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CLINICOPATHOLOGICAL CORRELATION OF COLPOSCOPIC AND HISTOPATHOLOGICAL FINDINGS IN WOMEN WITH INFLAMMATORY CERVICAL CYTOLOGY: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Inflammatory changes are among the most frequently reported findings on conventional Papanicolaou (Pap) smear, yet their correlation with underlying cervical pathology remains incompletely characterized, often prompting unnecessary anxiety and over-referral for colposcopic evaluation.

Objective: To describe the spectrum of colposcopic and histopathological findings in women with inflammatory cervical cytology and to examine the correlation between cytological severity, colposcopic appearance, and histopathological diagnosis.

Methods: This prospective observational study enrolled 100 consecutive women aged 21–65 years with inflammatory Pap smear reports attending the gynecology outpatient department of a saveetha medical college and hospital. All participants underwent colposcopic examination using the 2011 International Federation for Cervical Pathology and Colposcopy (IFCPC) nomenclature, followed by cervical biopsy from the most abnormal or, in its absence, a representative inflammatory area. Histopathological diagnoses were classified per World Health Organization (WHO) criteria. The relationship between cytological, colposcopic, and histopathological findings was examined descriptively.

Results: Mild inflammatory changes were the most common cytological finding (47.0%), followed by moderate (38.0%) and severe (15.0%) inflammation. Cervical ectopy (28.0%) and congestion/hyperemia (22.0%) were the predominant colposcopic findings. Chronic cervicitis (41.0%) was the most frequent histopathological diagnosis, followed by squamous metaplasia (24.0%) and endocervicitis (15.0%). No case of cervical intraepithelial neoplasia (CIN) or invasive carcinoma was identified. Cross-tabulation of colposcopic findings against histopathological diagnosis showed a benign, concordant predominant diagnosis for every colposcopic category, with row-wise concordance ranging from 40.0% to 100.0%.

Conclusion: Inflammatory cervical cytology was overwhelmingly associated with benign colposcopic and histopathological findings in this cohort, with no premalignant or malignant lesions detected, supporting a conservative, reassurance-oriented approach to women presenting with isolated inflammatory Pap smear reports.

KEYWORDS: Cervical cytology; Colposcopy; Chronic cervicitis; Bethesda System; Cervical intraepithelial neoplasia; Papanicolaou smear

INTRODUCTION

Cervical cancer remains a significant cause of morbidity and mortality among women worldwide. GLOBOCAN 2022 estimates recorded 662,301 new cases and 348,874 deaths from cervical cancer globally, with the burden disproportionately concentrated in countries with a low or medium Human Development Index [1]. Cytological screening using the conventional Papanicolaou (Pap) smear continues to serve as the cornerstone of early detection programs in resource-limited settings. Inflammatory or reactive cellular changes are among the most frequently encountered cytological findings in routine gynecological practice; a North Indian series of liquid-based cytology smears reported infection-associated inflammatory change in roughly one-quarter of specimens, with bacterial vaginosis as the leading identifiable organism [2]. The Bethesda System for Reporting Cervical Cytology formally categorizes such reactive and inflammatory changes alongside epithelial cell abnormalities [3].

Inflammatory cytological changes are non-specific and may reflect a wide range of underlying processes, including infective cervicitis, hormonal or atrophic change, mechanical irritation, or a benign reactive response of the squamous and glandular epithelium. Unlike squamous or glandular intraepithelial lesions, inflammatory smears do not, by

definition, indicate dysplastic change. Nevertheless, clinical practice in many settings remains inconsistent, with a substantial proportion of women with inflammatory cytology being referred for colposcopy and biopsy out of caution, contributing to patient anxiety, procedural burden, and cost without a clear evidence base for the yield of such referral. Colposcopy, interpreted using standardized nomenclature such as the 2011 International Federation for Cervical Pathology and Colposcopy (IFCPC) terminology, allows direct visualization of the transformation zone and guides biopsy from areas of concern [4]. Current risk-based screening and management guidelines, including those of the American Society for Colposcopy and Cervical Pathology (ASCCP), aim to personalize colposcopic referral and reduce unnecessary testing in low-risk women [5]. While the correlation between colposcopic impression and histopathological diagnosis has been extensively studied in the context of squamous intraepithelial lesions, comparatively limited data describe this correlation specifically in women whose index cytology is inflammatory rather than dysplastic.

