Corresponding Author
Anisha Nazar,
Department of Pathology, Sree Mookambika Institute Of Medical Sciences, Kanyakumari, Tamil Nadu, India
anishanasar00@gmail.com

Author Designation
[1]Professor
[2]PG
[3]Professor and HOD

Comparative Study of Pap Smear Cytology and Histopathology in Lesions of Cervix

[1]Lilarani Vijayaraghavan, [2]Anisha Nazar and [3]G. Rajan
[1-3]*Department of Pathology, Sree Mookambika Institute Of Medical Sciences, Kanyakumari, Tamil Nadu, India*

Abstract
Cervical cancer is a major public health concern, especially in low- and middle-income countries. Early detection through screening methods such as Pap smear cytology and histopathology is crucial for reducing the incidence and mortality of cervical cancer. This study aims to compare the diagnostic accuracy of Pap smear cytology and histopathological examination in detecting cervical lesions in women from Tamil Nadu. A cross-sectional study was conducted at a tertiary care hospital in Tamil Nadu, involving 150 women with clinical symptoms suggestive of cervical lesions. All participants underwent Pap smear cytology, followed by histopathological examination of cervical biopsies. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of Pap smear were calculated and compared to histopathology results. The majority of women (53.3%) had normal Pap smear findings, while 16.7% were diagnosed with low-grade squamous intraepithelial lesions (LSIL) and 13.3% with high-grade squamous intraepithelial lesions (HSIL). Histopathology confirmed chronic cervicitis in 46.7% of cases, followed by cervical intraepithelial neoplasia (CIN) and invasive carcinoma. The overall concordance between Pap smear and histopathology was 87.8%, with a sensitivity of 85.7%, specificity of 91.4%, and a PPV of 89.7%. Pap smear cytology demonstrated a high diagnostic accuracy in detecting cervical lesions, though histopathology remains the gold standard for definitive diagnosis. The combined use of both methods enhances early detection and appropriate management of cervical pathology in high-risk populations. Regular screening with Pap smear, followed by histopathological confirmation for abnormal results, is recommended to reduce cervical cancer burden.

INTRODUCTION

Cervical cancer is one of the leading causes of cancer-related morbidity and mortality in women worldwide, particularly in low- and middle-income countries. It arises from the cervix, the lower part of the uterus that connects to the vagina, and is predominantly caused by persistent infection with high-risk types of human papillomavirus (HPV). Early detection and screening have been proven to reduce the incidence and mortality associated with cervical cancer[1]. The two main diagnostic approaches for evaluating cervical lesions are Pap smear cytology and histopathological examination. Pap smear cytology is a screening tool that involves the collection of cells from the cervix to detect precancerous or cancerous changes. Histopathology, on the other hand, involves the microscopic examination of tissue biopsies, providing definitive diagnoses of cervical pathology. A combined approach of these two methods enhances the diagnostic accuracy for detecting cervical lesions[2].

Globally, cervical cancer ranks as the fourth most common cancer in women, with an estimated 604,000 new cases and 342,000 deaths in 2020 (Bray *et al.*, 2021). The burden of cervical cancer is particularly high in developing countries, where women often have limited access to effective screening and preventive measures[3]. According to the National Cancer Registry Programme (2020) in India, cervical cancer is the second most common cancer among women, contributing to about 23.6% of all cancers in women. In Tamil Nadu, the incidence rate is among the highest in the country, highlighting the urgent need for effective screening and early detection strategies to reduce the morbidity and mortality associated with cervical cancer[4].

Several studies have demonstrated the effectiveness of Pap smear cytology as a screening tool in detecting cervical cancer precursors, particularly in women who do not have access to regular medical care. A study by Ruksana *et al.*[5] (2020) in northern India reported that Pap smear had a sensitivity of 85% and a specificity of 91% in detecting cervical neoplasia, with high agreement between cytology and histopathology in detecting CIN III and invasive carcinoma. Similarly, Sakshi *et al.*[6] (2023) found that Pap smear cytology showed high sensitivity for detecting high-grade squamous intraepithelial lesions (HSIL) and cervical cancer, although the sensitivity for low-grade lesions was lower.

