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Pap Smear Findings in Postmenopausal Women: Correlation with Atrophic Changes and Malignancy Risk

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ABSTRACT

Background: Cervical cancer is a major health problem worldwide, particularly in developing countries such as India, which contributes nearly one-fifth of the global burden. Postmenopausal women present unique challenges in cytological screening due to estrogen deficiency–related atrophic changes that can mimic epithelial abnormalities, leading to potential diagnostic errors.

Objective: To assess Pap smear findings in postmenopausal women, evaluate the prevalence of atrophic smears, and correlate atypical epithelial abnormalities with the risk of premalignant and malignant lesions.

Materials and Methods: This cross-sectional observational study was conducted in the Departments of Obstetrics & Gynecology and Pathology at a tertiary care hospital in Central India over one year (January–December 2024). A total of 520 postmenopausal women underwent Pap smear examination using conventional Papanicolaou staining. Smears were reported as per the Bethesda System 2014. Cases with epithelial abnormalities underwent colposcopic-guided biopsy, and histopathological correlation was obtained in 42 cases.

Results: The majority of women were in the 51–60 years age group (46.2%), with a mean age of 58.4 years. Atrophic smears were the most frequent finding (60%), followed by inflammatory smears (23.8%). Epithelial cell abnormalities were detected in 11.7% of cases, with ASC-US (4.6%) being the most common, followed by HSIL (2.9%), LSIL (2.3%), and invasive carcinoma (2.5%). Histopathological correlation revealed that 59.5% of abnormal cytology cases were confirmed premalignant or malignant, while 40.5% were benign/reactive. Notably, all cases of LSIL, squamous cell carcinoma, and adenocarcinoma were confirmed malignant, whereas most ASC-US and some HSIL cases were benign on biopsy.

Conclusion: Atrophy is the predominant cytological finding in postmenopausal Pap smears and often mimics atypical or premalignant changes, posing interpretation challenges. Despite these pitfalls, Pap smear remains an essential screening tool, with nearly 5.4% of women in this study harboring HSIL or invasive carcinoma. Continued screening in postmenopausal women, supplemented by adjunctive methods such as HPV testing, can improve diagnostic accuracy and reduce unnecessary interventions, thereby strengthening cervical cancer prevention strategies in resource-limited settings.

Keywords: Pap smear, postmenopausal women, atrophy, cervical cancer, epithelial cell abnormality, Bethesda System

INTRODUCTION

Cervical cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide, with an estimated 604,000 new cases and 342,000 deaths in 2020 according to the World Health Organization (WHO) [1]. India alone contributes nearly 20% of the global cervical cancer burden, making it a major public health challenge [2]. Organized screening programs have shown significant success in reducing incidence and mortality in developed countries, largely due to the widespread use of the Papanicolaou (Pap) smear test [3].

The Pap smear is a simple, cost-effective, and widely accepted method for detecting precancerous lesions and invasive cervical carcinoma at an early stage [4]. However, its interpretation in postmenopausal women is often complicated by age-related physiological changes. Declining estrogen levels after menopause result in atrophy of the squamous epithelium, leading to smears dominated by small parabasal cells with high nuclear-cytoplasmic ratios [5]. These cytological features may mimic epithelial cell abnormalities, particularly atypical squamous cells and low-grade squamous intraepithelial lesions (LSIL), making differentiation from premalignant or malignant changes difficult [6].

Furthermore, atrophic smears may show background inflammation, poor cellular yield, and degenerative changes, which can obscure neoplastic lesions [7]. Such diagnostic pitfalls may result in over-diagnosis (false positives, leading to unnecessary interventions) or under-diagnosis (missed cases of true dysplasia or carcinoma) [8].

Given these interpretational challenges, it is important to study the cytological patterns in postmenopausal women and correlate them with histopathological findings, wherever available. While several studies from different parts of India have reported on Pap smear findings, there is limited data from Central India focusing specifically on postmenopausal women [9,10].

The present study was therefore undertaken at a tertiary care hospital in Central India, over a period of one year, with the following objectives:

1. To assess the range of Pap smear findings in postmenopausal women.
2. To evaluate the prevalence and spectrum of atrophic changes.
3. To correlate atypical/epithelial abnormalities in atrophic smears with the risk of premalignant and malignant lesions.

