Original Article

Colposcopic Evaluation of an Unhealthy Cervix and Its Correlation with Biopsy in the Sub-Divisional Hospital Gangavathi

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Abstract

Background: Cervical cancer is largely preventable through early detection and management of premalignant lesions. The objective is to evaluate colposcopic findings in women with an unhealthy cervix and determine their correlation with cervical biopsy findings at Sub-Divisional Hospital, Gangavathi. **Material and Methods:** This prospective observational study was conducted among 217 women aged 20–60 years presenting with abnormal symptoms or clinically unhealthy cervix. Eligible participants underwent clinical examination, Pap smear, colposcopic evaluation, and colposcopy-directed cervical biopsy where indicated. Diagnostic accuracy of Pap smear and colposcopy was calculated using cervical biopsy as the reference standard. **Results:** Pap smear showed sensitivity of 18.39%, specificity of 100%, PPV of 100%, NPV of 2.81%, and accuracy of 20.28% compared with cervical biopsy. Colposcopy showed higher sensitivity of 56.60%, specificity of 100%, PPV of 100%, NPV of 5.16%, and accuracy of 57.60%. For detection of premalignant/malignant lesions, colposcopy demonstrated sensitivity of 69.23%, specificity of 100%, PPV of 100%, NPV of 98.08%, and accuracy of 98.16%. **Conclusion:** Colposcopy showed better diagnostic performance than Pap smear and correlated significantly with cervical biopsy findings. Colposcopy-directed biopsy is essential for accurate diagnosis of premalignant and malignant cervical lesions in women with an unhealthy cervix.

Keywords: Unhealthy cervix, colposcopy, cervical biopsy, Pap smear, cervical intraepithelial neoplasia, cervical cancer.

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Introduction

Cervical cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide despite being largely preventable through effective screening and early intervention.[1] According to GLOBOCAN 2022, cervical cancer is the fourth most common cancer among women globally, with approximately 662,301 new cases and 348,874 deaths reported annually.[2] More than 90% of these deaths occur in low- and middle-income countries where organized screening programs and timely treatment are limited. Early identification and management of premalignant cervical lesions significantly reduce the incidence of invasive cervical cancer and improve patient survival.[3] In India, cervical cancer is the second most common cancer among women and remains an important public health concern.[4] It accounts for approximately 127,000 new cases and over 79,000 deaths each year, representing nearly one-fifth of the global cervical cancer burden. The high prevalence is attributed to poor awareness, inadequate screening, low socioeconomic status, early marriage, multiparity, and persistent infection with high-risk human papillomavirus (HPV).[5] Women residing in rural areas often present late because of limited access to healthcare facilities and cervical cancer screening services.[6] An unhealthy cervix is a common finding during routine gynecological examination and includes abnormalities such as cervical erosion (ectropion), chronic cervicitis, hypertrophied cervix, cervical polyps, nabothian cysts, contact bleeding, ulcerative lesions, leukoplakia, suspicious growths, and abnormal vascular patterns.[7] Although many of these lesions are benign and inflammatory, they may also represent cervical intraepithelial neoplasia (CIN) or early invasive cervical carcinoma.[8] Since visual examination alone cannot reliably differentiate benign from premalignant lesions, further diagnostic evaluation is essential. Persistent infection with oncogenic HPV types, particularly HPV-16 and HPV-18, is the principal etiological factor for cervical carcinogenesis.[9] Additional risk factors include early age at marriage, early initiation of sexual activity, multiple sexual partners, multiparity, prolonged oral contraceptive use, smoking, immunosuppression, poor genital hygiene, and low socioeconomic status. These factors contribute to chronic cervical inflammation and progressive epithelial dysplasia, making early screening imperative.[10]

