International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Role of Cervical Pap Smear Screening in Detection of Epithelial Cell Abnormalities and Cervical Malignancy

Dr Dheerendra Kumar Patel[1], Dr Jyoti Shukla[2], Dr Sonaxi Jain[3]

[1]Senior Resident Department of Pathology, Bundelkhand Medical College, Sagar, Madhya Pradesh, India
[2]Department of Pathology, Bundelkhand Medical College, Sagar, Madhya Pradesh, India
[3]Senior Resident Department of Pathology, Ananta Institute of Medical Science and Research Center, Udaipur, Rajasthan, India

OPEN ACCESS

Corresponding Author:

Dr Sonaxi Jain
Senior Resident Department of Pathology, Ananta Institute of Medical Science and Research Center, Udaipur, Rajasthan, India
Email: Sonakshi46j@gmail.com

Received: 15-04-2026
Accepted: 08-05-2026
Available online: 12-06-2026

ABSTRACT

Background: Cervical cancer remains a major health concern among women, particularly in developing countries where delayed diagnosis contributes to increased morbidity and mortality. Cervical Pap smear screening plays an important role in identifying premalignant and malignant epithelial lesions at an early stage.
Aim: To evaluate the role of cervical Pap smear screening in the detection of epithelial cell abnormalities and cervical malignancy.
Materials and Methods: A hospital-based cross-sectional study was conducted among 300 sexually active women attending the gynaecology outpatient department of a tertiary care hospital. Cervical smears were collected using the standard Pap smear technique and interpreted according to the Bethesda System 2015. Demographic, clinical, and cervical examination findings were recorded. Data were analysed using SPSS software.
Results: Most participants were in the 31–40-year age group (34.7%) and were multiparous (62.0%). White vaginal discharge (36.0%) was the commonest presenting complaint, while cervical erosion (29.3%) was the predominant abnormal cervical finding. NILM and inflammatory smears constituted the majority of cytological findings. Epithelial cell abnormalities were detected in 17.3% of women, with ASC-US and LSIL being the commonest lesions. Significant associations were observed between epithelial abnormalities and age (χ^2=19.82, p=0.001) as well as cervical examination findings (χ^2=21.46, p=0.0002).
Conclusion: Pap smear screening demonstrated substantial utility in identifying cervical epithelial abnormalities and early malignancy, supporting its continued use as a cost-effective screening strategy for cervical cancer prevention and early management.

Keywords: *Cervical Pap Smear, Cervical Cancer Screening, Epithelial Cell Abnormalities, Cervical Malignancy, Cervical Cytology, Bethesda System.*

INTRODUCTION

Cervical cancer remains a major public health concern and is one of the most preventable malignancies affecting women worldwide. Despite advances in preventive healthcare, cervical cancer continues to contribute substantially to cancer-related morbidity and mortality, particularly in low- and middle-income countries where organised screening programmes are inadequate. Persistent infection with high-risk human papillomavirus (HPV), especially HPV-16 and HPV-18, is recognised as the principal etiological factor in the development of cervical intraepithelial neoplasia (CIN) and invasive cervical carcinoma. However, the progression from HPV infection to malignancy is generally slow, providing an important window for early detection and intervention through screening strategies.[1,2]

The Papanicolaou (Pap) smear, introduced by Georgios Papanicolaou, revolutionised cervical cancer prevention by enabling cytological examination of exfoliated cervical cells. This screening method facilitates the identification of epithelial cell abnormalities before progression to invasive disease. Cervical cytology can detect a spectrum of

abnormalities, ranging from atypical squamous cells and low-grade squamous intraepithelial lesions to high-grade lesions and frank malignancy.[3] The adoption of organised Pap smear screening programmes has been associated with marked reductions in cervical cancer incidence and mortality globally.[4]

Interpretation of cervical cytology has been standardised through the Bethesda System, which provides a uniform terminology for reporting epithelial cell abnormalities. This system enhances diagnostic consistency and clinical management by categorising lesions according to their malignant potential and guiding appropriate follow-up procedures.[5] Although HPV testing and co-testing strategies have gained prominence in recent years, conventional and liquid-based Pap smear screening continue to play an indispensable role, particularly in resource-limited settings where molecular diagnostics may not be readily accessible.[6]

