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Original Research Article

Pattern of Cervical Pap Smear Cytology in a Tertiary Care Hospital in Eastern India

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Abstract

Background: Cervical cancer remains a major preventable malignancy in India, and cytology-based screening continues to be clinically relevant in resource-constrained tertiary-care settings.

Aim: To evaluate the pattern of cervical Pap smear cytology among women attending a tertiary care hospital in Eastern India.

Methods: This hospital-based observational study included 70 women who underwent conventional Pap smear examination at Jawaharlal Nehru Medical College, Bhagalpur, Bihar, India, from 10 May 2025 to 15 April 2026. Smears were collected from the ectocervix and endocervix, stained by the Papanicolaou method, and reported according to the 2014 Bethesda System. Descriptive statistics were used to summarize age distribution, presenting symptoms, adequacy, inflammatory changes, and epithelial cell abnormalities.

Results: The mean age was 43.6 +/- 10.8 years, with the largest proportion in the 41-50-year age group (32.9%). Overall, 66 smears (94.3%) were satisfactory and 4 (5.7%) were unsatisfactory. Negative for intraepithelial lesion or malignancy (NILM) constituted 45 cases (64.3%), including inflammatory/reactive smears in 39 (55.7%) and atrophic smears in 6 (8.6%). Epithelial cell abnormalities were detected in 21 cases (30.0%): ASC-US 7 (10.0%), LSIL 8 (11.4%), HSIL 4 (5.7%), atypical glandular cells 1 (1.4%), and squamous cell carcinoma 1 (1.4%). White discharge was the commonest indication (37.1%).

Conclusion: Pap smear cytology in this Eastern Indian tertiary-care cohort showed a predominance of inflammatory NILM smears, with a clinically meaningful burden of epithelial cell abnormalities. Structured cytology reporting, repeat sampling of unsatisfactory smears, and linkage of abnormal results to colposcopy and biopsy are essential for an effective cervical cancer prevention pathway.

Keywords: Pap smear; cervical cytology; Bethesda System; cervical cancer screening; epithelial cell abnormality; Bihar; Eastern India.

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Introduction

Cervical cancer is one of the most preventable yet persistently burdensome malignancies among women, particularly in low- and middle-income countries where organized screening remains uneven. Global estimates continue to place cancer of the cervix among the leading cancers in women, and India contributes a substantial share of the global incidence and mortality burden [1,2]. The biological basis for prevention is well established: persistent infection with oncogenic human papillomavirus (HPV), especially HPV 16 and 18, is the central causal pathway for cervical intraepithelial neoplasia and invasive carcinoma [3,4]. Because the pre-invasive phase is usually long and clinically silent, screening offers an opportunity to identify women before progression to cancer. The World Health Organization recommends HPV DNA testing as the preferred primary screening method where feasible, while acknowledging that cytology and visual inspection remain relevant in programmes that have not yet fully transitioned to HPV-based testing [5,6]. In India, where health systems range from urban tertiary centres to rural and semi-urban public hospitals, conventional Pap smear cytology remains an affordable, familiar, and widely deployable screening method. The Papanicolaou smear has historical importance in reducing cervical cancer incidence in countries with organized screening, and it remains valuable in opportunistic hospital-

based screening because it can identify inflammatory, infective, premalignant, and malignant patterns in the same specimen [7]. Standardized reporting is essential for reproducibility and clinical action. The Bethesda System provides a uniform framework for specimen adequacy, general categorization, interpretation of squamous and glandular abnormalities, and clinically meaningful recommendations [8,9]. It separates negative for intraepithelial lesion or malignancy (NILM) from epithelial cell abnormalities such as atypical squamous cells of undetermined significance (ASC-US), low-grade squamous intraepithelial lesion (LSIL), high-grade squamous intraepithelial lesion (HSIL), atypical glandular cells (AGC), and malignancy. This terminology enables clinicians to triage women to repeat cytology, HPV testing, colposcopy, biopsy, or oncologic referral according to risk.