Materials and Methods

This was a hospital-based, cross-sectional observational study conducted jointly in the Departments of Obstetrics & Gynecology and Pathology at a tertiary care hospital in Central India over a period of one year, from January 2024 to December 2024. The study population comprised postmenopausal women, defined as those who had completed at least one year since their last menstrual period, attending the gynecology outpatient department for various gynecological complaints or routine screening. A total of 520 women were included in the study after applying the eligibility criteria. Women with a history of hysterectomy, previously diagnosed cases of cervical carcinoma, those receiving hormone replacement therapy, and those who had undergone chemo-radiotherapy were excluded to avoid confounding cytological findings.

After obtaining informed consent, detailed clinical history including age, parity, presenting symptoms, and relevant past history was recorded. Cervical smears were collected using an Ayre's spatula and endocervical brush under aseptic precautions. The material obtained was evenly spread on clean glass slides, immediately fixed in 95% ethanol, and subsequently stained using the conventional Papanicolaou (Pap) staining technique. The stained smears were examined under light microscopy by trained cytopathologists.

Cytological reporting was carried out according to the Bethesda System 2014, and smears were classified into the following categories: negative for intraepithelial lesion or malignancy (NILM), atrophic smears, inflammatory smears, 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), and invasive carcinoma (squamous cell carcinoma or adenocarcinoma). Cases with epithelial cell abnormalities were further advised for colposcopic examination and biopsy wherever feasible. Histopathological correlation was obtained in 42 such cases.

All collected data were entered into Microsoft Excel and analyzed using descriptive statistical methods. The results were expressed as frequencies and percentages. Correlation between cytological findings and histopathology was performed to assess the accuracy of Pap smear interpretation in atrophic backgrounds.

Results

In the present study, a total of 520 postmenopausal women underwent Pap smear screening over a period of one year. The results were analyzed in terms of age distribution, spectrum of cytological findings, prevalence of epithelial cell abnormalities, and histopathological correlation wherever available.

Table 1. Age distribution of study participants (n = 520)

Age group (years)	Number of cases	Percentage (%)
41–50	52	10.0
51–60	240	46.2
61–70	166	31.9
>70	62	11.9
Total	**520**	**100**

The majority of women belonged to the 51–60 years age group (46.2%), with a mean age of 58.4 ± 6.2 years.

Table 2. Pap smear findings according to Bethesda System 2014 (n = 520)

Pap smear diagnosis	Number of cases	Percentage (%)
Atrophic smears	312	60.0
Inflammatory smears (NILM with inflammation)	124	23.8
ASC-US	24	4.6
LSIL	12	2.3
HSIL	15	2.9
Squamous cell carcinoma (SCC)	10	1.9
Adenocarcinoma	3	0.6
Total	**520**	**100**

Atrophic smears were the most common finding (60%), while epithelial cell abnormalities were observed in 11.7% of cases.

