

Prevalence and characteristics of abnormal Papanicolaou smear: An observational study from a tertiary care center of Tripura

Dr. Satadip Deb Roy^{1*}, Dr. Maharshi Debnath² and Dr. Kaberi Debbarma³

¹Assistant Professor, Department of Obstetrics and Gynecology, Tripura Medical College & Dr. BRAM teaching Hospital, Agartala, Tripura, India, 799014

²Assistant Professor, Department of Pathology, Tripura Medical College & Dr. BRAM teaching Hospital, Agartala, Tripura, India, 799014

³Assistant Professor, Department of Obstetrics and Gynecology, Tripura Medical College & Dr. BRAM teaching Hospital, Agartala, Tripura, India, 799014

*Corresponding Author: Dr. Satadip Deb Roy, Assistant Professor, Department of Obstetrics and Gynecology, Tripura Medical College & Dr. BRAM teaching Hospital, Agartala, Tripura, India, 799014
E-mail: satadip1591@gmail.com

Received: 14th June, 2026; Revised: 20th July 2026; Accepted: 20th August, 2026; Available Online: 05th September 2026

ABSTRACT

Background: Cervical cancer remains an important public health concern, and cervical cytology continues to have an important role in screening and detection of precancerous and malignant lesions. This study evaluated the pattern of PAP smear cytological findings in women attending a tertiary care centre in Tripura.

Methods: A descriptive observational study was conducted in collaboration with the Departments of Obstetrics and Gynecology and Pathology at Tripura Medical College. Both retrospective and prospective PAP smear records were included. Cytological findings were reported according to The Bethesda System for Reporting Cervical Cytology. Data were analyzed using IBM SPSS Statistics version 26.0. Categorical variables were summarized as frequencies and percentages, and associations were assessed using the chi-square test.

Results: A total of 760 PAP smear specimens were evaluated. The mean age of the women was 43.74 ± 12.08 years. Most specimens, 698 (91.8%), were reported as negative for intraepithelial lesion or malignancy (NILM), while 62 (8.2%) demonstrated abnormal cytology. Atypical squamous cells of undetermined significance (ASC-US) were the most frequent abnormality (18, 2.4%), followed by low-grade squamous intraepithelial lesion (LSIL) (11, 1.4%) and squamous cell carcinoma (SCC) (8, 1.1%). Abnormal cytology was significantly associated with age ($\chi^2=33.842$, $p<0.001$) and presenting symptoms ($\chi^2=27.911$, $p<0.001$). The proportion of abnormal cytology increased from 0% among women aged <30 years to 22.9% among those aged ≥ 60 years.

Conclusion: Most PAP smears showed NILM, although a clinically important proportion demonstrated epithelial abnormalities. The increasing frequency of abnormal cytology with advancing age and its association with presenting symptoms emphasize the importance of timely cervical cytological screening and appropriate evaluation of women with suspicious symptoms.

Keywords: papanicolaou test, cervical intraepithelial neoplasia, mass screening, vaginal discharge

How to cite this article: Deb Roy S, Debnath M, Debbarma K, Prevalence and characteristics of abnormal Papanicolaou smear: An observational study from a tertiary care center of Tripura. Int J Drug Deliv Technol. 2026; 16(7): 1619-1625. DOI: 10.25258/ijddt.16.7.177

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Cervical cancer remains a major public health challenge and is one of the leading causes of cancer-related morbidity and mortality among women worldwide. Globally, it ranks as the fourth most common cancer in women, with an estimated 660,000 new cases and approximately 350,000 deaths reported in 2022.^{1,2} Despite being largely preventable through effective screening and early treatment, the disease continues to impose a

substantial burden, particularly in low- and middle-income countries. India accounts for a significant proportion of the global cervical cancer burden. Current estimates suggest that around 123,907 women are newly diagnosed each year, with approximately 77,348 deaths annually. Cervical cancer is the second most common cancer among Indian women overall and among women aged 15–44 years.³ Data from the Indian Council of Medical Research indicate a considerable regional variation in disease

*Author for Correspondence: satadip1591@gmail.com

burden; in Tripura, the reported prevalence of cervical cancer is 16.2%, with higher prevalence in urban areas (21.1%) compared with rural areas (14.3%).⁴ Cervical cancer screening coverage in India remains alarmingly low. Nationally, only about 1.9% of women have ever undergone cervical cancer screening, and in Tripura this figure is even lower, at approximately 0.7%. This low uptake substantially limits opportunities for early detection and prevention, contributing to late presentation and poor outcomes.^{5,6}