This gap is clinically relevant. Cervical cancer screening programs in India and other resource-limited settings continue to face challenges of inconsistent referral practices and high attrition between screening and definitive diagnosis [6], and characterizing the colposcopic and histopathological spectrum associated with inflammatory cytology could inform more judicious referral practices and reduce unnecessary intervention in a population at low a priori risk of premalignant disease. The present study was therefore designed to describe the spectrum of colposcopic and histopathological findings among women with inflammatory cervical cytology, and to explore the descriptive correlation between cytological severity, colposcopic appearance, and histopathological diagnosis in this population.

MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based prospective observational study conducted in the Department of Obstetrics and Gynaecology of a saveetha medical college and hospital, in the outpatient and colposcopy clinics of the department. The study was designed and is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement for cross-sectional studies [7]. Cervical cytology was reported according to the Bethesda System for Reporting Cervical Cytology [3], colposcopic findings were documented using the 2011 IFCPC terminology [4], and patient evaluation was performed in accordance with standard American Society for Colposcopy and Cervical Pathology (ASCCP) recommendations wherever applicable [5].

Study period- 1 year, from January 2024 to January 2025

Study Population and Sampling

Women attending the gynecology outpatient department who were found to have inflammatory cervical cytology on conventional Pap smear were screened for eligibility. A consecutive sample of all eligible women with inflammatory cervical cytology presenting during the predefined study period was recruited. A total of 100 women fulfilled the eligibility criteria and completed the study protocol after providing written informed consent; all underwent colposcopic examination followed by cervical biopsy, and histopathological examination was available for every participant.

The study employed a pragmatic consecutive sample without a formal a priori sample size calculation. Although this may limit statistical precision and external generalizability, the inclusion of consecutive eligible participants during the study period reduced the potential for selection bias.

Eligibility Criteria

Inclusion criteria — women satisfying all of the following were included:

- Age between 21 and 65 years.
- Conventional Pap smear demonstrating inflammatory cervical cytology (mild, moderate, or severe inflammation).
- Willingness to undergo colposcopic examination and cervical biopsy.
- Provision of written informed consent.

Exclusion criteria — patients were excluded if they had:

- Pregnancy.
- Previously diagnosed cervical intraepithelial neoplasia or carcinoma cervix.
- Previous hysterectomy.
- History of treatment for cervical premalignant lesions.
- Active vaginal bleeding precluding satisfactory colposcopic examination.
- Refusal to participate.

Study Procedure

After obtaining written informed consent, a detailed history was recorded regarding age, parity, presenting complaints, menstrual history, obstetric history, and relevant gynecological history, along with findings of a complete pelvic examination, using a predesigned structured proforma.

Conventional cervical cytology reports were reviewed, and inflammatory Pap smears were categorized into mild, moderate, or severe inflammatory smears according to the reporting system used in the cytology laboratory. Cytologically identifiable infectious organisms, where reported — including Candida species, bacterial vaginosis, and Trichomonas vaginalis — were also documented.

All enrolled women underwent colposcopic examination using a standard colposcopy after application of 3–5% acetic acid, followed by Lugol's iodine wherever indicated. Colposcopic findings were documented according to the 2011 IFCPC nomenclature, including cervical ectopy, congestion or hyperemia, squamous metaplasia, cervical erosion, Nabothian follicles, edema, contact bleeding, acetowhite changes, and other visible abnormalities.

Following colposcopic evaluation, cervical biopsy was obtained from the most suspicious area identified during colposcopy. In women without a discrete abnormal lesion, biopsy was obtained from a representative inflammatory area according to departmental protocol. Tissue specimens were fixed in 10% neutral buffered formalin and processed routinely for histopathological examination.

Histopathological diagnoses were reported by experienced pathologists according to the WHO Classification of Female Genital Tumours [8]. Findings including chronic cervicitis, endocervicitis, squamous metaplasia, Nabothian cyst, cervical polyp, and other benign lesions were documented, and the presence or absence of cervical intraepithelial neoplasia and invasive carcinoma was specifically recorded.

The overall sequence of patient evaluation, from enrollment through histopathological diagnosis, is summarized in Figure 1.

