



Original Article

Diagnostic Accuracy of Colposcopy and Colposcopy-Guided Cervical Biopsy Among Women Aged More Than 30 Years With Abnormal Pap Smear

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ABSTRACT

Background: Cervical cancer is one of the leading causes of cancer-related morbidity and mortality among women, especially in developing countries. Early detection through effective screening and diagnostic methods is essential to reduce disease burden.

Objectives: To evaluate the diagnostic accuracy of colposcopy and colposcopy-guided cervical biopsy among women aged more than 30 years with abnormal Pap smear, and to compare it with Pap smear findings.

Materials and Methods: This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Kodagu Institute of Medical Sciences, Madikeri, over a period of 12 months (February 2024 to February 2025). A total of 85 women aged >30 years with symptoms suggestive of cervical pathology were included. Pap smear was performed for all participants, followed by colposcopy in abnormal cases, and colposcopy-guided biopsy for histopathological confirmation. Data were analysed using SPSS version 23, and diagnostic parameters such as sensitivity, specificity, PPV, NPV, and accuracy were calculated.

Results: The mean age of participants was 42.5 ± 7.3 years. The most common symptom was persistent vaginal discharge (37.6%). On Pap smear, inflammatory smears (28.2%) were the most frequent finding. Colposcopy commonly showed atypical vessels (29.4%). Histopathology revealed normal findings in 47.1% and CIN3 in 11.8% of cases. The sensitivity and specificity of Pap smear were 71.1% and 70.0%, respectively, whereas colposcopy showed higher sensitivity (88.9%) and specificity (85.0%). The overall diagnostic accuracy of colposcopy (87.1%) was significantly higher than that of Pap smear (70.6%).

Conclusion: Colposcopy with guided biopsy is a more accurate diagnostic modality than Pap smear for detecting cervical lesions. A combined approach of Pap smear screening followed by colposcopy is recommended for early diagnosis and better management of cervical cancer.

Keywords: Cervical cancer, Pap smear, Colposcopy, Cervical biopsy, Diagnostic accuracy.

INTRODUCTION

Cervical cancer remains a major public health problem worldwide, particularly in low- and middle-income countries. It is the fourth most common cancer among women globally, with a significant burden in developing nations due to lack of organized screening programs and limited awareness [1]. In India, cervical cancer is one of the leading causes of cancer-related morbidity and mortality among women, accounting for a substantial proportion of gynecological cancers [2].

Persistent infection with high-risk human papillomavirus (HPV) is recognized as the primary etiological factor in the development of cervical cancer. The progression from HPV infection to cervical intraepithelial neoplasia (CIN) and eventually invasive carcinoma is typically slow, providing a wide window for early detection and intervention [3].

Screening plays a crucial role in reducing the incidence and mortality associated with cervical cancer. The Papanicolaou (Pap) smear is a widely used, cost-effective screening tool that helps in detecting premalignant and malignant lesions of the cervix. However, despite its advantages, Pap smear has limitations such as false-negative results and variable sensitivity, which may lead to missed diagnoses [4].

Colposcopy is an important diagnostic procedure used for the evaluation of women with abnormal Pap smear results. It allows direct visualization of the cervix under magnification and helps identify suspicious areas for targeted biopsy. Colposcopy, when combined with biopsy, is considered the gold standard for the diagnosis of cervical lesions [5].

Colposcopy-guided cervical biopsy enhances diagnostic accuracy by enabling histopathological confirmation of lesions. It plays a vital role in differentiating benign, premalignant, and malignant conditions, thereby guiding appropriate management [6].

Despite the availability of these diagnostic modalities, there remains variability in their diagnostic performance. Evaluating and comparing the sensitivity, specificity, and overall accuracy of Pap smear and colposcopy is essential for optimizing screening strategies, especially in resource-limited settings [7].

Therefore, the present study was undertaken to assess the diagnostic accuracy of colposcopy and colposcopy-guided cervical biopsy among women aged more than 30 years with abnormal Pap smear, and to compare its effectiveness with Pap smear in detecting cervical lesions.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of Obstetrics and Gynaecology at Kodagu Institute of Medical Sciences (KoIMS), Madikeri.

Study Period

The study was conducted over a period of 12 months, from February 2024 to February 2025.

Study Population

The study included all women aged more than 30 years who attended the outpatient department (OPD) or were admitted with suspected cervical cancer.

Inclusion Criteria

Women were included if they were aged >30 years and presented with one or more of the following symptoms:

- White discharge per vagina
- Post-coital bleeding
- Inter-menstrual bleeding
- Post-menopausal bleeding

Exclusion Criteria

Women were excluded if they had:

- Acute cervical infections
- History of previously treated premalignant lesions or cervical cancer
- History of any other malignancy
- Pregnancy

Sampling Technique

A convenience sampling method was used to recruit study participants.

Sample Size Calculation

The sample size was calculated based on the prevalence of cervical carcinoma in India, which is 4.6%.

$$n = \frac{Z^2 \times p \times (100 - p)}{d^2}$$

Where:

- $Z = 1.96$ (standard normal variate at 95% confidence interval)
- $p = 4.6\%$ (prevalence)

- $d = 5\%$ (allowable error)

The calculated sample size was 67.23, which was increased by 25% to account for attrition, resulting in a final sample size of 85 women.