The natural history of cervical cancer is characterized by a prolonged pre-invasive phase, during which well-defined premalignant lesions can be detected before progression to invasive disease. The primary objective of cervical cancer screening is to identify and treat these precancerous lesions at an early stage. Evidence from developed countries demonstrates that organized screening and timely treatment can prevent up to 80% of cervical cancers. Since its introduction, the Papanicolaou (PAP) smear has been a cornerstone of cervical cancer screening and remains a widely used, cost-effective method for detecting cytological abnormalities of the cervix. Identification of abnormal Pap smear findings enables appropriate follow-up and intervention, although accurate interpretation requires trained personnel and laboratory infrastructure. In routine clinical practice, women presenting with symptoms suggestive of cervical pathology are commonly screened using Pap smear cytology.^{7,8}

While several studies from different regions of India have described the pattern of Pap smear abnormalities among symptomatic women, data from the north-eastern states, including Tripura, are limited and largely outdated.^{9–13} Tripura, a small north-eastern state of India with a population of approximately 3.67 million, has particularly low screening uptake and a paucity of recent epidemiological data on cervical cytological abnormalities.^{6,14} In this context, the present study was undertaken to assess the prevalence and characteristics of abnormal Papanicolaou smear findings among women attending a tertiary care centre in Tripura, with the aim of generating region-specific evidence to inform cervical cancer screening and prevention strategies.

MATERIAL AND METHODS

Study design and setting

This descriptive observational study was conducted in collaboration between the Departments of Obstetrics and Gynecology and Pathology at Tripura Medical College, a tertiary care teaching hospital in Tripura, India.

Study period

The study was conducted over a six-month prospective period following approval from the Institutional Ethics Committee (IEC). Both retrospective and prospective data were included. Retrospective data were obtained from the departmental registers of the Departments of Obstetrics and Gynecology and Pathology from January 2023 until the date of IEC approval. Subsequently, prospective data

were collected for six months from March to August following IEC approval. Data pertaining to all women who underwent PAP smear examination during the study period were retrieved from the relevant departmental records and registers.

Sample size

Sample size was calculated using $n = Z^2pq/d^2$, where $p = 91.2\%$, prevalence of abnormal pap smears.¹² With a 95% confidence interval and 5% precision, the minimum required sample size was 123.3. Rounding off the value and adding 10% non-response/missing data the final sample size was 137. However, as universal sampling was employed, all eligible PAP smear records available during the study period were included in the analysis.

Inclusion & Exclusion criteria

For the retrospective component, all available PAP smear records from January 2023 to the date of Institutional Ethics Committee approval were eligible for inclusion. Duplicate records and records with insufficient information for analysis were excluded.

For the prospective component, females aged more than 18 years presenting with complaints of leucorrhea, dyspareunia, intermenstrual bleeding, or postcoital bleeding were eligible for inclusion after providing written informed consent. Women who declined participation or did not provide informed consent were excluded. Specimens that were inadequate for cytological evaluation and those obtained from participants who had received chemotherapy were also excluded from the study.

Data collection & analysis

Data were collected using a structured data abstraction sheet that included relevant sociodemographic characteristics, clinical information, and PAP smear cytological findings. The data were entered into Microsoft Excel and subsequently imported into IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA) for statistical analysis. Cervical cytology was reported according to The Bethesda System for Reporting Cervical Cytology, using standardized categories for cervical epithelial abnormalities. Findings were classified as negative for intraepithelial lesion or malignancy (NILM) or as epithelial abnormalities. Continuous variables were summarized using mean $\pm$ standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Pearson chi-square test and a p -value < 0.05 was considered statistically significant.

Ethical considerations

The study received approval from the Institutional Ethics Committee of Tripura Medical College before initiation of data collection. Written informed consent was obtained from all participants enrolled prospectively. For the retrospective component, data were extracted from existing departmental records and anonymized for analysis. Clinical management was provided according to standard guidelines irrespective of study participation.

RESULT

A total of 760 PAP smear specimens were evaluated during the study period, comprising 254 specimens in 2023, 135 in 2024, 205 in 2025, and 166 in 2026. The

mean age of participants were 43.74 ± 12.08 years, ranging from 17–95 years and the largest proportion of women belonged to the 30–44-year age group (45.0%) (*Table 1*).