Figure 1. Study Design and Patient Workflow

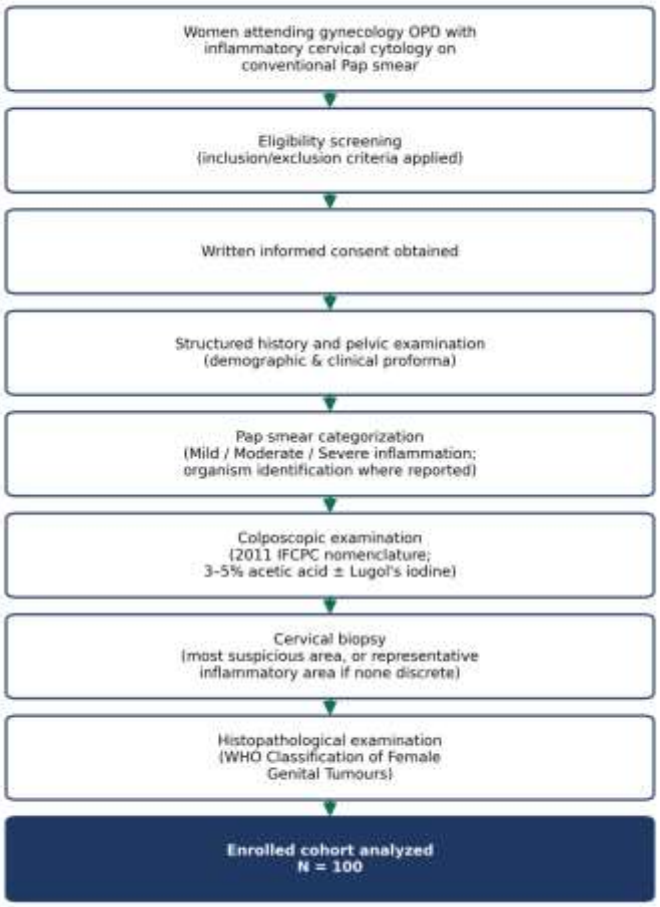

Figure 1. Study design and patient workflow (N = 100).

Outcome Measures

Primary outcome: Histopathological diagnosis in women with inflammatory cervical cytology.

Secondary outcomes:

- Distribution of inflammatory Pap smear severity.
- Spectrum of colposcopic findings.
- Distribution of histopathological diagnoses.
- Descriptive correlation between colposcopic findings and histopathological diagnosis.

- Descriptive association between the severity of inflammatory cervical cytology and predominant colposcopic findings.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. The spectrum of colposcopic findings, histopathological diagnoses, and their cross-tabulation were examined descriptively; given the exploratory nature of these secondary analyses and the distribution of findings across cells, no formal inferential statistical testing (e.g., Chi-square or Fisher's exact test) was applied to the correlation between colposcopic findings and histopathological diagnosis, or to the association between cytological severity and colposcopic findings. These relationships are therefore reported as descriptive concordance rather than as statistically tested associations.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee before commencement. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the Indian Council of Medical Research (ICMR) National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017). Written informed consent was obtained from all participants before enrollment, and confidentiality of participant information was maintained throughout the study.

RESULTS

Participants

A total of 100 women with inflammatory Pap smear reports fulfilling the eligibility criteria underwent colposcopic examination and cervical biopsy during the study period; histopathological examination was available for all 100 participants, with no losses to follow-up. As this study employed consecutive convenience sampling without prospectively documented screening logs, the total number of women screened for eligibility and the reasons for non-enrollment were not recorded; consequently, a complete STROBE-recommended participant flow diagram could not be constructed, and this is noted as a limitation.

The majority of participants belonged to the 31–40-year age group and were multiparous. White vaginal discharge was the most common presenting complaint. Baseline demographic and clinical characteristics are summarized in Table 1.

Characteristic	n (%)
Age 21–30 years	24 (24.0)
Age 31–40 years	46 (46.0)
Age 41–50 years	24 (24.0)
Age >50 years	6 (6.0)
Multiparous	88 (88.0)
Nulliparous	12 (12.0)
White vaginal discharge	58 (58.0)
Lower abdominal pain	22 (22.0)
Abnormal uterine bleeding	12 (12.0)
Routine screening	4 (4.0)
Postcoital bleeding	4 (4.0)

Table 1. Baseline demographic and clinical characteristics (N = 100).

Cytological Findings

Mild inflammatory smears constituted the largest proportion of cytological findings, followed by moderate and severe inflammation (Table 2). Cytologically identifiable organisms were observed in a minority of women; no organism was identified in the majority of smears.

