e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 978-982

Original Research Article

Cytological Spectrum of Cervical Lesions on Papanicolaou Smear and Correlation with Follow-Up Outcomes: A Retrospective Study at a Tertiary Care Centre

Hudda Sangeeta[1], Choudhary Indu[2], Gupta Shalini[3], Gupta Meenu[4]

[1,3,4]Assistant Professor, Department of Pathology, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

[2]Professor and Head of Department , Department of Pathology, Balvir Singh Tomar Institute of Medical Science and Research , Jaipur, Rajasthan, India

Received: 01-03-2026 / Revised: 15-04-2026 / Accepted: 21-05-2026

Corresponding author: Dr. Shalini Gupta

Conflict of interest: Nil

Abstract

Background: Cervical cancer is the fourth most common malignancy among women worldwide and a major cause of cancer-related mortality in low- and middle-income countries, with persistent oncogenic human papillomavirus (HPV) infection as the central aetiological event. The prolonged pre-invasive phase permits early detection through Papanicolaou (Pap) smear cytology. This study evaluated the cytological spectrum of cervical lesions and correlated atypical and high-grade abnormalities with follow-up outcomes.

Materials and Methods: This retrospective observational study was conducted in the Department of Pathology, MGUMST, Jaipur, between January 2025 and January 2026. Conventional Pap smears from 3650 women aged 21–65 years attending the gynaecology outpatient department were stained by the Papanicolaou technique and reported according to the 2014 Bethesda System. ASC-H, HSIL, and AGC/AIS cases were advised colposcopy and biopsy. Data were analysed using descriptive statistics.

Results: Epithelial abnormalities were detected in 700 cases (19.2%), while 2950 cases (80.8%) were negative for intraepithelial lesion or malignancy. LSIL was the most common abnormality (7.6%), followed by ASC-US (4.8%), HSIL (3.7%), ASC-H (1.9%), AGC/AIS (0.8%), and SCC (0.4%). ASC-US and LSIL predominated in younger women, whereas HSIL and malignancies were more frequent above 45 years. Follow-up of high-risk cytology yielded 76.9% CIN2+ lesions.

Conclusion: Pap smear screening remains a cornerstone of cervical cancer prevention in resource-limited settings. Age-specific screening, vigilant follow-up of high-risk cytology, and integration of HPV testing can further improve early detection and reduce the cervical cancer burden.

Keywords: Cervical Cancer; Papanicolaou Smear; Bethesda System; Cervical Intraepithelial Neoplasia; Human Papillomavirus; Cytology.

DOI: 10.25258/ijcpr.18.6.157

Introduction

Cervical cancer is the fourth most common cancer among women worldwide and a leading cause of cancer-related mortality in low- and middle-income countries. [1] According to GLOBOCAN 2020, approximately 604,000 new cases and 342,000 deaths were reported globally. [1] Persistent infection with oncogenic human papillomavirus (HPV) types, especially HPV-16 and HPV-18, is the central event in the pathogenesis of cervical cancer. [2,3]

The disease has a prolonged pre-invasive phase, allowing early detection through screening programmes. [4] The Pap smear has significantly reduced cervical cancer incidence and mortality in countries with organised screening. [5] The 2014 Bethesda System provides standardised terminology and risk stratification for cervical cytology reporting. [6]

Aims and Objectives

Aim: To study the cytological spectrum of cervical lesions detected on Pap smear and to correlate atypical and high-grade lesions with follow-up outcomes.

Objectives

1. To determine the frequency and distribution of cervical cytological abnormalities according to the Bethesda System. [6]
2. To analyse the age-wise distribution of epithelial abnormalities. [9]
3. To evaluate the follow-up outcomes of ASC-H, HSIL, and AGC/AIS lesions. [7,8]
4. To compare the findings with published Indian and international studies. [10,11]
5. To identify high-risk age groups and lesions requiring early intervention. [12]

Materials and Methods

This retrospective observational study was conducted in the Department of Pathology at Mahatma Gandhi University of Medical Sciences and Technology (MGUMST), Jaipur.

A total of 3650 women aged 21–65 years attending the gynaecology outpatient department between January 2025 and January 2026 were included. Women with a prior hysterectomy or a previously diagnosed cervical carcinoma were excluded. Cervical samples were collected using an Ayre's spatula and a cytobrush. Conventional Pap smears were fixed in 95% ethanol and stained using the Papanicolaou technique. Reporting was performed according to the 2014 Bethesda System. [6]

Cases diagnosed as ASC-H, HSIL, and AGC/AIS were advised repeat cytology, colposcopy, and biopsy as per standard guidelines. [7,8] Data analysis was performed using descriptive statistics, and results were expressed as frequencies and percentages.