Ethical Considerations

The study was initiated after obtaining approval from the Institutional Scientific Committee and the Institutional Ethics Committee of KolMS, Madikeri. Informed consent was obtained from all participants prior to inclusion in the study.

Data Collection

A detailed history including demographic characteristics, obstetric history, and clinical presentation was recorded using a structured proforma.

Pap Smear Procedure

Pap smear samples were collected using an Ayre's spatula and Cytobrush from the squamocolumnar junction of the cervix. The collected material was evenly spread onto a glass slide and immediately fixed using cytofix (95% ethyl alcohol with carbowax).

The slides were stained using the Papanicolaou (Pap) stain and interpreted according to the Bethesda System. Patients with abnormal Pap smear findings were advised to undergo colposcopic evaluation.

Colposcopy and Biopsy

Colposcopic examination was performed using a video colposcope. The cervix was first cleaned with normal saline to remove mucus. A green filter was used to assess vascular patterns. Then, 3% acetic acid was applied to identify abnormal areas in the transformation zone.

Directed biopsies were taken from suspicious areas using punch biopsy forceps. Biopsy specimens were fixed in 10% formalin, processed, and stained with hematoxylin and eosin (H&E). Histopathological findings were classified according to WHO guidelines.

Statistical Analysis

Data were entered in Microsoft Excel 2021 and analyzed using SPSS version 23.

Quantitative variables were expressed as mean \pm standard deviation (SD), while qualitative variables were presented as frequencies and percentages.

The Chi-square test was used to assess associations between categorical variables. Diagnostic parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated for Pap smear and colposcopy.

A p-value < 0.05 was considered statistically significant.

Interventions Performed in the Study

The study involved Pap smear collection, followed by colposcopy in patients with abnormal results, and cervical biopsy for histopathological confirmation.

RESULT AND OBSERVATIONS

TABLE:1 DISTRIBUTION OF AGE, AGE GROUPS, AND PARITY (N = 85)

Variable	Category	Frequency (N)	Percentage (%)	Mean \pm SD / Range
Age (years)	—	85	—	42.5 \pm 7.3
	Minimum	—	—	31.0
	Maximum	—	—	55.0
Age Groups	31–40 years	38	44.7	—
	41–50 years	28	32.9	—
	51–60 years	19	22.4	—
Parity	0	17	20.0	—
	1	26	30.6	—
	2	15	17.6	—
	3	27	31.8	—

The mean age of study participants was 42.5 \pm 7.3 years (range: 31–55 years). The majority belonged to the 31–40 years age group (44.7%), followed by 41–50 years (32.9%) and 51–60 years (22.4%).

Regarding parity, most participants had parity 3 (31.8%), followed by parity 1 (30.6%), parity 0 (20.0%), and parity 2 (17.6%).

TABLE: 2 DISTRIBUTIONS OF SOCIOECONOMIC STATUS AND EDUCATION (N = 85)

Variable	Category	Frequency (N)	Percentage (%)
Socioeconomic Status	Lower class	30	35.3
	Middle class	29	34.1
	Upper class	26	30.6
Education Status	10th Class	16	18.8
	12th Class	24	28.2
	Bachelors	33	38.8
	Masters	10	11.8
	Ph.D	2	2.4

TABLE: 3 DISTRIBUTION OF OCP USE, MENOPAUSAL STATUS, AND CLINICAL FEATURES (N = 85)

Variable	Category	Frequency (N)	Percentage (%)
OCP Use	No	69	81.2
	Yes	16	18.8
Menopausal Status	Premenopausal	55	64.7
	Postmenopausal	30	35.3
Clinical Features	Persistent vaginal discharge	32	37.6
	Abnormal bleeding	21	24.7
	Postcoital bleeding	20	23.5
	Postmenopausal bleeding	12	14.1

Most participants did not use OCPs (81.2%), while 18.8% reported usage. A majority were premenopausal (64.7%), compared to 35.3% postmenopausal.

Regarding clinical presentation, persistent vaginal discharge (37.6%) was the most common symptom, followed by abnormal bleeding (24.7%), postcoital bleeding (23.5%), and postmenopausal bleeding (14.1%).

TABLE: 4 DISTRIBUTION OF PAP SMEAR RESULTS AND COLPOSCOPY FINDINGS (N = 85)

Variable	Category	Frequency (N)	Percentage (%)
Pap Smear Results	Inflammatory smear	24	28.2
	ASC-US	16	18.8
	AGC	12	14.1
	ASC-H	12	14.1
	LSIL	11	12.9
	HSIL	10	11.1
Colposcopy Findings	Normal	17	20.0
	Mosaic	22	25.9
	Punctuation	21	24.7
	Atypical vessels	25	29.4

On Pap smear evaluation, inflammatory smears (28.2%) were the most common finding, followed by ASC-US (18.8%). HSIL was observed in 11.1% of cases.

