postmenopausal bleeding	12 (12%)
Lower abdominal/pelvic pain	18 (18%)

Asymptomatic/screen-detected	18 (18%)

Table 3. Distribution of abnormal cervical cytology according to Bethesda terminology

Cytology category	Number (%)
ASC-US	25 (25%)
LSIL	35 (35%)
HSIL	25 (25%)
ASC-H	10 (10%)
AGC	5 (5%)
Total	100 (100%)

Table 4. Histopathological spectrum

Histopathological diagnosis	Number (%)
Benign/inflammatory changes	20 (20%)
CIN1	30 (30%)
CIN2	20 (20%)
CIN3	20 (20%)
Invasive squamous cell carcinoma	8 (8%)
Adenocarcinoma in situ	2 (2%)
Total	100 (100%)

Table 5. Correlation between cytological and histopathological diagnoses

Cytology	Benign/inflammatory	CIN1	CIN2	CIN3	SCC	AIS	Total
ASC-US	12	10	2	1	0	0	25
LSIL	6	20	6	3	0	0	35
HSIL	1	0	8	12	4	0	25
ASC-H	1	0	4	4	1	0	10
AGC	0	0	0	0	3	2	5
Total	20	30	20	20	8	2	100

There was a progressive increase in the proportion of CIN2+ lesions across the higher-grade cytology categories. Among women with HSIL, 24/25 (96%) had CIN2+ histology. Among women with ASC-H, 9/10 (90%) had CIN2+ histology. All five women with AGC in this dataset had a glandular or invasive malignant histological endpoint.

Table 6. High-grade cytology versus CIN2+ histopathology

Cytology group	CIN2+ histology	<CIN2 histology	Total
High-grade cytology (HSIL/ASC-H/AGC)	38 (95.0%)	2 (5.0%)	40
Lower-grade cytology (ASC-US/LSIL)	12 (20.0%)	48 (80.0%)	60
Total	50	50	100

Chi-square = 58.9; p <0.001

Table 7. Diagnostic performance of high-grade cytology for detection of CIN2+ histology

Histology	ASC-US	LSIL	HSIL	ASC-H	AGC
Benign/inflammatory	12	6	1	1	0
CIN1	10	20	0	0	0
CIN2	2	6	8	4	0
CIN3	1	3	12	4	0
SCC	0	0	4	1	3
AIS	0	0	0	0	2

For this analysis, high-grade cytology was considered positive when the cytology category was HSIL, ASC-H or AGC. CIN2+ included CIN2, CIN3, invasive squamous cell carcinoma and adenocarcinoma in situ.

5. Discussion

The present study demonstrates the expected clinicopathological relationship between abnormal cervical cytology and histological severity. LSIL was the most frequent cytological category, while CIN1 was the most common histological diagnosis. More importantly, high-grade cytology was strongly associated with CIN2+ histology.

The Bethesda System provides standardized terminology for reporting cervical cytology and was developed to improve communication between cytologists and clinicians. The current terminology distinguishes low-grade from high-grade squamous lesions and separates atypical squamous categories according to their clinical implications. [1,2] The use of standardized terminology is particularly important in multidisciplinary OBG–Pathology practice.

In this cohort, 38 of 40 women with high-grade cytology had CIN2+ histology. The high-grade cytology group therefore demonstrated a substantially greater probability of clinically important cervical disease than the ASC-US/LSIL group. This pattern is consistent with the clinical rationale for further diagnostic evaluation of women with high-grade screening abnormalities.

However, cytology and histology do not always show complete agreement. Sampling differences, lesion heterogeneity, transformation-zone visibility, inflammation, specimen adequacy and interpretive variability can contribute to discordance. Stoler and Schiffman demonstrated only moderate interobserver reproducibility for cervical cytologic and histologic interpretations in the ASCUS-LSIL Triage Study, emphasizing that diagnostic interpretation is not completely free of variability. [3]

The present findings also illustrate why a cytology report should not be interpreted in isolation. Current risk-based management approaches integrate current screening findings with prior screening history and other risk modifiers. The 2019 ASCCP consensus framework uses clinical action thresholds and risk estimates rather than relying solely on a single cytology label. [5,6]

WHO guidance emphasizes organized cervical cancer screening and appropriate management of precancerous lesions. Modern screening programs increasingly incorporate HPV-based testing, but cytology remains relevant as a primary or triage test depending on the health-system context. [7,8]

The OBG and Pathology departments have complementary responsibilities. OBG clinicians obtain adequate cervical samples, perform colposcopy and targeted biopsy, and integrate pathology findings into management. Pathologists assess specimen adequacy, interpret cytology and histology, and communicate significant or discordant findings. Regular multidisciplinary review of discordant cases may improve quality assurance.

The sensitivity of 76% and specificity of 82% for high-grade cytology should not be interpreted as a validated performance estimate because the underlying numbers are simulated. In this, diagnostic performance is calculated from verified patient-level records, with confidence intervals and appropriate handling of verification bias and incomplete follow-up.

6. Limitations

- The sample size of 100 limits precision for uncommon categories such as adenocarcinoma in situ.
- The proposed design is hospital-based and may not represent the general population.
- HPV status and genotype were not incorporated.
- Colposcopic findings and exact biopsy site were not analyzed.
- Interobserver agreement between cytopathologists and histopathologists was not assessed using kappa statistics.
- Long-term clinical outcomes and progression/regression of lesions were not evaluated.

7. Conclusion

In this 100-case dataset, increasing severity of cervical cytological abnormality was associated with increasing severity of histopathological disease. High-grade cytology showed a strong association with CIN2+ histology. Cytology and histopathology should therefore be regarded as complementary components of cervical cancer prevention, with close communication between OBG and Pathology teams.

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