Results

Overall Cytological Findings: A total of 3650 Pap smears were evaluated. Negative for intraepithelial lesion or malignancy (NILM) accounted for 2950 cases (80.8%), while epithelial abnormalities were observed in 700 cases (19.2%) (Table 1).

Table 1: Overall Pap smear findings

Cytological diagnosis	Number of cases	Percentage
NILM	2950	80.8%
Epithelial abnormalities	700	19.2%
Total	3650	100%

Spectrum of Epithelial Abnormalities: LSIL was the most frequent abnormality, followed by ASC-US and HSIL. Glandular abnormalities were less frequent but demonstrated higher malignant potential (Table 2).

Table 2: Distribution of epithelial abnormalities

Cytological category	Number of cases	Percentage
ASC-US	175	4.8%
LSIL	276	7.6%
ASC-H	68	1.9%
HSIL	137	3.7%
AGC / AIS	28	0.8%
SCC	16	0.4%

Age-Wise Distribution of Cervical Lesions: The distribution of predominant lesions across age groups is summarised in Table 3.

Table 3: Age-wise distribution of cervical lesions

Age group (years)	Predominant lesion	Interpretation
21–30	ASC-US / LSIL	Transient HPV infection [5]
31–45	LSIL	Persistent infection [6]
46–60	HSIL	Progressive dysplasia [7]
>60	SCC / AGC-AIS	Invasive malignancy [8]

Follow-Up Outcomes of High-Risk Cytology: Follow-up outcomes of the high-risk cytological categories are presented in Table 4. The overall yield of CIN2+ lesions among the followed-up high-risk cases was 75.2%.

Table 4: Follow-up outcomes of high-risk cytology

Cytology category	Followed-up cases	CIN2+ / AIS (%)
ASC-H	68	68.1%
HSIL	137	82.5%
AGC / AIS	28	80.0%
Overall	233	76.9%

Comparison with Other Studies: A comparison of the present findings with selected Indian and international studies is shown in Table 5.

Table 5: Comparison of the present study with selected Indian and international studies

Study / Year	Type / Region	Total smears	Abnormal (%)	Commonest lesion	LSIL (%)	HSIL (%)	Follow-up CIN2+ (%)
Sherwani et al., 2007	Hospital-based, India	3000	16.8	LSIL	9.0	3.5	70
Bhatla et al., 2018	Multicentric, India	4500	14.6	ASC-US	6.2	3.0	73
Sankaranarayanan et al., 2009	Population-based, India	6000	11.4	LSIL	7.0	2.1	78
Europe, 2010	Population-based	5000	4.0	LSIL	3.2	0.8	65
USA, 2012	Population-based	5200	5.3	ASC-US	4.1	1.2	67
Present study, 2026	Tertiary care, India	3650	19.2	LSIL	7.6	3.7	76.9

Cytomorphological Features of Cervical Lesions: Representative Cytomorphological features of the commonly encountered epithelial abnormalities are illustrated in Figures 1–5. All smears were stained using the Papanicolaou stain.

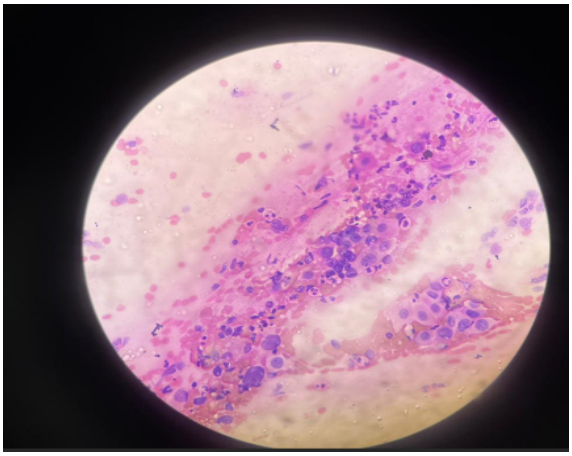

Figure 1: LSIL on Pap smear (Pap stain, ×400). Superficial and intermediate squamous cells showing koilocytosis, perinuclear halos, and mild nuclear enlargement.