Table 1: Distribution of study participants by age

Age group (years)	Frequency	Percentage
<30	80	10.5
30–44	342	45
45–59	255	33.6
≥ 60	83	10.9
Total	760	100

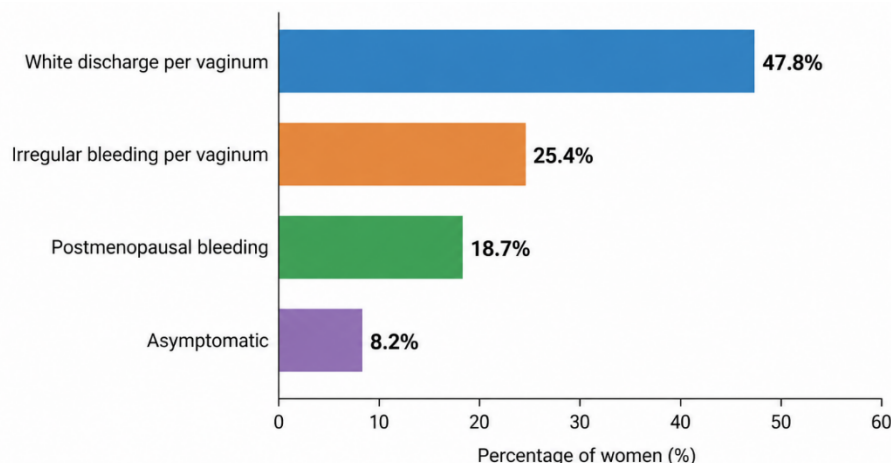
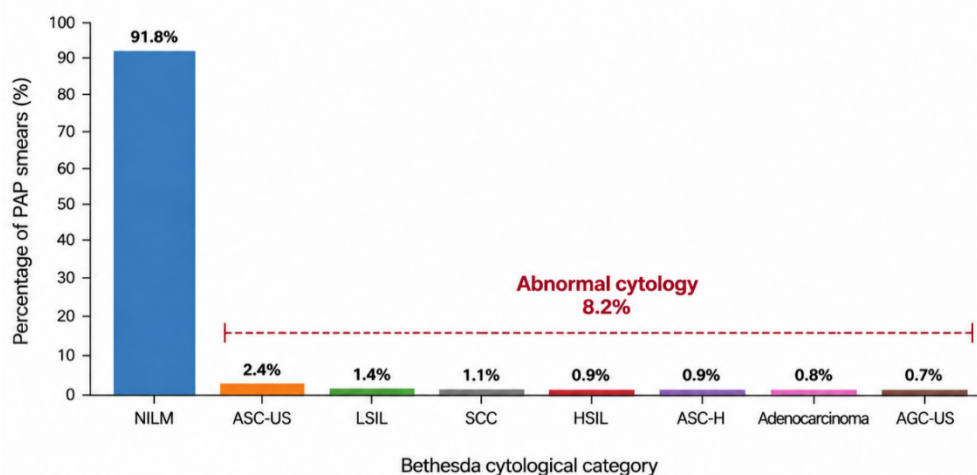


Figure 1: Distribution of presenting symptoms/complaints among participants

White discharge per vaginam was the most frequently reported complaint, occurring in 363 (47.8%) women. Irregular bleeding per vaginam was reported in 193 (25.4%), while 142 (18.7%) women presented with

postmenopausal bleeding. A total of 62 (8.2%) women were asymptomatic at the time of PAP smear examination (*Figure 1*).



NILM = Negative for intraepithelial lesion or malignancy; ASC-US = atypical squamous cells of undetermined significance; LSIL = low-grade squamous intraepithelial lesion; SCC = squamous cell carcinoma; HSIL = high-grade squamous intraepithelial lesion; ASC-H = atypical squamous cells, cannot exclude HSIL; Adenocarcinoma = adenocarcinoma; AGC-US = atypical glandular cells of undetermined significance.

Figure 2: Distribution of cytological findings (n=760)

Among the 760 PAP smear specimens evaluated, 698 (91.8%) were reported as negative for intraepithelial lesion or malignancy (NILM), whereas 62 (8.2%) demonstrated cytological abnormalities. Among the abnormal

cytological findings, atypical squamous cells of undetermined significance (ASC-US) were the most frequent (18/760, 2.4%), followed by low-grade squamous intraepithelial lesion (LSIL) (11/760, 1.4%) and squamous

cell carcinoma (SCC) in 8 (1.1%) cases. Atypical squamous cells, cannot exclude high-grade squamous intraepithelial lesion (ASC-H) and high-grade squamous intraepithelial lesion (HSIL) were each reported in 7

(0.9%) cases. Adenocarcinoma was identified in 6 (0.8%) cases, while atypical glandular cells of undetermined significance (AGC-US) were observed in 5 (0.7%) cases (**Figure 2**).