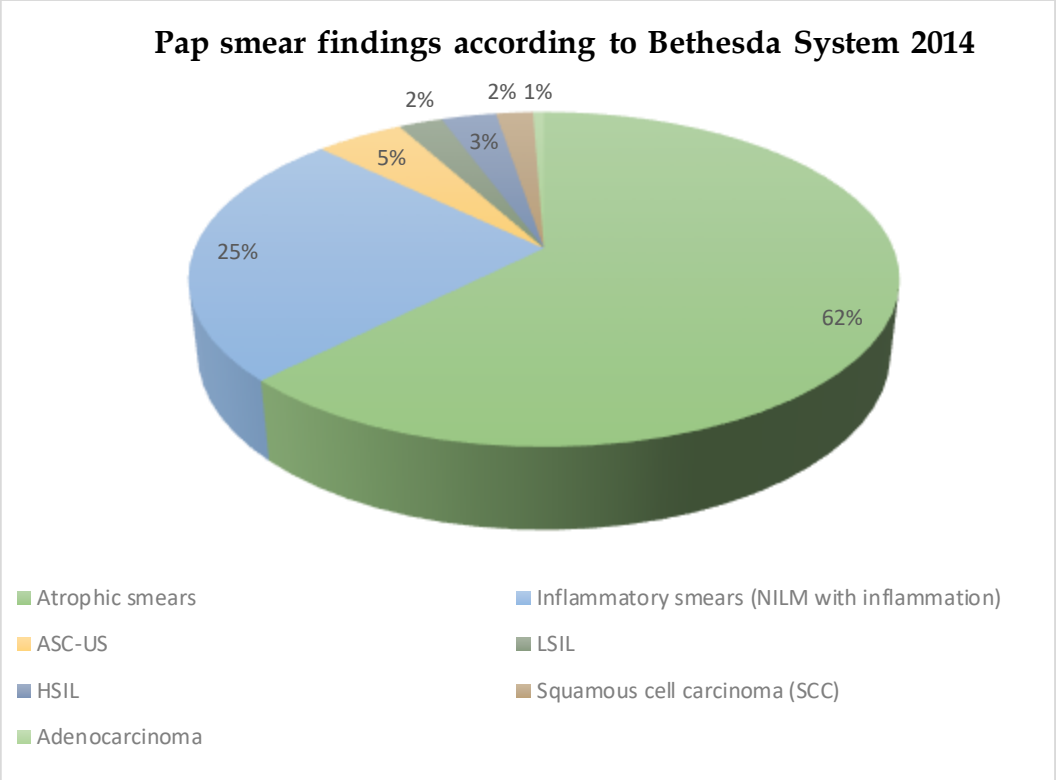

Figure 1: Distribution of Pap smear findings in postmenopausal women as per the Bethesda System 2014 (n = 520). Atrophic smears were the most common finding (60%), followed by inflammatory smears (23.8%). Epithelial abnormalities were seen in 11.7% of cases, including ASC-US, LSIL, HSIL, squamous cell carcinoma, and adenocarcinoma.

Table 3. Distribution of epithelial abnormalities (n = 64)

Type of epithelial abnormality	Number of cases	Percentage (%) among ECA
ASC-US	24	37.5
LSIL	12	18.8
HSIL	15	23.4
Squamous cell carcinoma (SCC)	10	15.6
Adenocarcinoma	3	4.7
Total	**64**	**100**

Among epithelial abnormalities, ASC-US (37.5%) was the most common, followed by HSIL (23.4%).

Table 4. Histopathological correlation of epithelial abnormalities (n = 42 cases with biopsy)

Cytology diagnosis	Cases biopsied	Benign/ Reactive (n)	Confirmed premalignant/ malignant (n)	Confirmation rate (%)

ASC-US	15	11	4	26.7
LSIL	8	0	8	100.0
HSIL	10	6	4	40.0
SCC	6	0	6	100.0
Adenocarcinoma	3	0	3	100.0
Total	**42**	**17 (40.5%)**	**25 (59.5%)**	—

Biopsy correlation confirmed that while most ASC-US and some HSIL cases were benign/reactive, all cases of LSIL, SCC, and adenocarcinoma were malignant on histopathology.

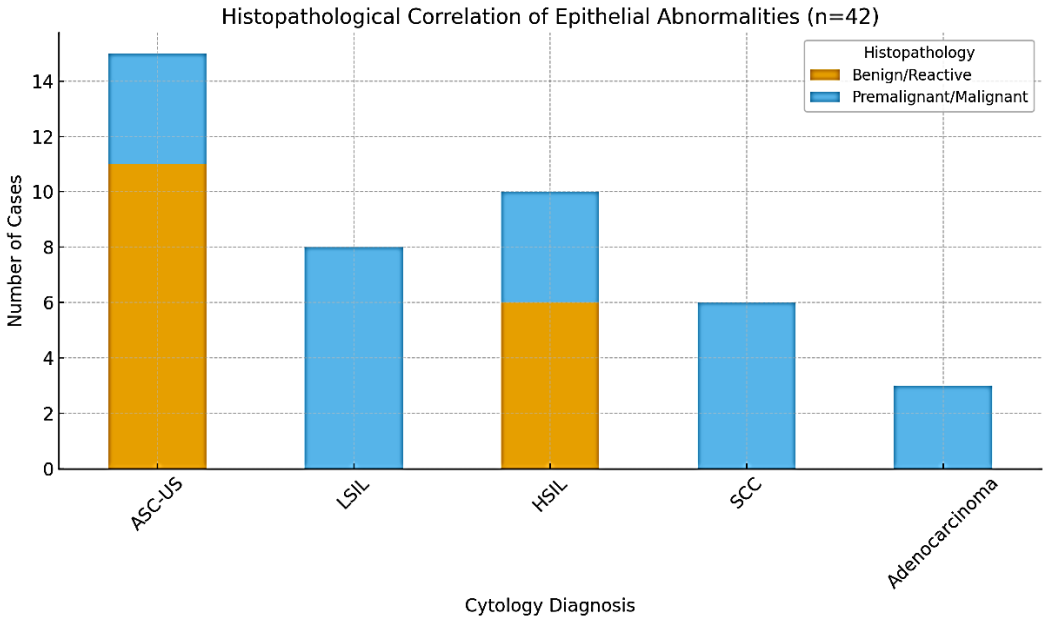

Figure 2: Histopathological correlation of epithelial abnormalities in postmenopausal women (n = 42). The graph shows the distribution of benign/reactive versus confirmed premalignant/malignant cases for each cytological category. While ASC-US and some HSIL cases were benign, all LSIL, SCC, and adenocarcinoma cases were confirmed malignant on biopsy.