Hospital-based Pap smear studies from India consistently report that a large proportion of smears are inflammatory or reactive, while epithelial cell abnormalities constitute a smaller but clinically important subset [10-14]. Such patterns are shaped by age, parity, genital hygiene, reproductive tract infections, menopausal status, sexual and obstetric history, and the fact that many women present for screening only when symptomatic. In rural and semi-urban Eastern India, including Bihar, several barriers amplify late presentation: low awareness, social stigma around gynecological symptoms, limited routine screening behaviour, travel constraints, and inadequate follow-up after an abnormal screening test. Consequently, even small institutional cytology audits are useful because they reveal the local burden of treatable infections, premalignant lesions, unsatisfactory sampling, and high-risk cytological categories requiring urgent linkage to care.

The present study was undertaken at Jawaharlal Nehru Medical College, Bhagalpur, Bihar, a tertiary care institution serving a mixed urban, peri-urban, and rural population. The objective was to evaluate the pattern of cervical Pap smear cytology in women attending the gynecology and pathology services over an 11-month period. The study emphasizes Bethesda-based reporting, age-wise distribution, clinical indications, smear adequacy, and the proportion of epithelial cell abnormalities. By describing a realistic hospital-based cytology profile from Eastern India, the study aims to support quality improvement in cervical screening, strengthen follow-up pathways for abnormal smears, and provide locally relevant evidence for clinicians, pathologists, and public health planners.

Materials and Methods

This hospital-based observational descriptive study was conducted in the Department of Pathology in collaboration with the Department of Obstetrics and Gynecology, Jawaharlal Nehru Medical College, Bhagalpur, Bihar, India, from 10 May 2025 to 15 April 2026. A total of 70 women who attended the gynecology outpatient department and underwent cervical Pap smear examination during the study period were included. Women presenting for routine screening as well as those with symptoms such as vaginal discharge, lower abdominal pain, pruritus, post-coital bleeding, intermenstrual bleeding, or post-menopausal bleeding were eligible. Women with a known treated cervical malignancy, previous hysterectomy, active heavy menstrual bleeding at the time of sampling, or inadequate clinical information were excluded.

After explaining the procedure and obtaining consent as per institutional practice, women were placed in the lithotomy position and the cervix was visualized using a sterile Cusco speculum without lubricant. Samples were obtained from the ectocervix and transformation zone using an Ayre spatula and, where indicated, from the endocervical canal using a cytobrush. Smears were immediately fixed in 95% ethyl alcohol and stained by the conventional Papanicolaou technique. Each smear was examined by trained pathology personnel and reported according to the 2014 Bethesda System for Reporting Cervical Cytology. Smear adequacy, inflammatory background, organism-associated cytopathic changes where identifiable, atrophic changes, squamous epithelial cell abnormalities, glandular abnormalities, and malignant cells were recorded.

Data were entered into a structured spreadsheet and checked for consistency. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequencies and percentages. Cytological findings were grouped into NILM/benign, epithelial cell abnormality, and unsatisfactory categories. Age-wise and symptom-wise distributions were analyzed descriptively. Because the study was designed as a cytology pattern audit rather than an intervention trial, no formal hypothesis testing was planned; however, proportions were calculated to one decimal place to facilitate comparison with published literature.

Results

Seventy women were included in the final analysis. The age ranged from 22 to 68 years, with a mean age of 43.6 +/- 10.8 years. The largest age group was 41-50 years (23/70, 32.9%), followed by 31-40 years (18/70, 25.7%). White discharge was the commonest clinical indication for Pap smear