Pap smear screening offers several advantages, including simplicity, cost-effectiveness, minimal invasiveness, and feasibility for large-scale population screening. Early recognition of epithelial abnormalities allows timely colposcopic evaluation and treatment of premalignant lesions, thereby interrupting progression to invasive carcinoma.[7] Nevertheless, factors such as inadequate sampling, interpretative variability, and false-negative results may affect diagnostic accuracy, necessitating quality assurance and periodic screening.[8]

Considering the continuing burden of cervical malignancy and the importance of early diagnosis, evaluating the role of cervical Pap smear screening in detecting epithelial cell abnormalities and cervical cancer remains clinically significant. Understanding its diagnostic utility may further strengthen screening policies and improve women's reproductive health outcomes.

METHODOLOGY

A hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynaecology in collaboration with the Department of Pathology at a tertiary care teaching hospital. The study was designed to evaluate the role of cervical Pap smear screening in detecting epithelial cell abnormalities and cervical malignancy among women attending the outpatient department. The study population comprised sexually active women attending the gynaecology outpatient department who underwent cervical cancer screening using Pap smear examination during the study period.

Prior to commencement of the study, approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from all participants after explaining the study's purpose and procedures. Confidentiality and anonymity of participant information were maintained throughout the study. A total of 300 women fulfilling the eligibility criteria were included in the study. Participants were enrolled using a convenience sampling technique until the required sample size was reached.

Inclusion Criteria

1. Sexually active women aged 21–65 years.
2. Women attending the gynaecology outpatient department and willing to undergo Pap smear screening.
3. Women who provided written informed consent for participation.

Exclusion Criteria

1. Pregnant women.
2. Women with active vaginal bleeding or menstruation at the time of examination.
3. Women previously diagnosed and treated for cervical carcinoma.
4. Women who had undergone hysterectomy.
5. Women unwilling to participate in the study.

Study Procedure and Data Collection

After obtaining informed consent, detailed demographic and clinical information was recorded using a structured proforma. Information regarding age, parity, marital status, socioeconomic status, presenting gynaecological complaints, age at marriage, contraceptive use, and relevant medical and sexual history was collected.

A general and gynaecological examination was performed in all participants. Cervical examination was carried out using a sterile Cusco's speculum to visualise the cervix and identify any gross abnormalities such as erosion, discharge, hypertrophy, ulceration, bleeding, or suspicious lesions.

Pap Smear Collection and Cytological Examination

Cervical samples were collected under aseptic precautions using Ayre's spatula and/or endocervical brush. The squamocolumnar junction and transformation zone were adequately sampled by gently rotating the spatula through 360 degrees over the ectocervix. The collected material was evenly spread onto clean glass slides and immediately fixed using 95% ethyl alcohol to prevent air-drying artefacts. The slides were transported to the pathology laboratory and stained using the conventional Papanicolaou staining technique. Adequacy of the smear and cytological findings was assessed by experienced cytopathologists.

Cytological Interpretation

Pap smear findings were interpreted and reported according to the Bethesda System for Reporting Cervical Cytology (2015). Smears were categorised as:

- Negative for intraepithelial lesion or malignancy (NILM)
- Inflammatory smear
- 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 other epithelial malignancies.

Women with abnormal cytological findings were advised to undergo further evaluation, including colposcopy and biopsy, where indicated.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were used to summarise demographic and clinical variables. Categorical variables were expressed as frequency and percentage. Associations between epithelial cell abnormalities and relevant clinical variables were analysed using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

The present hospital-based cross-sectional study included 300 women who underwent cervical Pap smear screening to detect epithelial cell abnormalities and cervical malignancy. Cytological findings were interpreted according to the Bethesda System (2015). Descriptive and inferential statistical analyses were performed to assess the association between demographic and cervical clinical findings with epithelial cell abnormalities.