DISCUSSION

The present study analyzed Pap smear findings in 520 postmenopausal women over a period of one year in a tertiary care hospital of Central India. The majority of women were in the 51–60 year age group, with a mean age of 58.4 years. Similar age distribution has been reported in other Indian studies, reflecting the higher likelihood of postmenopausal women seeking gynecological care during this period of life [9,10].

In the current study, atrophic smears were the most common cytological finding (60%), consistent with hypoestrogenic changes after menopause. This observation is comparable to reports by Bhatla et al. [11] and Ranabhat et al. [12], who found atrophic changes in 55–70% of postmenopausal smears. Atrophy poses a diagnostic dilemma, as the predominance of parabasal cells with high nuclear-cytoplasmic ratio can mimic atypia. This may lead to over-diagnosis of ASC-US or LSIL, thereby reducing the specificity of Pap smear in older women [13].

Epithelial cell abnormalities (ECA) were identified in 11.7% of cases, with ASC-US (4.6%) being the most frequent, followed by HSIL (2.9%). This finding is consistent with studies from North and South India, where the prevalence of ECA in postmenopausal women ranged between 8–15% [14,15]. The detection of HSIL and carcinoma in nearly 5.4% of women in our study highlights the continued burden of cervical cancer in this age group, underscoring the importance of screening even after menopause.

Histopathological correlation was available in 42 women with abnormal cytology. Of these, 40.5% were benign/reactive and 59.5% were confirmed as premalignant or malignant lesions. Importantly, 64% of atypical atrophic smears (reported as ASC-US or HSIL) were benign on biopsy, reflecting the well-recognized problem of false positives in the setting of atrophy [16]. However, one-third of atypical atrophic smears did harbor true dysplasia or carcinoma, emphasizing the need for cautious interpretation, repeat cytology, and colposcopic evaluation in such cases.

Our findings reinforce the observation that while Pap smear remains a valuable screening tool in postmenopausal women, its limitations are more pronounced in this age group. Adjunctive use of HPV DNA testing and colposcopy has been

recommended by several authors to improve diagnostic accuracy and reduce false positives [17,18]. Moreover, training cytologists to recognize atrophic patterns and correlate with clinical findings can minimize misinterpretation.

Strengths and Limitations

The strength of this study lies in its relatively large sample size and inclusion of histopathological correlation in abnormal cases. However, limitations include its single-center design and lack of routine HPV testing, which could have provided further insight into the risk stratification of postmenopausal women.

Implications

Given the rising life expectancy in India, a significant proportion of women now spend one-third of their lives in the postmenopausal period. Screening strategies for this group must take into account the challenges posed by atrophic changes. Our findings suggest that while Pap smear is useful, integration with HPV testing or liquid-based cytology may improve diagnostic yield and reduce unnecessary interventions.

CONCLUSION

The present study highlights that atrophy is the most common cytological finding in Pap smears of postmenopausal women, observed in 60% of cases. Atrophic changes often mimic epithelial abnormalities, particularly ASC-US and LSIL, thereby complicating interpretation. While the majority of atypical atrophic smears were benign/reactive on histopathology, nearly one-third represented true premalignant or malignant lesions.

The detection of HSIL and invasive carcinoma in 5.4% of women underscores the continued risk of cervical cancer in the postmenopausal population and reinforces the need for ongoing screening beyond reproductive age. Careful cytological evaluation, combined with clinical correlation, repeat cytology, colposcopic examination, and histopathological confirmation, is essential to avoid both over- and under-diagnosis.

In resource-limited settings such as Central India, Pap smear remains an invaluable tool for cervical cancer screening in postmenopausal women. However, the incorporation of adjunctive methods such as HPV testing or liquid-based cytology may improve diagnostic accuracy and reduce false positives related to atrophic smears. Strengthening awareness and screening programs for postmenopausal women can significantly contribute to reducing the burden of cervical cancer in India.

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