Colposcopy is considered one of the most valuable diagnostic

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tools for evaluating women with an unhealthy cervix.[11] It enables magnified visualization of the transformation zone after application of 3–5% acetic acid and Lugol's iodine, allowing identification of acetowhite epithelium, mosaic pattern, punctation, atypical vascularity, and other features suggestive of cervical intraepithelial neoplasia. Furthermore, colposcopy facilitates directed cervical biopsy from the most suspicious areas, thereby improving diagnostic accuracy and reducing sampling error.[12] Histopathological examination of colposcopy-directed biopsy specimens remains the gold standard for confirming cervical intraepithelial neoplasia and invasive cervical cancer. While colposcopy provides visual assessment of cervical abnormalities, biopsy establishes the definitive diagnosis by demonstrating the degree of epithelial dysplasia or malignancy.[13] Therefore, correlating colposcopic impressions with histopathological findings is essential for determining the diagnostic performance of colposcopy and guiding appropriate clinical management.[14] Several international studies have reported high sensitivity of colposcopy for detecting high-grade cervical lesions, although its specificity varies depending on the experience of the examiner and the grading system used. Studies have demonstrated that colposcopy-directed biopsy significantly improves the detection of CIN compared with cytology alone and helps avoid unnecessary treatment in women with benign inflammatory lesions. Accurate correlation between colposcopic findings and histopathology allows better risk stratification and timely intervention.[15]

Objective: To evaluate colposcopic findings in women with an unhealthy cervix and determine their correlation with cervical biopsy findings at Sub-Divisional Hospital, Gangavathi.

Materials and Methods

This was a prospective observational study conducted at----------from----------. A total of 217 women were included in the study. The sample size was estimated based on previously reported sensitivity and specificity of colposcopy, with expected sensitivity of 83%, specificity of 72%, disease prevalence of 14%, precision of 15%, confidence level of 95%, and expected dropout rate of 20%. Systematic random sampling was used. Every third eligible patient fulfilling the inclusion and exclusion criteria was included after obtaining written informed consent. Women aged 20–60 years presenting with abnormal symptoms such as profuse white discharge, postcoital bleeding, intermenstrual bleeding, or postmenopausal bleeding were included. Women with clinically unhealthy cervix diagnosed on speculum examination, including cervical erosion, cervicovaginitis, cervical polyp, condyloma, or suspicious cervical changes, and women with Pap smear showing dysplasia were also included. Women younger than 20 years or older than 60 years, patients with active bleeding at the time of examination, women with frank invasive cervical cancer, women who had undergone total hysterectomy, and pregnant women were excluded from the study.

Colposcopic Evaluation and Biopsy Procedure: Eligible patients were counselled regarding the procedure, and written informed consent was obtained. Detailed history, physical examination, vulval examination, and speculum examination of the cervix and vagina were performed. Colposcopic examination was carried out using a standard colposcope with 5X, 10X, and 20X magnification and an inbuilt green filter. The cervix was first cleaned with normal saline to remove discharge and was examined under illumination. Five percent acetic acid was then applied, and the cervix was assessed for acetowhite areas, surface contour, margins of lesions, punctation, mosaic pattern, abnormal vessels, and transformation zone visibility. The vascular pattern was further assessed using the green filter. Lugol's iodine was then applied to identify iodine-negative areas suggestive of abnormal epithelium.

Colposcopy-directed biopsy was taken from abnormal or suspicious areas using cervical punch biopsy forceps. In homogeneous acetowhite lesions, biopsy was taken from an area near the new squamocolumnar junction because it was more likely to harbor the most significant abnormality. In heterogeneous acetowhite lesions, biopsy was taken from the most suspicious area. In cases where the squamocolumnar junction was not fully visualized, especially among postmenopausal women, endocervical curettage was performed where indicated. Biopsy specimens were preserved in 10% formalin, properly labelled, and sent for histopathological examination. Colposcopic findings were documented in Odell's diagram, and colpophotographs were taken where necessary. The primary outcome was the correlation between colposcopic findings and histopathological findings on colposcopy-directed biopsy. Secondary outcomes included the frequency of CIN lesions detected on colposcopy and biopsy, and the diagnostic accuracy of colposcopy using biopsy as the reference standard.

Data Analysis: Data were entered in Microsoft Excel and analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Diagnostic accuracy of colposcopy was calculated in terms of sensitivity, specificity, positive predictive value, and negative predictive value, taking biopsy findings as the reference standard. A p-value <0.05 was considered statistically significant.

Results

Cervical biopsy identified abnormal findings in 212 (97.7%) participants and normal findings in 5 (2.3%). All 39 women with abnormal Pap smear findings had abnormal biopsy results, whereas among the 178 women with normal Pap smear findings, 173 had abnormal biopsy findings and only 5 had normal biopsy findings. The association between Pap smear and cervical biopsy was not statistically significant (Chi-square = 1.11, p = 0.29). Pap smear demonstrated a sensitivity of 18.39% (95% CI: 13.42%–24.28%) and specificity of 100.00% (95% CI: 47.82%–100.00%).