On colposcopy, atypical vessels (29.4%) were the most frequent finding, followed by mosaic pattern (25.9%) and punctuation (24.7%), while 20.0% showed normal findings

TABLE: 5 DISTRIBUTION OF BIOPSY RESULTS, FINAL DIAGNOSIS, AND DIAGNOSTIC ACCURACY (N = 85)

Variable	Category	Frequency (N)	Percentage (%)
Biopsy Results	Normal	40	47.1
	CIN3	10	11.8
	Carcinoma in situ	9	10.6
	Chronic cervicitis	9	10.6
	CIN2	7	8.2
	Benign	5	5.9

	CIN1	5	5.9
Final Diagnosis	Normal	40	47.1
	CIN3	10	11.8
	Carcinoma in situ	9	10.6
	Chronic cervicitis	9	10.6
	CIN2	7	8.2
	Benign	5	5.9
	CIN1	5	5.9

TABLE 6: COMPARISON OF DIAGNOSTIC ACCURACY OF PAP SMEAR AND COLPOSCOPY

Diagnostic Parameter	Pap Smear (%)	Colposcopy (%)
Sensitivity (Sn)	71.1	88.9
Specificity (Sp)	70.0	85.0
Positive Predictive Value (PPV)	72.7	87.0
Negative Predictive Value (NPV)	68.3	87.2
Diagnostic Accuracy	70.6	87.1

DISCUSSION

Cervical cancer continues to be a significant health burden in developing countries like India, where effective screening and early detection strategies are crucial. The present study evaluated the diagnostic accuracy of Pap smear and colposcopy with colposcopy-guided biopsy in women aged more than 30 years presenting with symptoms suggestive of cervical pathology.

In the present study, the mean age of participants was 42.5 ± 7.3 years, with the majority belonging to the 31–40 years age group (44.7%). This finding is comparable to studies by Bhatla et al. and Arbyn et al., which also reported a higher prevalence of cervical lesions among women in the fourth decade of life [8,9]. This age distribution reflects the natural history of HPV infection progressing to precancerous lesions over time.

Parity has been identified as an important risk factor for cervical cancer. In our study, the majority of women had multiparity (parity ≥ 3), which is consistent with findings from previous studies that reported increased risk of cervical neoplasia with higher parity due to prolonged hormonal exposure and cervical trauma during childbirth [10].

Socioeconomic and educational status also influence the incidence of cervical cancer. In the present study, most women belonged to the lower and middle socioeconomic classes, and a significant proportion had education up to the bachelor level. Lower socioeconomic status has been associated with poor access to screening and healthcare services, leading to delayed diagnosis [11].

Regarding clinical presentation, persistent vaginal discharge (37.6%) was the most common symptom, followed by abnormal bleeding and postcoital bleeding. Similar findings have been reported in other studies, where vaginal discharge and abnormal bleeding were the predominant presenting complaints in women with cervical lesions [12].

On Pap smear evaluation, inflammatory smears (28.2%) were the most common finding, followed by ASC-US and epithelial abnormalities. Although Pap smear is an effective screening tool, its sensitivity is variable. In the present study, the sensitivity and specificity of Pap smear were 71.1% and 70.0%, respectively, which is comparable to previous studies reporting moderate sensitivity but high specificity [13].

Colposcopy findings in this study showed that atypical vascular patterns (29.4%) were the most common, followed by mosaic and punctation patterns. These findings are consistent with established colposcopic features of cervical intraepithelial neoplasia described in earlier studies [14].

Colposcopy demonstrated higher diagnostic performance in the present study, with sensitivity of 88.9% and specificity of 85.0%, which is significantly better than Pap smear. Similar results have been reported by studies conducted by Sankaranarayanan et al., which highlighted the superior sensitivity of colposcopy in detecting high-grade lesions [15].

Histopathological examination remains the gold standard for diagnosis. In this study, 47.1% of cases were reported as normal, while CIN3 (11.8%) was the most common high-grade lesion identified. The distribution of CIN lesions in this study is comparable with previous literature, which indicates a gradual increase in detection of higher-grade lesions with improved diagnostic methods [16].

The comparison of diagnostic accuracy revealed that colposcopy (87.1%) was significantly more accurate than Pap smear (70.6%). Additionally, colposcopy showed higher PPV (87.0%) and NPV (87.2%), indicating better reliability in both

ruling in and ruling out disease. These findings are in agreement with other studies that emphasize the importance of colposcopy as a diagnostic tool following abnormal cytology [17].

Overall, the findings of this study reinforce that while Pap smear remains an essential screening modality, colposcopy with guided biopsy provides superior diagnostic accuracy and should be considered for definitive evaluation in women with abnormal cytology. Early detection through combined screening approaches can significantly reduce the burden of cervical cancer.

CONCLUSION

Colposcopy with colposcopy-guided biopsy showed higher diagnostic accuracy compared to Pap smear in detecting cervical lesions. While Pap smear remains an important screening tool, colposcopy is more reliable for definitive evaluation of abnormal findings.

Thus, a combined approach of Pap smear followed by colposcopy is recommended for early detection and effective management of cervical cancer.

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