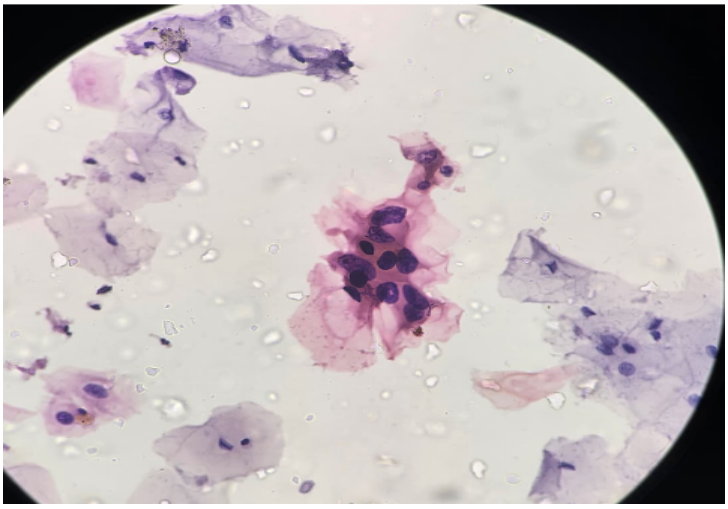

Figure 2: HSIL on Pap smear (Pap stain, ×400). Dysplastic squamous cells with a high nuclear-to-cytoplasmic ratio, hyperchromatic nuclei, and irregular nuclear contours.

ASC-H on Pap smear (Pap stain, ×400). Atypical squamous cells showing nuclear enlargement and hyperchromasia, suspicious for a high-grade lesion.

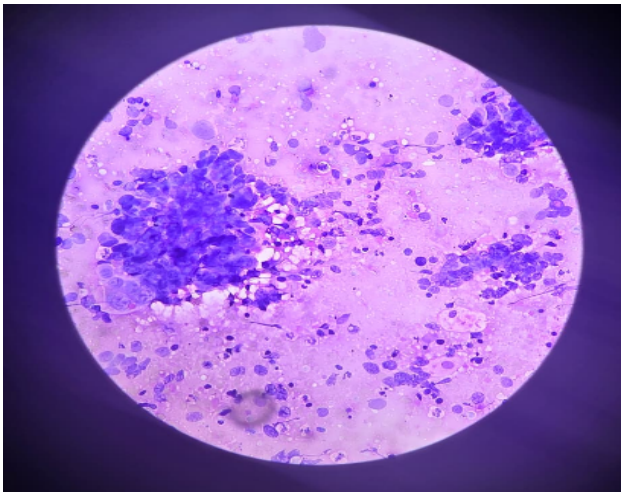

Figure 4: Squamous cell carcinoma on Pap smear (Pap stain, ×400). Marked cellular pleomorphism, coarse chromatin, irregular nuclear membranes, and tumour diathesis.

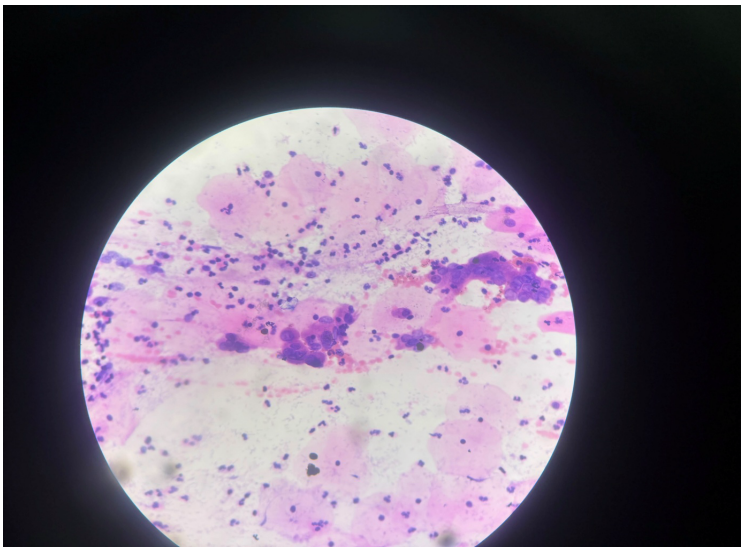

Figure 5: AGC / AIS on Pap smear (Pap stain, ×400). Crowded glandular cell groups showing nuclear stratification, hyperchromasia, and feathering.

Discussion

The epithelial abnormality rate of 19.2% in the present study is higher than that reported in population-based Indian studies (11.4–14.6%), [10,11] a finding consistent with hospital-based screening populations. LSIL (7.6%) was the most common abnormality, as reported by Sherwani et al. [1] and Sankaranarayanan et al. [11] The HSIL rate (3.7%) exceeded the rates reported from Europe (0.8%) and the USA (1.2%) (Table 5), reflecting delayed presentation, the lack of organised screening, and persistent high-risk HPV infection in India.