Variable	n (%)
Mild inflammation	47 (47.0)

Variable	n (%)
Moderate inflammation	38 (38.0)
Severe inflammation	15 (15.0)
Candida spp.	6 (6.0)
Bacterial vaginosis	5 (5.0)
Trichomonas vaginalis	2 (2.0)
No organism identified	87 (87.0)

Table 2. Pap smear findings (N = 100).

Colposcopic Findings

Cervical ectopy (28.0%) and congestion/hyperemia (22.0%) were the most frequently observed colposcopic findings, followed by squamous metaplasia (17.0%) and cervical erosion (12.0%). A normal colposcopic appearance was seen in a single participant (Table 3, Figure 1).

Finding	n (%)
Cervical ectopy	28 (28.0)
Congestion / Hyperemia	22 (22.0)
Squamous metaplasia	17 (17.0)
Cervical erosion	12 (12.0)
Nabothian follicles	8 (8.0)
Edema	5 (5.0)
Contact bleeding	4 (4.0)
Acetowhite changes	3 (3.0)
Normal cervix	1 (1.0)

Table 3. Spectrum of colposcopic findings (N = 100).

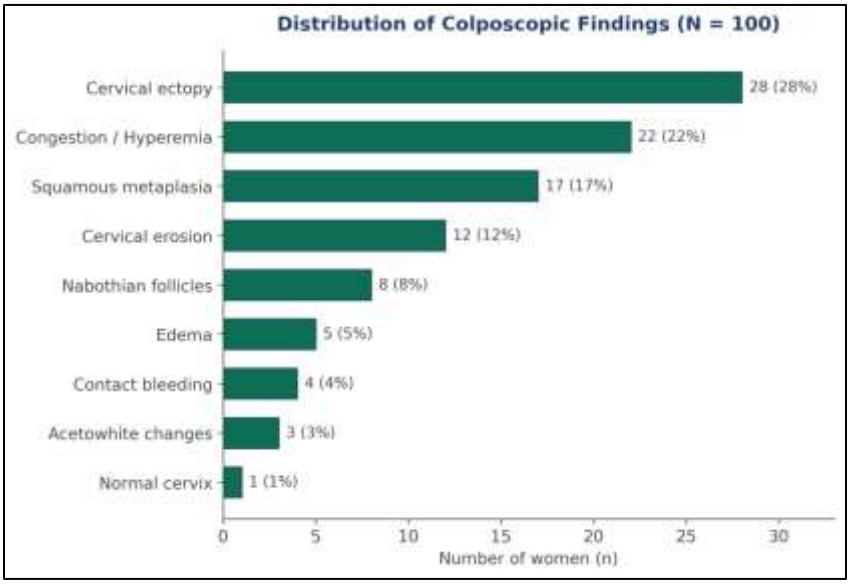

Figure 2. Distribution of colposcopic findings among 100 women with inflammatory cervical cytology.

Histopathological Findings

Chronic cervicitis was the most common histopathological diagnosis (41.0%), followed by squamous metaplasia (24.0%) and endocervicitis (15.0%) (Table 4, Figure 3). No case of cervical intraepithelial neoplasia (CIN) or invasive carcinoma was identified on histopathological examination of any of the 100 biopsy specimens.

Diagnosis	n (%)
Chronic cervicitis	41 (41.0)
Squamous metaplasia	24 (24.0)
Endocervicitis	15 (15.0)
Nabothian cyst	8 (8.0)
Cervical polyp	6 (6.0)
Other benign lesions	6 (6.0)

Table 4. Histopathological diagnosis (N = 100). No CIN or invasive carcinoma was identified.