examination (26/70, 37.1%), followed by lower abdominal pain (14/70, 20.0%) and routine screening without symptoms (11/70, 15.7%). Overall, 66 smears (94.3%) were satisfactory for evaluation and 4 smears (5.7%) were unsatisfactory due to obscuring inflammation, hemorrhage, or low squamous cellularity. NILM/benign cytology was reported in 45 cases (64.3%), including 39 inflammatory/reactive smears and 6 atrophic smears. Epithelial cell abnormalities were identified in 21 cases (30.0%). Among these, ASC-US was observed in 7 cases (10.0%), LSIL in 8 cases (11.4%), HSIL in 4 cases (5.7%), AGC in 1 case (1.4%), and squamous cell carcinoma in 1 case (1.4%). The proportion of epithelial cell abnormalities was higher in women above 50 years, largely due to HSIL, AGC, and malignant cytology categories. The findings are summarized in Tables 1-3 and Figures 1-2.

Table 1: Age-wise distribution and broad cytology categories among women undergoing Pap smear examination (n=70)

Age group (years)	N	%	NILM/benign	Epithelial cell abnormality	Unsatisfactory
21-30	9	12.9	7	1	1
31-40	18	25.7	14	3	1
41-50	23	32.9	19	4	0
51-60	14	20.0	12	2	0
>60	6	8.6	3	4	0

Table 2: Bethesda cytology pattern and recommended clinical action (n=70)

Bethesda category	n	%	Recommended clinical action/follow-up
NILM - inflammatory/reactive	39	55.7	Treat infection/inflammation if symptomatic; routine screening as per age and risk
NILM – atrophic	6	8.6	Correlate with menopausal status; consider repeat smear after estrogen therapy if clinically indicated
ASC-US	7	10.0	Repeat cytology/HPV triage or colposcopy according to local protocol and risk factors
LSIL	8	11.4	Colposcopy or HPV-based triage; ensure follow-up and counselling
HSIL	4	5.7	Urgent colposcopy-directed biopsy and histopathological confirmation
AGC	1	1.4	Colposcopy, endocervical evaluation and histopathological correlation
Squamous cell carcinoma	1	1.4	Immediate gynecologic oncology referral and tissue diagnosis
Unsatisfactory	4	5.7	Repeat smear after correction of sampling/inflammatory factors

Table 3: Clinical indication and dominant cytology pattern (n=70)

Clinical indication/symptom	n	%	Most frequent cytology pattern
Routine screening/asymptomatic	11	15.7	NILM/reactive changes
White discharge	26	37.1	Inflammatory NILM with infective background
Lower abdominal pain	14	20.0	Inflammatory/reactive NILM
Post-coital/intermenstrual bleeding	9	12.9	ASC-US/LSIL enriched subgroup
Post-menopausal bleeding	5	7.1	Atrophy, HSIL or malignancy to be excluded
Pruritus/dyspareunia	5	7.1	Inflammatory smear with candidal/trichomonal clue where present

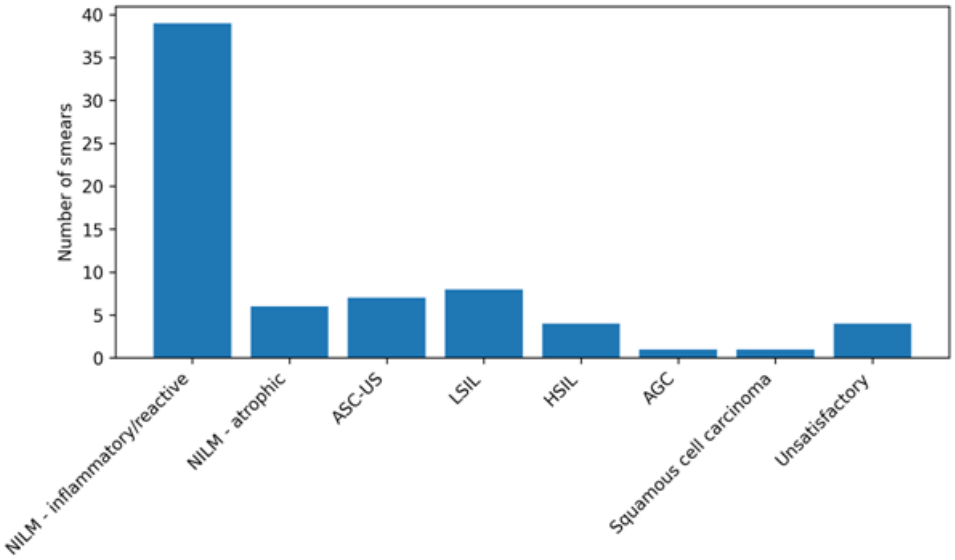

Figure 1: Distribution of Pap smear cytology categories (n=70)