Age-related trends showed ASC-US and LSIL predominating in younger women, whereas HSIL and malignancies were more common above 45 years of age,9 consistent with the natural progression from transient HPV infection to persistent dysplasia. Follow-up of high-risk cytology (ASC-H, HSIL, and AGC/AIS) revealed 76.9% CIN2+, comparable to the findings of Pretorius et al. (70%), [17] Castle et al. (73%), [8] and Arbyn et al. (78%). [13] Glandular abnormalities, although less frequent, showed a higher malignant potential, emphasising the need for careful evaluation and timely colposcopic assessment of the ASC-H, HSIL, and AGC/AIS categories. [7,8]

Overall, the present study corroborates published Indian and international literature, [8,11,16] highlighting the importance of hospital-based screening, vigilant follow-up, and the integration of HPV testing for improved early detection.

Conclusion

Pap smear screening remains a cornerstone of cervical cancer prevention in resource-limited settings. [19] The high prevalence of epithelial abnormalities and the significant follow-up yield of CIN2+ lesions underline the importance of age-specific screening and vigilant follow-up. The

integration of HPV testing with cytology can further enhance early detection and reduce the cervical cancer burden. [14,15]

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209–249.
2. zur Hausen H. Papillomaviruses and cancer: from basic studies to clinical application. N Engl J Med. 2002;347(21):1643–1651.
3. Walboomers JMM, Jacobs MV, Manos MM, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol. 1999;189(1):12–19.
4. Papanicolaou GN. A new procedure for staining vaginal smears. Science. 1942;95(2469):438–439.
5. Sankaranarayanan R, Esmy PO, Rajkumar R, et al. Effect of visual screening on cervical cancer incidence and mortality in Tamil Nadu, India. Lancet. 2007;370(9585):398–406.
6. Nayar R, Wilbur DC. The Bethesda System for Reporting Cervical Cytology. 3rd ed. New York: Springer; 2015.
7. Massad LS, Einstein MH, Huh WK, et al. 2012 updated consensus guidelines for the management of abnormal cervical cancer screening tests and cancer precursors. J Low Genit Tract Dis. 2013;17(5 Suppl 1):S1–S27.
8. Castle PE, Fetterman B, Poitras NE, et al. Five-year experience of human papillomavirus DNA and Papanicolaou test cotesting. Obstet Gynecol. 2009;113(3):595–600.
9. Moscicki AB, Schiffman M, Kjaer S, Villa LL. Updating the natural history of human papillomavirus and anogenital cancers. Vaccine. 2006;24(Suppl 3):S3/42–S3/51.
10. Bhatla N, Aoki D, Sharma DN, Sankaranarayanan R. Cancer of the cervix uteri. Int J Gynaecol Obstet. 2018;143(Suppl 2):22–36.
11. Sankaranarayanan R, Nene BM, Shastri SS, et al. HPV screening for cervical cancer in rural India. N Engl J Med. 2009;360(14):1385–1394.
12. Bosch FX, Broker TR, Forman D, et al. Comprehensive control of human papillomavirus infections and related diseases. Vaccine. 2013;31(Suppl 7):H1–H31.
13. Arbyn M, Anttila A, Jordan J, et al. European guidelines for quality assurance in cervical cancer screening. Lancet. 2009;374(9706):1764–1772.
14. Ronco G, Dillner J, Elfström KM, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer. Lancet. 2014;383(9916):524–532.
15. Schiffman M, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human papillomavirus and cervical cancer. Lancet. 2007;370(9590):890–907.
16. Sherwani RK, Khan T, Akhtar K, et al. Conventional Pap smear and liquid-based cytology for cervical cancer screening. J Cytol. 2007;24(4):167–172.
17. Pretorius RG, Zhang WH, Belinson JL, et al. Colposcopically directed biopsy, random cervical biopsy, and endocervical curettage. Am J Obstet Gynecol. 2006;195(5):1260–1265.
18. Arbyn M, Ronco G, Anttila A, et al. Evidence regarding HPV testing in secondary prevention of cervical cancer. BMJ. 2012;344:e670.
19. World Health Organization. Comprehensive cervical cancer control: a guide to essential practice. Geneva: WHO Press; 2014.
20. Solomon D, Davey D, Kurman R, et al. The 2001 Bethesda System: terminology for reporting cervical cytology. JAMA. 2002;287 (16):2114–2119.