[Table 2] shows the diagnostic accuracy of colposcopy compared with cervical biopsy. Of the 120 women with abnormal colposcopic findings, all had abnormal biopsy findings, while among the 97 women with normal colposcopy, 92 had abnormal biopsy findings and 5 had normal biopsy findings. The association between colposcopy and cervical biopsy was

statistically significant (Chi-square = 6.30, p = 0.01). Colposcopy demonstrated a sensitivity of 56.60% (95% CI: 49.64%–63.38%) and specificity of 100.00% (95% CI: 47.82%–100.00%).

Table 1: Diagnostic Accuracy of Pap Smear Compared with Cervical Biopsy (n = 217)

Pap smear	Cervical biopsy abnormal	Cervical biopsy normal	Total
Abnormal	39	0	39
Normal	173	5	178
Total	212	5	217
Chi-square test = 1.11, p = 0.29			
Diagnostic parameter	**Value**	**95% CI**	
Sensitivity	18.39%	13.42% to 24.28%	
Specificity	100.00%	47.82% to 100.00%	
Positive predictive value	100.00%	90.98% to 100.00%	
Negative predictive value	2.81%	2.64% to 2.99%	
Accuracy	20.28%	15.14% to 26.25%	
AUC	0.592	0.523 to 0.658	

Table 2: Diagnostic Accuracy of Colposcopy Compared with Cervical Biopsy (n = 217)

Colposcopy	Cervical biopsy abnormal	Cervical biopsy normal	Total
Abnormal	120	0	120
Normal	92	5	97
Total	212	5	217
Chi-square test = 6.30, p = 0.01			
Diagnostic parameter		**Value**	**95% CI**
Sensitivity		56.60%	49.64% to 63.38%
Specificity		100.00%	47.82% to 100.00%
Positive predictive value		100.00%	96.97% to 100.00%
Negative predictive value		5.16%	4.45% to 5.96%
Accuracy		57.60%	50.73% to 64.27%
AUC		0.783	0.722 to 0.836

All 47 biopsy-confirmed benign lesions were correctly identified by colposcopy, while 65 of the 170 non-benign lesions were misclassified as benign and 105 were correctly identified as other lesions. The association between colposcopy and cervical biopsy findings was highly statistically significant (Chi-square = 55.98, p = 0.0001).

Table 3: Diagnostic Accuracy of Colposcopy for Detection of Benign Lesions Compared with Cervical Biopsy (n = 217)

Colposcopy	Cervical biopsy benign	Cervical biopsy other	Total
Benign	47	65	112
Other	0	105	105
Total	47	170	217
Chi-square test = 55.98, p = 0.0001			
Diagnostic parameter		**Value**	**95% CI**
Sensitivity		100.00%	92.45% to 100.00%
Specificity		61.77%	54.01% to 69.10%
Positive predictive value		41.96%	37.40% to 46.68%
Negative predictive value		100.00%	96.55% to 100.00%
Accuracy		70.05%	63.48% to 76.06%
AUC		0.809	0.750 to 0.859