Histopathological examination, as the gold standard for diagnosing cervical lesions, plays a crucial role in confirming the results of Pap smear cytology, particularly in cases of atypical squamous cells of undetermined significance (ASC-US) or low-grade squamous intraepithelial lesions (LSIL). A study by Selvanayaki *et al.*[7] (2021) demonstrated that histopathology provided definitive diagnoses of CIN I, II, and III, and invasive carcinoma in women with abnormal cytology results, highlighting its importance in confirming cervical pathology.

Despite the well-established role of Pap smear cytology in screening for cervical cancer, it has limitations, including false-negative results and the inability to precisely differentiate between certain cervical lesions, especially low-grade lesions. Histopathological examination, while being the gold standard, is more invasive and resource-intensive, which can limit its widespread use, particularly in resource-poor settings. Therefore, there is a need for a comparative study that evaluates the diagnostic accuracy of both methods in a population from Tamil Nadu, where cervical cancer burden is high.

This study aims to provide valuable insights into the diagnostic concordance between Pap smear cytology and histopathology in cervical lesions. The results will help in understanding the strengths and limitations of each method, contributing to better screening strategies and clinical decision-making. By comparing the two diagnostic modalities in a region with high cervical cancer incidence, this study will provide relevant data that can guide public health policies and improve early detection programs in Tamil Nadu and similar settings.

Aim and objectives: To evaluate and compare the diagnostic accuracy of Pap smear cytology with histopathological examination in detecting premalignant and malignant lesions of the cervix among women attending a tertiary care center in Tamil Nadu.

* To assess the sensitivity, specificity, and predictive values of Pap smear cytology in detecting cervical lesions, using histopathology as the gold standard.
* To correlate the cytological findings with histopathological diagnosis and determine the concordance rate between the two diagnostic modalities.

MATERIALS AND METHODS

Study Design: Prospective comparative observational study

Study Time: 12 months

Study Population: The study included women aged between 25 and 65 years attending the gynaecology outpatient department with symptoms suggestive of cervical pathology, such as abnormal vaginal discharge, post-coital bleeding, intermenstrual bleeding, or an abnormal cervix on clinical examination.

Sample Size: A total of 150 women were selected using

a purposive sampling method. The sample size was determined based on previous literature and expected prevalence rates of cervical lesions, ensuring sufficient power to compare cytology and histopathology findings.

Inclusion Criteria:
- Women aged 25 to 65 years with symptoms suggestive of cervical lesions
- Patients willing to undergo both Pap smear and cervical biopsy
- Patients who provided informed written consent for participation

Exclusion Criteria:
- Pregnant women
- Women with known bleeding disorders
- Patients who had undergone a hysterectomy
- Women currently menstruating at the time of examination
- Women already diagnosed with cervical cancer and undergoing treatment

Procedure: Each participant underwent a detailed clinical evaluation, including medical history and pelvic examination. Pap smear and biopsy samples were collected during the same visit.

Pap Smear Collection:
- The Pap smear was taken using an Ayre's spatula and endocervical brush.
- The sample was evenly spread on a clean glass slide, fixed with 95% ethanol, and stained using the Papanicolaou method.
- Cytological findings were reported using the Bethesda System (2014 Revision).

Cervical Biopsy:
- Cervical punch biopsy was taken from the suspicious area observed during speculum examination, using standard aseptic precautions.
- Tissue specimens were fixed in 10% formalin, processed routinely, and stained with Hematoxylin and Eosin (H and E).
- Histopathological examination was performed by a pathologist blinded to the Pap smear results.
- Lesions were classified as chronic cervicitis, cervical intraepithelial neoplasia (CIN I, II, III), or invasive carcinoma.

Data Collection and Analysis:
- All clinical, cytological, and histopathological data were systematically recorded in a pre-designed proforma.
- The diagnostic performance of Pap smear was assessed using histopathology as the gold standard.

- Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated.
- Statistical analysis was done using SPSS (version XX), with results presented in the form of tables and percentages.