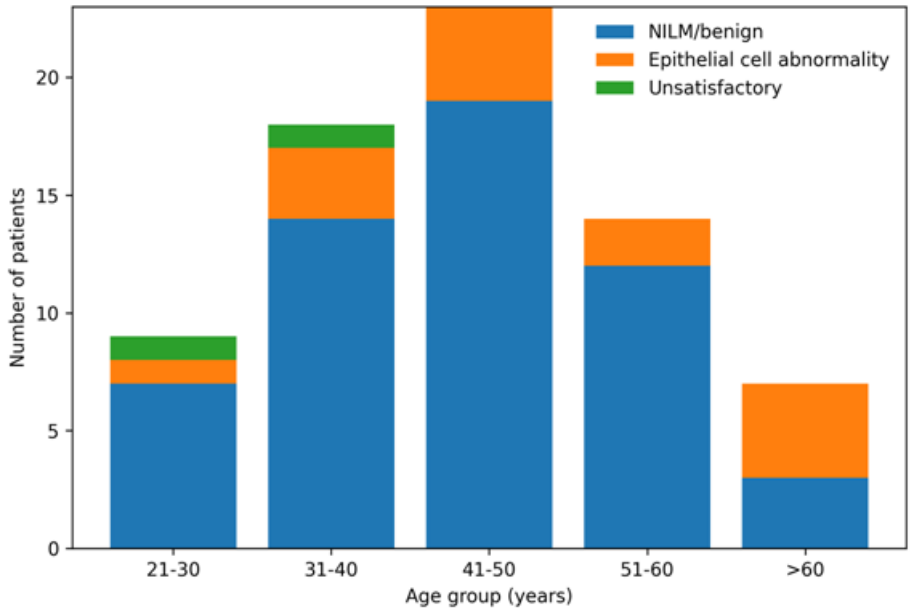

Figure 2: Age-wise distribution of broad cytology pattern

Discussion

The present study demonstrates that cervical Pap smear cytology in a tertiary care hospital in Eastern India is dominated by NILM smears with inflammatory or reactive changes, while a smaller but important proportion of women show epithelial cell abnormalities requiring structured follow-up. In this cohort of 70 women, 64.3% of smears were categorized as NILM/benign, 30.0% showed epithelial cell abnormalities, and 5.7% were unsatisfactory. The predominance of inflammatory NILM smears is consistent with several Indian hospital-based studies, where women frequently undergo Pap testing because of discharge, pelvic pain, or other symptoms rather than through organized population screening [10-14]. Inflammation in a Pap smear is non-specific, but in clinical practice it is important because it may reflect bacterial vaginosis, candidiasis, trichomoniasis, cervicitis, poor genital hygiene, or reactive epithelial changes that can obscure cytological interpretation. Therefore, treatment of symptomatic infection and repeat sampling when inflammation is heavy are important components of cytology quality.

The epithelial cell abnormality rate in the present study was 30.0%, which is higher than many large opportunistic screening series but may be explained by referral bias, small sample size, and inclusion of symptomatic women in a tertiary-care setting. Verma et al. reported the utility of Bethesda-based cytology in a North Indian population and emphasized that ASC-US and LSIL form a substantial proportion of abnormal smears, while HSIL and malignancy represent smaller but high-priority categories [10]. Similar Indian studies from

tertiary hospitals have shown that ASC-US and LSIL are usually the commonest abnormalities, whereas HSIL and carcinoma are less frequent but clinically decisive because they require colposcopy-directed biopsy and timely treatment [11-14]. Our distribution mirrors this pattern: LSIL (11.4%) and ASC-US (10.0%) were the most frequent epithelial abnormalities, followed by HSIL (5.7%), AGC (1.4%), and squamous cell carcinoma (1.4%).