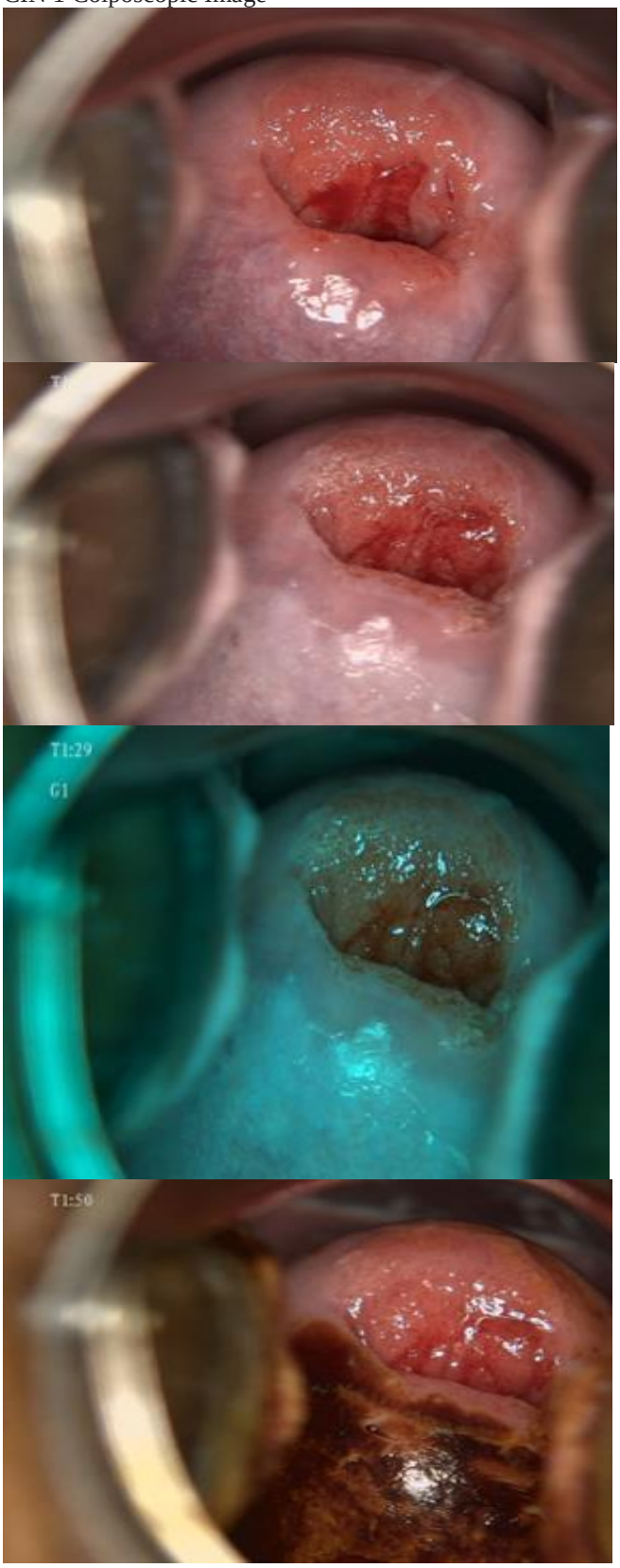
[Table 4] presents the diagnostic accuracy of colposcopy for detecting premalignant and malignant cervical lesions compared with cervical biopsy. Of the 13 biopsy-confirmed premalignant or malignant lesions, colposcopy correctly identified 9 cases, while 4 cases were missed. None of the 204 women without premalignant or malignant lesions were incorrectly classified as positive by colposcopy. The association between colposcopy and cervical biopsy was highly statistically significant (Chi-square = 146.6, p = 0.0001).

Table 4: Diagnostic Accuracy of Colposcopy for Detection of Premalignant/Malignant Lesions Compared with Cervical Biopsy (n = 217)

Colposcopy	Cervical biopsy premalignant/malignant	Cervical biopsy other	Total
Premalignant/Malignant	9	0	9
Other	4	204	208
Total	13	204	217
Chi-square test = 146.6, p = 0.0001			
Diagnostic parameter		**Value**	**95% CI**
Sensitivity		69.23%	38.57% to 90.91%
Specificity		100.00%	98.21% to 100.00%
Positive predictive value		100.00%	66.37% to 100.00%

Negative predictive value	98.08%	95.76% to 99.14%
Accuracy	98.16%	95.35% to 99.50%
AUC	0.846	0.791 to 0.891

CIN 1 Colposcopic Image



Colposcopic Image # Growth on the Cervix

Discussion

The aim of the present prospective observational study was to assess the diagnostic usefulness of colposcopy in women with an unhealthy cervix and to compare its results with the histopathology of the cervical biopsy, considered as the gold standard. Colposcopy was shown to have a high diagnostic yield over Pap smear, especially in the diagnosis of CIN and premalignant lesions. Histopathological examination revealed cervical abnormalities in most of the women, underlining the need for biopsy to make a definite diagnosis. The mean age of the study population was 34.88 ± 7.86 years; almost half of the sample consisted of the age group 31-40 years (45.2%). These age distributions have been reported in other studies as well, where the largest proportion of patients undergoing colposcopy were women in their third and fourth decades. The age group is believed to be at high risk since during the reproductive years persistent HPV infection, multiparity and chronic cervical inflammation predisposes to cervical dysplasia.[16]