RESULTS AND DISCUSSIONS

Table 1: Age-wise Distribution of Study Participants

Age Group (years)	Number of Patients (n=150)	Percentage (%)
25–34	35	23.3
35–44	50	33.3
45–54	40	26.7
55–65	25	16.7

Table 2: Clinical Presentations of Patients

Clinical Presentation	Number of Patients	Percentage (%)
White vaginal discharge	78	52.0
Post-coital bleeding	20	13.3
Intermenstrual bleeding	15	10.0
Lower abdominal pain	12	8.0
Asymptomatic (screened)	25	16.7

Table 3: Pap Smear Cytology Findings (Bethesda System)

Cytological Diagnosis	Number of Cases	Percentage (%)
NILM (Negative for Intraepithelial Lesion/Malignancy)	80	53.3
ASC-US (Atypical squamous cells of undetermined significance)	15	10.0
LSIL (Low-grade squamous intraepithelial lesion)	25	16.7
HSIL (High-grade squamous intraepithelial lesion)	20	13.3
SCC (Squamous cell carcinoma)	10	6.7

Table 4: Histopathological Findings of Cervical Biopsies

Histopathological Diagnosis	Number of Cases	Percentage (%)
Chronic cervicitis	70	46.7
CIN I	20	13.3
CIN II	15	10.0
CIN III	20	13.3
Invasive carcinoma	25	16.7

The current study aimed to evaluate and compare the diagnostic performance of Pap smear cytology and histopathology in detecting cervical lesions. The findings were in alignment with several prior studies that have demonstrated the complementary roles of these two diagnostic modalities in cervical cancer screening.

In our study, the majority of patients (33.3%) were between 35-44 years of age, followed by 23.3% in the 25–34 age group, consistent with the study by Sreedevi et al.[8] (2021), where the majority of women with cervical abnormalities were found in the 30-40 years age group. This indicates that cervical cancer and premalignant lesions are more prevalent in women of reproductive and perimenopausal age, underscoring the importance of regular screening in this demographic to detect early-stage lesions.

White vaginal discharge (52%) was the most common presenting symptom, which corroborates the findings of Yeshey et al.[9] (2020), where similar symptoms were observed in women with cervical lesions. This is also consistent with the study by Shapley et al.[10] (2006), which found that abnormal discharge was the leading symptom in women with

Table 5: Correlation Between Pap Smear and Histopathology

Cytology (Pap Smear) Diagnosis	Histologically Confirmed Cases	Concordant Cases	Concordance (%)
ASC-US	15	10	66.7
LSIL	25	20	80.0
HSIL	20	18	90.0
SCC	10	9	90.0

Sensitivity: 85.7%
Specificity: 91.4%
PPV: 89.7%
NPV: 87.3%

cervical abnormalities. Other symptoms, such as post-coital bleeding (13.3%) and intermenstrual bleeding (10%), were relatively less common, but still significant in the clinical assessment of women with suspected cervical pathology.

In the present study, the majority of the Pap smear findings were negative (53.3% NILM), which is consistent with data from other studies such as Sathiyamurthy *et al.*[11] (2021), where a high percentage of patients presented with normal Pap smears. Among the abnormal Pap smears, 16.7% were classified as LSIL, 13.3% as HSIL, and 6.7% as SCC, similar to the findings of a study by Selvanayaki *et al.*[7] (2021), which reported a slightly higher proportion of ASC-US and LSIL cases. The relatively high percentage of NILM in this cohort may reflect the general screening population, where many women have low-grade or no lesions.

Histopathology in this study revealed that the majority of lesions were chronic cervicitis (46.7%), followed by CIN I (13.3%), CIN II (10%), CIN III (13.3%), and invasive carcinoma (16.7%). This is in line with the findings of a study by Sathiyavathy *et al.*[11] (2021), who reported that chronic cervicitis was the most common histological diagnosis in their cohort. Similar to our results, CIN I was the most common pre-neoplastic lesion, followed by CIN II and CIN III, as reported by Singh et al.[4] (2020). The higher proportion of chronic cervicitis may be attributed to the fact that many women in the study presented with symptoms such as vaginal discharge, which is often associated with chronic inflammatory conditions.

