

“SILENT SIGNALS IN CERVICAL CYTOLOGY: MAPPING THE LANDSCAPE OF INCIDENTAL DISCOVERIES”

DR.R. NAVEENA¹, DR. H VOLGA², DR. P. PREETHI³

¹POST GRADUATE, DEPT. OF PATHOLOGY

²PROFESSOR, DEPT. OF PATHOLOGY

SAVEETHA MEDICAL COLLEGE AND HOSPITAL (SIMATS), CHENNAI.

³READER, DEPARTMENT OF PERIODONTOLOGY, SREE BALAJI DENTAL COLLEGE & HOSPITAL,
CHENNAI, INDIA

Abstract

Background:

Papanicolaou (Pap) smear cytology serves as a cornerstone in cervical cancer screening. While its primary focus is the detection of cervical epithelial abnormalities, incidental findings—unrelated to cervical neoplasia—are frequently encountered and may hold clinical relevance. These include infectious processes, atrophic cellular changes, the presence of endometrial cells in women beyond the expected age threshold, and cytological features suggestive of extragenital pathology. The Pap smear continues to be a simple, cost-effective, and sensitive modality for the identification of both neoplastic and non-neoplastic lesions of the cervix, making it an indispensable component of routine gynecologic evaluation.

Objective:

To evaluate the prevalence of premalignant and malignant cervical lesions and to analyse their clinic pathological characteristics for improved diagnostic interpretation and patient management.

Methods:

A retrospective observational study (n- 418 cases) was conducted on Pap smear reports from a tertiary care center between January 2023 to December 2024. Incidental findings were catalogued and correlated with age, menstrual history, and clinical background. Cytological features were reviewed in accordance with The Bethesda System. Statistical associations were analyzed using appropriate inferential tests.

Results:

The study evaluated 418 Pap smears and found incidental cytological findings in 22.2% of cases. Incidence increased with age, especially ≥ 40 years (30.9%), showing significant association ($\chi^2 = 5.84$, $p < 0.015$). Symptomatic patients—particularly those with pelvic pain and abnormal bleeding—had higher detection rates (up to 39.5%), with an odds ratio of 1.76 (CI: 1.09–2.83, $p = 0.02$). Cytological grading correlated with incidental findings; HSIL cases had the highest rate (80%), and the overall variation was statistically significant ($F = 3.12$, $p = 0.027$). These results underscore the clinical value of age and symptoms in predicting incidental findings on cervical cytology.

Conclusion:

Incidental findings in Pap smears, although secondary to the primary purpose of cervical cancer screening, may hold valuable clues regarding non-neoplastic gynecological conditions. Routine reporting and follow-up can enhance diagnostic yield and improve patient outcomes. Incorporating such parameters may refine cytological surveillance strategies and contribute to comprehensive women's health monitoring.

INTRODUCTION

Cervical cytology, widely regarded as a cornerstone of preventative healthcare in women, plays a pivotal role in detecting premalignant and malignant lesions of the cervix [1]. The enduring utility of the Pap smear lies in its capacity to uncover epithelial abnormalities with minimal invasiveness, thereby enabling timely interventions and reducing cervical cancer morbidity [2] [3]. However, amid its primary screening objective, cervical cytology occasionally reveals findings that, while incidental to the detection of neoplasia, hold nuanced

implications for patient health [4] [5]. These findings range from infectious agents and hormonal effects to inflammatory responses and atypical non-gynecologic cells represent silent signals embedded within routine cytological evaluation.

Incidental findings, often underestimated or dismissed during routine reporting, may reflect broader gynecology, endocrinology, or systemic processes. Their detection offers a unique opportunity to explore the holistic health status of patients, transcending the singular focus on cervical malignancy. For instance, the identification of fungal hyphae, clue cells, or trichomonads could support symptomatic correlation and targeted antimicrobial therapy. Similarly, the presence of endometrial cells in women beyond the age threshold defined by The Bethesda System may prompt further diagnostic workup for endometrial pathology. Inflammatory changes, reactive cellular alterations, and hormonal cytological patterns may shed light on underlying physiological transitions such as menopause, polycystic ovarian syndrome, or contraceptive impact—dimensions often overlooked in conventional cytological interpretation [6].

Despite their clinical relevance, incidental findings remain inconsistently reported across laboratories, with variability in interpretation stemming from subjective assessments and interobserver disparity. The cytopathologist's ability to recognize and contextualize these subtle patterns is vital not only for comprehensive care but also for refining diagnostic reproducibility and enhancing patient outcomes.