The majority of participants were uneducated (63.1%) and lower socio-economic status (61.8%). Previous studies have consistently shown that women with poor educational level and low socioeconomic status have less awareness about cervical cancer screening and prevention. Chronic cervical lesions and premalignant disease are more prevalent among these populations due to limited access to screening services, poor genital hygiene and delayed health care seeking.[17] Participants' reproductive history also showed known risk factors for cervical disease. The mean age at marriage was 18.72 ± 2.94 years, and the mean age at first delivery was 21.49 ± 2.82 years. Over three-quarters (77.4%) had been married before age 20 and about 80% had two to four children. In the past, early marriage, early sexual activity, multiparity and repeated cervical trauma due to childbirth have also been reported as factors associated with chronic infection with HPV and persistent cervical epithelial dysplasia.[18]

88.5% of participants described white discharge as their presenting symptom, compared with intermenstrual bleeding (7.4%), dyspareunia with abdominal pain (3.2%) and postcoital bleeding (0.9%). Studies have reported the most common symptom to be vaginal discharge. While many of these symptoms are associated with inflammatory conditions there is a significant number of people who experience persistent vaginal discharge which may also be associated with a premalignant cervical lesion which warrants detailed assessment. Clinical examination revealed that cervical erosion was seen in 47.93% of the women, while the hypertrophied cervix was seen in 21.66% of women.[19] This observation is in line with previous studies that have found cervical erosion and chronic cervicitis to be the most frequent abnormalities found by speculum examination. A visual examination, however, is not a reliable way to differentiate between benign inflammatory lesions and cervical intraepithelial neoplasia and thus a colposcopy is necessary. The comparison study of Pap smear with cervical biopsy was one of the main findings of the present study. The pap smear result revealed only a 18.39% sensitivity and 100% specificity, resulting in a diagnostic accuracy rate of 20.28%. Although every abnormal Pap smear correctly predicted abnormal biopsy findings (PPV 100%), the extremely low sensitivity indicated that a large number of abnormal cervical lesions were missed when Pap smear was used alone.[20,21] Conventional pap smear has also been found to be relatively insensitive in previous studies, primarily due to poor sampling, inflammatory change and observer-dependent interpretation. These results indicate that although pap smear is an excellent screening test, it is not enough to be used in a stand-alone approach in symptomatic women. Histopathological evaluation is still the "gold standard" for the diagnosis of cervical epithelial defects. The present study confirms the benefits of biopsy in giving a definite diagnosis of the severity of the disease and distinguish the inflammatory changes, benign lesions, CIN and invasive carcinoma. Histopathology is essential before starting definitive treatment; colposcopy will also be useful in the detection of suspicious lesions. It has been consistently reported in the literature that the use of a colposcopy-guided biopsy greatly enhances the accuracy of diagnosis and decreases underdiagnosis and overtreatment. The results of the current study have several clinical implications. If the Pap smear is normal, but a woman complains of persistent discharge, erosion of her cervical tissue, bleeding when touching the cervix, or cervix that appears to be unhealthy, she should have a colposcopy anyway. Pap test alone is not as sensitive to detect high-grade abnormal cells, which may lead to misdiagnosis. The use of colposcopy and biopsy in the diagnostic pathway can significantly enhance early detection of CIN and enable prompt interventions before a cancer develops.

Conclusion

It is concluded that colposcopy is an effective diagnostic tool for evaluating women with an unhealthy cervix and shows good correlation with cervical biopsy findings. Compared with Pap smear, colposcopy demonstrated better sensitivity, diagnostic accuracy, and ability to detect premalignant and malignant cervical lesions. Although Pap smear showed high specificity, its low sensitivity indicates that many abnormal cervical lesions may be missed if it is used alone. Colposcopy-directed biopsy remains essential for definitive diagnosis, as histopathology confirms the nature and severity of cervical lesions. Therefore, women presenting with an unhealthy cervix should undergo colposcopic evaluation with biopsy from suspicious areas to ensure early detection and timely management of cervical intraepithelial neoplasia and to reduce the risk of progression to cervical cancer.

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Conflicts of interest

There are no conflicts of interest.

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