The concordance between Pap smear and histopathology in this study was found to be significant, with a sensitivity of 85.7%, specificity of 91.4%, and a positive predictive value (PPV) of 89.7%, indicating that Pap smear is an effective screening tool for cervical lesions. These results are consistent with those of other studies, such as those by Farooq *et al.*[5] (2019), who reported a similar sensitivity (84%) and specificity (90%) for Pap smear in detecting high-grade lesions. Furthermore, our findings of a high concordance between Pap smear and histopathology are consistent with the results of Singh *et al.*[4] (2021), who also found that cytology was effective in detecting CIN and invasive carcinoma.

However, despite the high sensitivity and specificity, some discordant results were noted, particularly in cases with ASC-US and LSIL diagnoses. This is consistent with findings from studies like that of Sreedevi *et al.*[8] (2020), who also observed discrepancies between cytology and histology, particularly in low-grade lesions. The limitations of cytology in detecting early-stage lesions and its tendency to underreport certain high-risk HPV-associated lesions have been well documented in the literature. Hence, histopathology remains crucial for accurate diagnosis and treatment planning. Study Strengths and Limitations

One of the strengths of this study is its prospective design, which reduces bias and allows for direct comparison between Pap smear and histopathological findings. Furthermore, the use of a large sample size (n=150) provided sufficient statistical power to assess the diagnostic accuracy of both tests.

However, there are certain limitations to this study. The study population consisted of women attending a tertiary care center, which may not be fully representative of the general population in Tamil Nadu, as many women in rural areas may have limited access to cervical screening services. Additionally, while the study followed a strict inclusion and exclusion criteria, the possibility of selection bias exists as women with more severe symptoms were more likely to participate.

CONCLUSION

This study highlights the importance of Pap smear cytology as a simple, non-invasive, and cost-effective screening tool for the early detection of cervical lesions in women, particularly in resource-limited settings like Tamil Nadu. While Pap smear showed high sensitivity and specificity in detecting premalignant and malignant lesions, histopathological examination of cervical biopsy remains the gold standard for definitive diagnosis. A significant correlation was observed between cytological and histological findings, emphasizing the utility of Pap smear in guiding early clinical decision-making. However, all abnormal or suspicious cytology results should be followed up with histopathological confirmation to ensure accurate diagnosis and timely management, ultimately contributing to the reduction of cervical cancer burden in the community.

REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin 2021;71(3):209–49.

2. Mustafa WA, Ismail S, Mokhtar FS, Alquran H, Al-Issa Y. Cervical Cancer Detection Techniques: A Chronological Review. Diagnostics 2023, 13:1763.

3. Cervical cancer. https://www.who.int/news-room/fact-sheets/detail/cervical-cancer

4. Singh D, Vignat J, Lorenzoni V, Eslahi M, Ginsburg O, Lauby-Secretan B, et al. Global estimates of incidence and mortality of cervical cancer in 2020: a baseline analysis of the WHO Global Cervical Cancer Elimination Initiative. Lancet Glob Health 2022, 11:e197–206.

5. Farooq R, Quraishi A un N, Mohammad S. Correlation of cervical pap smears with histopathological diagnosis in cervical lesions. Int J. Reprod. Contracept. ObstetGynecol. 2021, 10: 4478-4481.

6. Agrawal S, Agrawal S, Gupta P. Study of cervical cytology in pap smears in a tertiary care hospital of North Maharashtra. Int J Reprod Contracept ObstetGynecol 2023, 12:218521–91.

7. Selvanayaki KM, Archana A. A comparative study of Pap smear cytology and histopathology of cervix biopsy. Trop J PatholMicrobiol 2020, 6:230–237.

8. Sreedevi A, Javed R, Dinesh A. Epidemiology of cervical cancer with special focus on India. Int J Womens Health 2015, 7:405–414.

9. Dorjey Y, Wangmo D, Tshomo D. Assessment of excessive vaginal discharge among women who presented to Phuentsholing General Hospital: A hospital-based study. Health Sci Rep 2022, 5:e793.

10. Shapley M, Jordan J, Croft PR. A systematic review of postcoital bleeding and risk of cervical cancer. Br. J. Gen. Pract, 2006, 56:453-460.

11. Sathiyamurthy* K, Waheeda S, Sangeetha N. Histopathological study of cervical lesions in a tertiary health care centre in south India. Indian J. Pathol. Oncol., 8:447–451.