Table 1. Demographic and Clinical Characteristics of Participants

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
21–30	70	23.3
31–40	104	34.7
41–50	82	27.3
>50	44	14.7
Parity		
Nulliparous	38	12.7
Primiparous	76	25.3
Multiparous	186	62.0
Presenting Symptoms		
White discharge	108	36.0
Lower abdominal pain	58	19.3
Irregular/postcoital bleeding	62	20.7
Asymptomatic	72	24.0
Per Speculum Findings		
Healthy cervix	126	42.0
Cervical erosion	88	29.3
Hypertrophy	36	12.0
Cervical inflammation/discharge	38	12.7
Suspicious lesion	12	4.0

Most women were in the 31–40-year age group (34.7%), and 62.0% were multiparous. White vaginal discharge represented the commonest presenting symptom (36.0%). Healthy cervix was observed in 42.0% women, whereas cervical erosion constituted the most frequent abnormal cervical finding (29.3%).

Table 2. Association of Pap Smear Findings with Age Group and Cervical Examination Findings

Variable	NILM / Inflammatory (n=248)	Epithelial Cell Abnormalities* (n=52)	χ^2	p-value
Age Group				
21–30 years	66	4	19.82	0.001*
31–40 years	92	12		
41–50 years	60	22		
>50 years	30	14		
Per Speculum Findings				

Healthy cervix	118	8	21.46	0.0002*
Cervical erosion	72	16		
Hypertrophy	28	8		
Cervical inflammation	22	16		
Suspicious lesion	8	4		

Distribution of epithelial abnormalities (n=52):

- ASC-US – 18 (6.0%)
- ASC-H – 4 (1.3%)
- LSIL – 14 (4.7%)
- HSIL – 10 (3.3%)

*Epithelial abnormalities included ASC-US, ASC-H, LSIL, HSIL and squamous cell carcinoma.

- Squamous cell carcinoma – 6 (2.0%)

Epithelial cell abnormalities were detected in 52 women (17.3%). A statistically significant association was observed between age group and epithelial abnormalities (χ^2=19.82, p=0.001), with higher prevalence noted among women aged 41 years and above. Cervical examination findings also demonstrated a significant association with abnormal cytology (χ^2=21.46, p=0.0002). Women with cervical inflammation, erosion, and suspicious lesions showed higher frequencies of epithelial abnormalities compared to those with healthy cervix.

Pap smear screening identified epithelial abnormalities in nearly one-fifth of screened women and demonstrated statistically significant associations with advancing age and abnormal cervical findings. These findings supported the diagnostic utility of cervical cytology in early identification of premalignant and malignant cervical lesions and reinforced the importance of routine cervical cancer screening.

DISCUSSION

The present study assessed cervical Pap smear screening among 300 women and found that most participants were in the 31–40-year age group, with multiparous women constituting the majority. Similar demographic trends have been reported in cervical screening studies, where middle-aged and multiparous women represent the predominant screened population owing to increased healthcare utilisation and cumulative exposure to cervical risk factors.[9,10] Cervical pathology is often influenced by reproductive and behavioural determinants, making screening particularly relevant in this age group.

White vaginal discharge was the most frequent presenting complaint in the present study, and cervical erosion emerged as the commonest abnormal per speculum finding. Comparable findings have been documented in previous cytological studies, where symptomatic women presenting with discharge and a clinically abnormal cervix showed higher rates of abnormal smears.[11,12] However, the presence of clinically normal cervix in several women with abnormal cytology in the present study highlighted the limitation of visual examination alone and emphasised the need for cytological screening. Most smears in the present study were categorised as NILM or inflammatory. This observation is consistent with earlier reports showing predominance of inflammatory and benign cytological patterns in hospital-based screening programmes.[13] Despite this, epithelial cell abnormalities were detected in 17.3% of women, indicating a meaningful burden of premalignant lesions.