Age-wise analysis showed that most women screened were between 31 and 50 years, reflecting the age at which reproductive tract symptoms and opportunistic screening commonly intersect in outpatient practice. However, the concentration of more serious abnormalities among older women is noteworthy. Cervical carcinogenesis is typically a multistep process, and persistent high-risk HPV infection may progress over years from low-grade lesions to high-grade precancer and invasive carcinoma [3,4]. Thus, detection of HSIL, AGC, and malignant cells in women over 50 years in this study reinforces the need for not excluding peri-menopausal and post-menopausal women from screening. Atrophic cytology in older women may also complicate interpretation and repeat sampling after treatment of atrophy may be necessary when cytological atypia is equivocal.

The unsatisfactory smear rate of 5.7% in the present study is acceptable for a conventional cytology service but still represents preventable loss of screening opportunity. The Bethesda System requires explicit reporting of adequacy because unsatisfactory smears do not reliably exclude disease [8,9]. Common reasons include scant cellularity, blood, air-drying artefact, thick smearing, or obscuring inflammatory exudate. Quality improvement measures such as proper visualization of the cervix, sampling of the transformation zone, immediate fixation, avoidance of sampling during active bleeding, and periodic feedback to smear takers can reduce the unsatisfactory rate.

From a public health perspective, the findings should be interpreted in the context of evolving global and Indian cervical cancer prevention strategies. WHO now recommends HPV DNA testing as the preferred primary screening approach, while existing cytology programmes may continue until HPV testing is operational [5,6]. In India, implementation is heterogeneous, and conventional Pap smear remains a practical tool in many tertiary and district-level facilities. The clinical value of Pap cytology is maximized when abnormal results are not treated as isolated laboratory findings but are embedded in a pathway that includes counselling, documentation, recall, colposcopy, biopsy, treatment of precancer, and surveillance. For a tertiary hospital serving Bihar and adjoining Eastern Indian regions, a Bethesda-based cytology audit can identify both disease burden and process gaps, particularly inadequate sampling and follow-up attrition.

The strengths of this study include use of Bethesda terminology, inclusion of clinical indications, and age-wise categorization relevant to local service planning. Limitations include the modest sample size, hospital-based design, absence of HPV testing, and lack of systematic histopathological correlation for all abnormal smears. Therefore, the findings should not be interpreted as community prevalence. Nevertheless, they provide a useful institutional snapshot and support the need for larger prospective studies integrating HPV testing, colposcopy, biopsy correlation, and follow-up outcomes.

Conclusion

In this tertiary-care cohort from Bhagalpur, Bihar, Pap smear cytology showed a predominance of inflammatory NILM smears, with epithelial cell abnormalities detected in nearly one-third of screened women. LSIL and ASC-US were the commonest abnormalities, while HSIL, AGC, and malignant cytology occurred in a smaller but clinically significant subset. The study highlights the continuing relevance of Pap smear screening in Eastern India and underscores the need for quality sampling, Bethesda-based reporting, repeat testing of unsatisfactory smears, and assured linkage of abnormal cytology to colposcopy and histopathology.

Declarations

Ethics approval: The study was conducted as an observational cytology audit using routine hospital diagnostic records. Formal ethics approval may be obtained or waived according to institutional policy before journal submission.

Consent: Written informed consent for Pap smear examination was obtained as per routine clinical practice. Patient identifiers were not included in the analysis.

Conflicts of interest: None declared.

Funding: No external funding was received.

Data availability: De-identified summary data are included within the article tables.

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