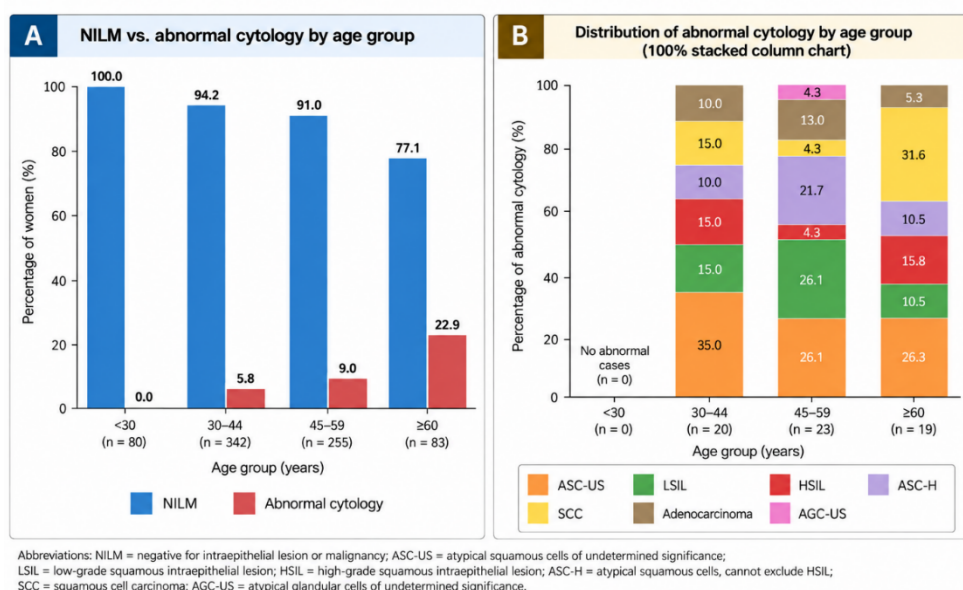


Figure 3: Distribution of cytological findings by age-group (n=760)

As shown in **Figure 3**, the proportion of abnormal PAP smear cytology demonstrated an increasing pattern with advancing age, from no abnormal findings among women aged <30 years to 5.8%, 9.0%, and 22.9% among those aged 30–44, 45–59, and ≥60 years, respectively. Among women with abnormal cytology, the distribution of Bethesda categories varied across age groups, with ASC-US and LSIL contributing substantially to abnormalities in the younger age groups, whereas SCC constituted the largest proportion of abnormal findings among women aged ≥60 years.

Among the non-neoplastic and infective findings reported on PAP smear which were mutually inclusive, inflammatory changes were documented in 145 (19.1%) specimens, while bacterial vaginosis was detected in 89 (11.7%) and atrophic changes in 72 (9.5%). Candida/fungal elements and Trichomonas were reported in 10 (1.3%) and 11 (1.4%) specimens, respectively (**Figure 4**).