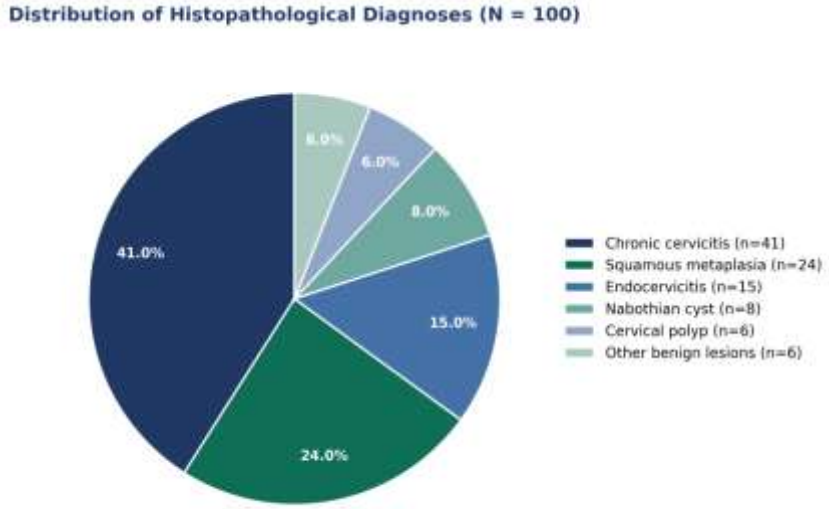

Figure 3. Distribution of histopathological diagnoses among 100 women with inflammatory cervical cytology.

Correlation Between Colposcopic Findings and Histopathological Diagnosis

Cross-tabulation of colposcopic findings against histopathological diagnosis is presented in Table 5 and visualized as a heat map in Figure 4. Each colposcopic category showed a benign predominant histopathological correlate, with row-wise concordance ranging from 40.0% (edema, tied between chronic cervicitis and endocervicitis) to 100.0% (normal cervix, corresponding entirely to Nabothian cyst on histopathology). Cervical ectopy, congestion/hyperemia, cervical erosion, and contact bleeding were predominantly associated with chronic cervicitis (concordance 50.0–58.3%); squamous metaplasia on colposcopy corresponded to squamous metaplasia on histopathology in 70.6% of cases; Nabothian follicles corresponded to Nabothian cyst in 75.0% of cases; and acetowhite change was most frequently associated with cervical polyp (66.7%). No colposcopic category was associated with CIN or carcinoma on histopathology.

Colposcopic finding	Chronic cervicitis	Squamous metaplasia	Endocervicitis	Nabothian cyst	Cervical polyp	Other benign	Total	Concordance (%)
Cervical ectopy	16	5	3	1	1	2	28	57.1
Congestion / Hyperemia	12	2	5	0	1	2	22	54.5
Squamous metaplasia	2	12	1	0	1	1	17	70.6

Colposcopic finding	Chronic cervicitis	Squamous metaplasia	Endocervicitis	Nabothian cyst	Cervical polyp	Other benign	Total	Concordance (%)
Cervical erosion	7	2	2	0	0	1	12	58.3
Nabothian follicles	0	1	0	6	0	1	8	75.0
Edema	2	1	2	0	0	0	5	40.0
Contact bleeding	2	0	1	0	1	0	4	50.0
Acetowhite changes	0	1	1	0	2	0	3	66.7
Normal cervix	0	0	0	1	0	0	1	100.0
Total	41	24	15	8	6	6	100	—

Table 5. Cross-tabulation of colposcopic findings against histopathological diagnosis, with row-wise concordance for the predominant diagnosis (N = 100).

Concordance (%) denotes the proportion of the row total accounted for by its predominant histopathological diagnosis. No formal statistical test of association was applied (see Statistical Analysis).