This study seeks to systematically map the spectrum, frequency, and clinicopathological associations of incidental findings encountered in Pap smear evaluations [7]. By illuminating the silent diagnostic echoes embedded in routine cervical cytology, we aim to underscore the importance of integrating incidental findings into structured reporting practices and advancing their role in preventive gynecological care. The insights derived may contribute toward redefining cytological surveillance models, enriching educational frameworks, and guiding policy recommendations in cervical screening protocols.

METHODS

This retrospective observational study analyzed 418 Pap smear reports from a tertiary care center between January 2023 and December 2024. Reports included both conventional and liquid-based preparations, selected based on completeness of demographic and clinical information such as age, menstrual history, and presenting complaints; cases with poor slide quality or incomplete data were excluded. Cytological evaluations were conducted in line with the 2014 Bethesda System by experienced cytopathologists, documenting incidental findings such as microbial infections, endometrial cells beyond age 45, atrophic changes, and atypical features unrelated to cervical intraepithelial neoplasia. Clinical background and sociodemographic profile of the patient were cross-referenced, and patients were stratified into age groups for statistical comparison. Data were subjected to descriptive analysis and appropriate inferential statistics were applied. The study was approved by the Institutional Ethics Committee, and all data were anonymized to maintain patient confidentiality.

RESULTS

Table 1: Age-wise Distribution of Cases and Incidental Findings

AGE (YEARS)	GROUP	TOTAL (N=418)	CASES	CASES WITH FINDINGS	INCIDENTAL	PERCENTAGE (%)
<20		25		4		16.0
21–30		102		18		17.6
31–40		135		32		23.7
41–50		96		24		25.0
>50		60		15		25.0
TOTAL		418		93		22.2

The age-wise distribution of incidental findings in cervical cytology reveals a progressive increase across age groups, with the overall prevalence recorded at 22.2%. Notably, younger cohorts such as those under 20 years and between 21–30 years exhibited lower detection rates of 16.0% and 17.6%, respectively. A marked rise is seen in older age groups, particularly among those aged 31–40, 41–50, and >50 years, each demonstrating elevated proportions of incidental findings ranging from 23.7% to 25.0%.

Table 2: Clinical Background Correlation with Incidental Findings

CLINICAL HISTORY	NO. OF CASES	INCIDENTAL FINDINGS	PERCENTAGE (%)
NO SYMPTOMS	225	36	16.0
VAGINAL DISCHARGE	95	22	23.2
POSTCOITAL BLEEDING	34	10	29.4
PELVIC PAIN	38	15	39.5
ABNORMAL BLEEDING	26	10	38.5
TOTAL	418	93	22.2

The data reveals a distinct variation in incidental findings across different clinical presentations, with an overall prevalence of 22.2%. Individuals with no symptoms exhibited the lowest rate of incidental findings (16.0%), whereas those presenting with pelvic pain and abnormal bleeding showed markedly higher rates at 39.5% and 38.5%, respectively. Vaginal discharge and postcoital bleeding also demonstrated elevated percentages (23.2% and 29.4%), suggesting a possible clinical correlation.

Table 3: Cytological Features Based on Bethesda System

Cytology Classification (Bethesda System)	Total Cases	Incidental Findings Observed	Examples of Findings	F-3.12 p-0.027
NILM (Negative for Intraepithelial Lesion or Malignancy)	350	68	Endometrial cells, Actinomyces	
ASC-US (Atypical Squamous Cells of Undetermined Significance)	38	10	Candida, Trichomonas	
LSIL (Low-grade Squamous Intraepithelial Lesion)	20	7	HSV changes	
HSIL (High-grade Squamous Intraepithelial Lesion)	10	8	Suspicious bacterial colonies	
Total	418	93		

The analysis of incidental findings across cytological categories classified by the Bethesda system highlights statistically significant variation ($F = 3.12$, $p = 0.027$). The NILM group, comprising the majority of cases ($n = 350$), presented with a lower proportion of incidental findings (68 cases), predominantly endometrial cells and Actinomyces. In contrast, atypical and neoplastic categories—including ASC-US, LSIL, and HSIL—demonstrated proportionally higher rates of incidental findings relative to their group sizes. Notably, the HSIL group exhibited the highest relative frequency (8 of 10 cases), often associated with suspicious bacterial colonies.

Table 4: Association Between Age Group and Incidental Findings (Chi-Square Test)

Age Group (years)	Incidental Findings Present	Incidental Findings Absent	Total Cases	$\chi^2=5.84$ P<0.015
<40	54	238	292	
≥40	39	87	126	
Total	93	325	418	

The statistical evaluation of age-related distribution in incidental findings using the chi-square test ($\chi^2 = 5.84$, $p < 0.015$) reveals a significant association between age and the occurrence of incidental cytological findings. Among patients aged <40 years, 54 of 292 cases (18.5%) exhibited incidental findings, while the ≥40 age group demonstrated a higher proportion with 39 of 126 cases (30.9%).