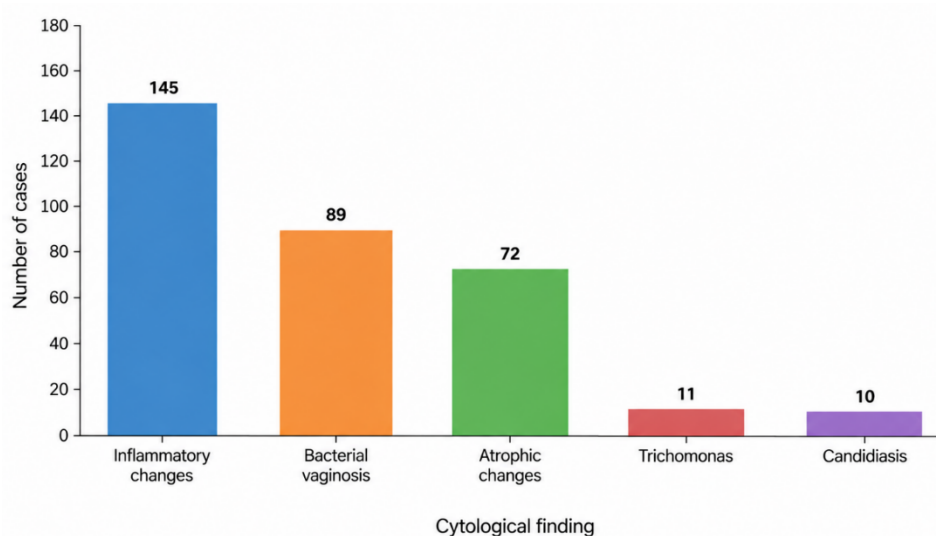


Figure 4: Distribution of additional findings (*mutually inclusive*)

Abnormal PAP smear cytology was significantly associated with both age group and presenting symptoms (**Table 2**). The proportion of abnormal cytology increased

progressively with age, from 0% among women aged <30 years to 5.8%, 9.0%, and 22.9% among those aged 30–44, 45–59, and ≥60 years, respectively ($\chi^2 = 33.842$, $df = 3$; p

< 0.001). Similarly, abnormal cytology varied significantly by presenting symptom, with the proportion being 19.0% among women presenting with postmenopausal bleeding, compared with 6.7% among those with irregular bleeding

per vaginum, 5.2% among those with white discharge per vaginum, and 4.8% among asymptomatic women ($\chi^2 = 27.911$, $df = 3$; $p < 0.001$) (Table 2).

Table 2: Association of age group and presenting symptoms with abnormal PAP smear cytology

Characteristic	Normal cytology	Abnormal cytology	χ^2 (df)	p-value
Age group (years)				
<30	80 (100.0)	0 (0.0)	33.842 (3)	<0.001*
30–44	322 (94.2)	20 (5.8)		
45–59	232 (91.0)	23 (9.0)		
≥60	64 (77.1)	19 (22.9)		
Presenting symptom				
Asymptomatic	59 (95.2)	3 (4.8)	27.911 (3)	<0.001*
Irregular bleeding per vaginum	180 (93.3)	13 (6.7)		
Postmenopausal bleeding	115 (81.0)	27 (19.0)		
White discharge per vaginum	344 (94.8)	19 (5.2)		

Values represent n (%), *Statistically significant

DISCUSSION

The present study evaluated 760 PAP smear specimens from women attending a tertiary care centre in Tripura and identified cytological abnormalities in 62 (8.2%) cases. The predominance of NILM findings (91.8%) indicates that most smears did not show epithelial abnormality, while the abnormalities included ASC-US, LSIL, HSIL, ASC-H, glandular abnormalities, adenocarcinoma, and SCC. The large sample provides a contemporary description of cervical cytology in a setting where recent regional data remain limited.

The overall proportion of abnormal cytology was lower than that reported in several earlier hospital-based studies from Tripura. Khasnabish et al., in a five-year study of 1,349 women at the same tertiary-care institution, reported 639 abnormal smears, although 184 specimens were inadequate; LSIL, SCC and ASC-US were reported in 8.37%, 5.2%, and 1.11% of all cases, respectively.¹³ Majumder and Chakma, studying 600 smears from the same institution during 2018–2020, reported abnormal findings in 91.2% of specimens, with inflammatory changes accounting for 50.7%, HSIL 5.2%, and SCC 2.3%.¹² These differences should not be interpreted as evidence of a temporal decline because the study populations and reporting structures differed substantially. The earlier studies included women selected for gynecological complaints and therefore are not directly comparable with the broader contemporary hospital population in the present study.

The distribution of individual epithelial abnormalities was broadly comparable with more recent data from other Indian tertiary-care settings. In a study from AIIMS Kalyani involving 2,133 women, NILM accounted for 93.24% of smears, while ASC-US, LSIL, HSIL and ASC-H were reported in 2.06%, 0.52%, 0.23% and 0.14%, respectively.¹⁵ The present study showed a higher frequency of LSIL (1.4%) and HSIL (0.9%), while ASC-US was similar at 2.4%. A study among symptomatic

women in a secondary-care hospital in northern India reported epithelial abnormalities in 4.2%, including ASC-US in 0.8% and HSIL in 0.3%.¹⁰ Other Indian hospital-based studies have also demonstrated substantial heterogeneity in cytological patterns; Divya et al. reported inflammatory changes in 56.4% and ASC-US, AGC-US and HSIL in 11.9%, 9.4% and 2.4%, respectively, while Agrawal et al. reported inflammatory changes in 146 of 240 smears, with ASC-US, LSIL, HSIL and SCC in 5, 6, 2 and 1 cases, respectively.^{9,16} Such variation may reflect differences in age structure, symptom profile, referral patterns, screening practices, cytological preparation, and the proportion of women undergoing screening because of symptoms rather than through population-based programs.