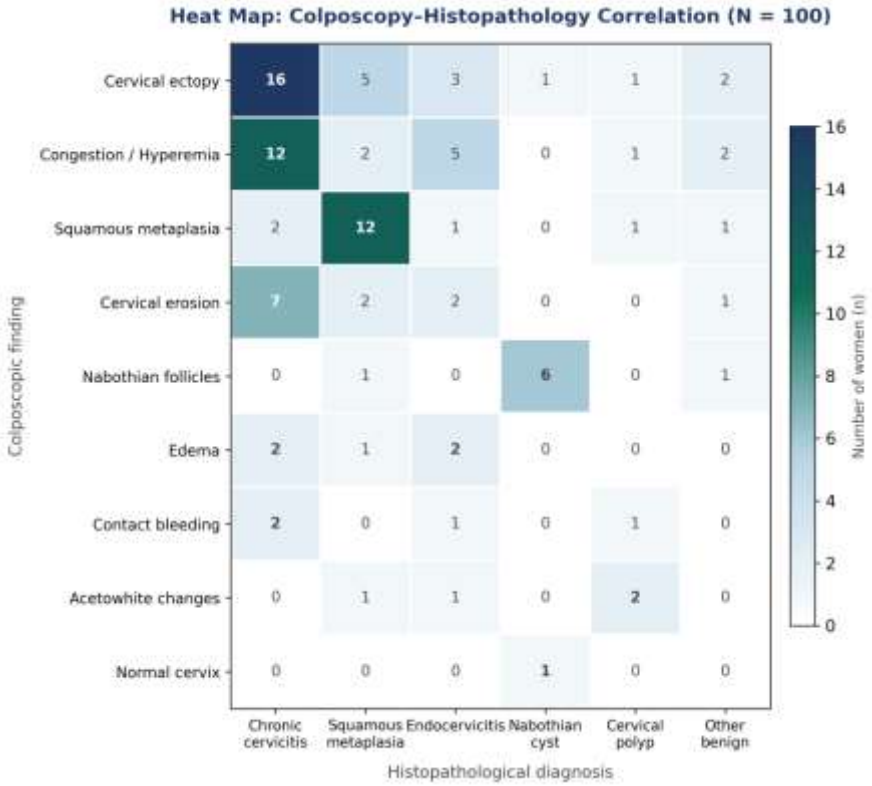

Figure 4. Heat map showing the distribution of histopathological diagnoses across colposcopic finding categories (N = 100).

Association Between Inflammatory Cytology Severity and Colposcopic Findings

The predominant colposcopic finding associated with each grade of cytological inflammation is summarized in Table 6. Cervical ectopy was the predominant colposcopic finding in women with mild inflammatory smears, congestion/hyperemia predominated in moderate inflammatory smears, and a mixed pattern of benign inflammatory changes was observed in women with severe inflammatory smears. This association is reported descriptively; no formal statistical test was applied.

Pap smear severity	Predominant colposcopic finding
Mild	Cervical ectopy

Pap smear severity	Predominant colposcopic finding
Moderate	Congestion / Hyperemia
Severe	Mixed benign inflammatory changes

Table 6. Predominant colposcopic finding by inflammatory Pap smear severity (descriptive).

Overall, inflammatory Pap smears in this cohort were predominantly associated with benign colposcopic and histopathological findings. Chronic cervicitis, cervical ectopy, and squamous metaplasia constituted the most frequent observations at each stage of evaluation, and no cervical intraepithelial neoplasia or invasive carcinoma was identified in any participant.

DISCUSSION

Principal Findings

In this prospective observational study of 100 women with inflammatory cervical cytology, colposcopic and histopathological evaluation revealed an overwhelmingly benign spectrum of findings. Chronic cervicitis, squamous metaplasia, and endocervicitis together accounted for the large majority of histopathological diagnoses, and no case of cervical intraepithelial neoplasia or invasive carcinoma was identified. Colposcopic findings such as cervical ectopy and congestion/hyperemia showed concordant benign histopathological correlates, and the severity of cytological inflammation did not appear to track with a shift toward more concerning colposcopic appearances.

Comparison with Existing Literature

The absence of premalignant or malignant histopathology in this cohort is consistent with the understanding that inflammatory cytological changes, as distinct from squamous or glandular intraepithelial lesions, largely reflect reactive or infective processes rather than dysplastic change. A colposcopy audit from a tertiary center in Vellore, India, similarly reported that colposcopic impression correlated with cervical biopsy findings in the large majority of cases, with benign and low-grade outcomes predominating among women referred for non-high-grade indications [9]. A prospective Indian study of women with an unhealthy-appearing cervix likewise reported a high overall concordance (90.9%) between colposcopic and histopathological findings, with cervical intraepithelial neoplasia (CIN) confirmed in only a minority (21.3%) of biopsies [10]. A Chinese prospective study of women referred for colposcopy similarly used histopathology as the reference standard and found that lesion severity, rather than any single triage modality alone, best predicted high-grade outcomes, underscoring the predominantly benign case-mix typical of unselected colposcopy referral populations [11]. Outside Asia, a Cervical One-Stop Assessment Clinic in Ireland evaluating women referred for abnormal cervical appearance or symptoms found that, among those biopsied, benign diagnoses such as metaplasia and cervicitis accounted for the large majority of results, with CIN identified in only a small fraction of attendees [12]. Regional guidelines such as the 2024 Hong Kong College of Obstetricians and Gynaecologists cervical screening guidelines similarly emphasize a second-tier triage step before colposcopic referral, to avoid over-referral of women unlikely to harbor high-grade disease [13]. Collectively, these Indian, Asian, and international data lend external plausibility to the predominantly benign spectrum observed in the present cohort.