ASC-US and LSIL were the most common epithelial abnormalities, whereas HSIL and squamous cell carcinoma were detected at smaller but clinically important proportions. Similar cytological distributions have been reported in previous hospital-based studies and reflect the natural progression of cervical epithelial alterations, where low-grade lesions outnumber invasive malignancies.[14] Importantly, the present study demonstrated statistically significant associations between epithelial abnormalities and advancing age and abnormal cervical findings. Comparable associations have been documented in screening guidelines and epidemiological studies, supporting the increased probability of persistent cervical lesions among older women and those with suspicious cervical changes.[15,16]

Overall, the findings supported Pap smear screening as a practical and valuable method for early recognition of cervical epithelial abnormalities and cervical malignancy.

CONCLUSION

Cervical Pap smear screening proved to be an effective and practical tool for the early detection of epithelial cell abnormalities and cervical malignancy. Significant associations were observed between abnormal cytology, advancing age, and abnormal cervical findings, supporting targeted screening among high-risk women. Routine Pap smear screening may contribute substantially to early diagnosis, timely intervention, and the reduction of the cervical cancer burden.

REFERENCES

1. Walboomers JM, Jacobs MV, Manos MM, Bosch FX, Kummer JA, Shah KV, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol. 1999;189(1):12-19.
2. Schiffman M, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human papillomavirus and cervical cancer. Lancet. 2007;370(9590):890-907.
3. Traut HF, Papanicolaou GN. Cancer of the uterus: the vaginal smear in its diagnosis. Cal West Med. 1943;59(2):121-122.
4. Ronco G, Dillner J, Elfström KM, Tunesi S, Snijders PJ, Arbyn M, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomised controlled trials. Lancet. 2014;383(9916):524-532.
5. Nayar R, Wilbur DC, editors. The Bethesda System for Reporting Cervical Cytology: Definitions, Criteria and Explanatory Notes. 3rd ed. Cham: Springer; 2015.
6. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. Lancet Glob Health. 2020;8(2):e191-e203.
7. Sankaranarayanan R, Nene BM, Shastri SS, Jayant K, Muwonge R, Budukh AM, et al. HPV screening for cervical cancer in rural India. N Engl J Med. 2009;360(14):1385-1394.
8. Nanda K, McCrory DC, Myers ER, Bastian LA, Hasselblad V, Hickey JD, et al. Accuracy of the Papanicolaou test in screening for and follow-up of cervical cytologic abnormalities: a systematic review. Ann Intern Med. 2000;132(10):810-819.
9. Patel MM, Pandya AN, Modi J. Cervical Pap smear study and its utility in cancer screening, to specify the strategy for cervical cancer control. Natl J Community Med. 2011;2(1):49-51.
10. Ranabhat SK, Shrestha R, Tiwari M. Analysis of abnormal epithelial lesions in cervical Pap smears in Mid-Western Nepal. J Pathol Nepal. 2011;1(1):30-33.
11. Pradhan B, Pradhan SB, Mital VP. Correlation of Pap smear findings with clinical findings and cervical biopsy. Kathmandu Univ Med J. 2007;5(4):461-467.
12. Bamanikar SA, Baravkar DS, Chandanwale SS, Dapkekar P. Study of cervical Pap smears in a tertiary hospital. Indian Med Gaz. 2014;148(7):250-254.
13. Sachan PL, Singh M, Patel ML, Sachan R. A study on cervical cancer screening using Pap smear test and clinical correlation. Asia Pac J Oncol Nurs. 2018;5(3):337-341.
14. Bukhari MH, Saba K, Qamar S, Majeed MM, Niazi S, Naeem S. Clinicopathological importance of Papanicolaou smears for the diagnosis of premalignant and malignant lesions of the cervix. J Cytol. 2012;29(1):20-25.
15. Saslow D, Solomon D, Lawson HW, Killackey M, Kulasingam SL, Cain J, et al. American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology screening guidelines for the prevention and early detection of cervical cancer. CA Cancer J Clin. 2012;62(3):147-172.
16. Moyer VA; U.S. Preventive Services Task Force. Screening for cervical cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med. 2012;156(12):880-891.