Age was an important correlate of abnormal cytology. Abnormal findings increased from 0% in women aged <30 years to 5.8% in those aged 30–44 years, 9.0% in those aged 45–59 years, and 22.9% among women aged ≥60 years ($\chi^2=33.842$, $p<0.001$). This pattern is consistent with the epidemiology of persistent HPV-related cervical disease, in which precancerous and invasive lesions may become more apparent with increasing age. The earlier Tripura study by Khasnabish et al. similarly reported LSIL predominantly in the fifth and sixth decades, HSIL across the fourth to seventh decades, and SCC mainly in the sixth and seventh decades.¹³ In the present study, SCC constituted a substantial proportion of abnormal findings among women aged ≥60 years, supporting continued attention to cervical abnormalities in older women.

Presenting symptoms were also significantly associated with abnormal cytology. Postmenopausal bleeding was associated with the highest proportion of abnormal smears (19.0%), compared with 6.7% among women with irregular bleeding, 5.2% among those with white discharge, and 4.8% among asymptomatic women ($\chi^2=27.911$, $p<0.001$). The predominance of white discharge in the study population is consistent with earlier Indian hospital-based observations; Khasnabish et al.

reported leucorrhea as their most frequent presenting complaint.¹³ In contrast, a dedicated screening study among 1,100 asymptomatic women in Mumbai reported a different overall cytological distribution, underscoring the influence of screening population and clinical selection on observed PAP smear patterns.¹⁷ These findings should be interpreted as associations rather than evidence that symptoms cause cytological abnormality, because symptomatic women attending a tertiary centre represent a clinically selected population.

Non-neoplastic findings were also frequent, particularly inflammatory changes (19.1%), bacterial vaginosis (11.7%), and atrophic changes (9.5%). This supports the continuing utility of cervical cytology for identifying accompanying inflammatory and infectious findings in routine gynecological practice. The frequency of inflammatory changes was considerably lower than the 50.7% reported by Majumder and Chakma, but differences between studies may reflect variation in case mix, diagnostic criteria, and recording of multiple cytological findings per smear.¹²

The findings should be interpreted in light of the hospital-based observational design. Referral and symptom-related selection may have influenced the observed prevalence, and the results cannot be directly extrapolated to the general female population of Tripura. Cytology alone also cannot establish histological grade or invasive disease; women with abnormal smears require appropriate follow-up, including repeat cytology, HPV testing, colposcopy, and biopsy where clinically indicated.¹⁸ Nevertheless, the present study provides contemporary regional evidence from 760 smears and demonstrates significant associations of abnormal cytology with increasing age and presenting symptoms. These findings support strengthening cervical screening and systematic follow-up pathways in tertiary-care settings, while population-based studies are needed to establish community-level prevalence.

LIMITATIONS

This study has several limitations. Its hospital-based observational design may have introduced selection and referral bias, limiting the generalizability of the findings to the wider community. As the study was conducted in a tertiary-care setting, women with symptoms or other clinical indications may have been overrepresented. In addition, PAP smear cytology is a screening and morphological assessment method and does not provide histopathological confirmation of cervical lesions; therefore, cytological abnormalities could not be correlated with biopsy findings or subsequent clinical outcomes. The retrospective component also limited the availability and completeness of some clinical and sociodemographic variables. Further prospective, community-based studies with histopathological correlation and longitudinal follow-up are warranted.

CONCLUSION

Most PAP smears were reported as negative for intraepithelial lesion or malignancy, while epithelial

abnormalities constituted a smaller but clinically important proportion of samples. Abnormal cytology showed a significant association with increasing age, particularly among women aged ≥ 60 years, and with presenting symptoms, with postmenopausal bleeding demonstrating a notably higher proportion of abnormal findings. The observed variation in cytological patterns across age groups highlights the importance of appropriate cervical cancer screening and timely evaluation of women with suspicious symptoms. These findings provide useful contemporary regional data and support continued strengthening of cervical cancer screening and follow-up services in tertiary-care settings.

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