Mechanistic Interpretation

Inflammatory cytological changes typically arise from infective cervicitis, hormonally mediated epithelial changes, or mechanical and chemical irritation of the ectocervix, all of which produce reactive squamous and glandular atypia without true dysplastic transformation. Cervical ectopy and squamous metaplasia represent physiological states of the transformation zone, where reserve cells undergo metaplastic conversion from columnar to squamous epithelium as part of normal cervical maturation rather than as a pathological process [14]. This physiological basis likely explains their frequent co-occurrence with chronic cervicitis or squamous metaplasia on histopathology rather than with CIN. The colposcopic correlates observed — congestion, hyperemia, erosion, and edema — are similarly consistent with a predominantly inflammatory rather than neoplastic process.

Clinical Implications

These findings suggest that, in the absence of additional risk factors or overtly abnormal colposcopic features (such as dense acetowhite change, atypical vessels, or mosaicism), an isolated inflammatory Pap smear report may not, by itself, warrant automatic referral for colposcopy and biopsy in all cases. Current risk-based screening and management frameworks already advocate reserving colposcopic referral for women at demonstrably higher risk, using triage strategies such as HPV genotyping or repeat testing rather than referring all cytological abnormalities directly to colposcopy [5]. This concern is not merely procedural: a systematic review of triage strategies for low-grade cytology concluded that indiscriminate colposcopic referral of equivocal or mildly abnormal smears yields a high proportion of unnecessary referrals relative to the detection of clinically significant disease [15], and a cross-sectional study of Italian women awaiting their first colposcopy found that a substantial proportion reported clinically relevant stress, anxiety, or depressive symptoms while awaiting results, particularly among younger and less-educated women [16]. A more selective, risk-stratified approach for women with inflammatory cytology specifically — reserving

colposcopic referral for persistent inflammatory changes, high-risk HPV positivity, or colposcopically suspicious features — could reduce unnecessary procedures, patient anxiety, and healthcare costs while preserving diagnostic yield for clinically significant disease.

Strengths

- Prospective design with standardized, internationally recognized classification systems for cytology (Bethesda), colposcopy (IFCPC 2011), and histopathology (WHO), enhancing reproducibility and comparability with other studies.
- Histopathological correlation was available for all enrolled participants, avoiding verification bias that can arise when biopsy is performed selectively only in colposcopically abnormal cases.
- Consecutive enrolment of eligible women reduced the potential for selection bias in patient recruitment.

Limitations

- This was a single-center study, which may limit the generalizability of findings to other populations and practice settings.
- The study employed a pragmatic consecutive sample without a formal a priori sample size calculation, which may affect statistical precision.
- As screening logs were not prospectively maintained, the total number of women assessed for eligibility and reasons for non-enrolment were not recorded, precluding construction of a complete STROBE-recommended participant flow diagram.
- The correlation between cytological severity, colposcopic findings, and histopathological diagnosis was examined descriptively rather than through formal inferential statistical testing; the reported concordance figures should therefore be interpreted as exploratory rather than confirmatory.
- Colposcopic impression itself is known to have only moderate interobserver reproducibility even when standardized scoring systems are used [17], which may have contributed some variability to the colposcopic findings recorded in this study.
- HPV status was not assessed, precluding evaluation of its influence on the observed cytological–colposcopic–histopathological correlations.

Future Research

Larger, multicentric studies with formal sample size calculation and prospective documentation of participant flow would help confirm these findings and support their generalizability. A recent systematic review commissioned to inform Canadian cervical screening guidelines highlighted persistent uncertainty regarding the comparative harms and benefits of different triage strategies following abnormal cytology, reinforcing the need for context-specific evidence of this kind [18]. Future work incorporating high-risk HPV testing alongside cytological, colposcopic, and histopathological evaluation could help define which women with inflammatory cytology derive genuine benefit from colposcopic referral, supporting the development of evidence-based, risk-stratified referral algorithms.

CONCLUSION

In this cohort of women with inflammatory cervical cytology, colposcopic and histopathological findings were predominantly benign, with chronic cervicitis, cervical ectopy, and squamous metaplasia as the most frequent observations and no cervical intraepithelial neoplasia or invasive carcinoma identified. These findings support a conservative, reassurance-oriented approach to the management of women presenting with isolated inflammatory Pap smear reports.

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