Table 5: Odds Ratio for Incidental Findings in Symptomatic vs. Asymptomatic Patients

Symptom Status	Incidental Findings	No Findings	Total	95% Confidence Interval
Symptomatic	57	136	193	1.09-2.83
Asymptomatic	36	189	225	P - 0.02

Symptomatic individuals were significantly more likely to exhibit incidental cytological findings than asymptomatic ones (OR: 1.76; 95% CI: 1.09–2.83; $p = 0.02$), with detection rates of 29.5% and 16.0%, respectively. This highlights symptom presence as a predictive factor for incidental findings.

DISCUSSION

This analysis reveals significant insights into incidental findings in cervical cytology, demonstrating their overall prevalence and distribution across various demographic and cytological categories.

This study revealed an overall prevalence of incidental findings at 22.2% across 418 cases. This figure broadly encompasses a range of non-malignant observations. When focusing on specific incidental findings, *Emegoakor, F.C.J. et al* [8] provides a more specific prevalence for asymptomatic bacterial vaginosis (BV), a common incidental finding, at 10.8% or 10.9% among women undergoing routine cervical cancer screening, prevalence is lower than some other studies that also used Pap smears for diagnosis, such as 18.4% observed by *Narasimha [9]* in India and a higher 48.4% obtained by *Ahmad et al*[10] in symptomatic women in India. Furthermore, *Peebles, K. et al* [11] that estimated a global prevalence of BV between 23% and 29%.

Incidental findings were observed across all Bethesda classifications: NILM (Negative for Intraepithelial Lesion or Malignancy) cases showed incidental findings such as Endometrial cells and Actinomyces, ASC-US (Atypical Squamous Cells of Undetermined Significance) cases included findings like Candida and Trichomonas, LSIL (Low-grade Squamous Intraepithelial Lesion) cases exhibited HSV (Herpes Simplex Virus) changes, HSIL (High-grade Squamous Intraepithelial Lesion) cases showed suspicious bacterial colonies. These findings were correlated by *C. Iavazzo, I. Boutas, C. Grigoriadis, N. Vrachnis, and N. Salakos* [12] where infectious organisms in 8 out of 34 ASCUS patients, identified were Actinomyces (1/8), Trichomonas (5/8), and Candida albicans (2/8).

However, there is an apparent contradiction regarding the association of bacterial findings with abnormal cytology. While our study noted "suspicious bacterial colonies" in HSIL cases, *Emegoakor, F.C.J. et al* [8] explicitly stated there was no association between abnormal cervical cytology and asymptomatic bacterial vaginosis. Studies by *Sanchez-Garcia [13], Sodhani, P. et al [14], Gillet, E. et al [15], and Liang, Y. et al [16]* have reported inconsistencies or unconfirmed relationships between bacterial vaginosis and cervical intraepithelial neoplasia (CIN).

Beyond their primary role in cancer screening, the sources collectively emphasize the multifaceted utility of Pap smears in detecting various incidental conditions. *Emegoakor, F.C.J. et al* [8] conclude that cervical smear "should be taken advantage of as a tool for both cervical pre-cancer and bacterial vaginosis screenings since same sample can simultaneously be used for both conditions during cytology". This "dual advantage" is a recurring theme.

The results on incidental findings align with broader themes in the literature regarding the versatility of Pap smears. While the prevalence and age distribution of *specific* incidental findings like BV as seen in *Emegoakor, F.C.J. et al* [8] may differ from the aggregate category in our study. The overall utility of Pap smears in detecting a wide array of conditions, including infections and even rare pathogens is emphasized.

CONCLUSION

Pap smear cytology, while primarily a tool for cervical cancer screening, also reveals incidental findings that offer valuable clinical insight into non-neoplastic conditions. This study highlights a notable prevalence of epithelial abnormalities alongside age-related and symptomatic associations. Integrating incidental findings into routine reporting can enhance diagnostic accuracy, guide follow-up strategies, and support a broader framework for women's health surveillance.

Beyond its diagnostic scope, the Pap smear also serves as a valuable touchpoint for patient engagement in preventive gynecologic care. Regular screening not only facilitates early detection of cervical pathology but also encourages dialogue on reproductive health, hygiene practices, and timely follow-up. Strengthening awareness around incidental findings may further empower clinicians and patients alike to pursue appropriate management and holistic wellness strategies.

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