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Original Research Article

Colposcopic Evaluation of Clinically Unhealthy Cervix and Its Correlation with Histopathological Findings

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Abstract

Background: A clinically unhealthy cervix may be associated with benign inflammatory conditions as well as cervical intraepithelial neoplasia (CIN) and invasive carcinoma. Colposcopy provides magnified assessment of cervical abnormalities and facilitates targeted biopsy, while histopathology remains the definitive diagnostic method. This study evaluated colposcopic findings and their correlation with histopathological diagnoses among women with a clinically unhealthy cervix. ***Methods:*** This prospective observational study was conducted in the Department of Obstetrics and Gynecology, Dhaka Medical College Hospital, Bangladesh, from January to June 2026. A total of 150 women with a clinically unhealthy cervix were enrolled. All participants underwent clinical examination, colposcopic evaluation, and colposcopy-directed cervical biopsy. Histopathological findings were considered the reference standard. The diagnostic performance of colposcopy for detecting CIN 2+ was assessed, and agreement between colposcopic impression and histopathological diagnosis was evaluated using Cohen's kappa. ***Results:*** The mean age was 44.1±10.2 years, and 31.3% were aged 41–50 years. Abnormal vaginal discharge was the commonest complaint (60.7%), while acetowhite epithelium was the most frequent colposcopic finding (48.7%). Histopathology revealed chronic cervicitis/inflammatory lesions in 34.7%, CIN 1 in 19.3%, CIN 2 in 11.3%, CIN 3 in 9.3%, and invasive squamous cell carcinoma in 6.7%. Overall, CIN 2+ was identified in 27.3%. Colposcopy showed 85.4% sensitivity, 83.5% specificity, and 84.0% diagnostic accuracy for CIN 2+. Agreement with histopathology was fair (κ=0.37, $p<0.001$). ***Conclusion:*** Colposcopy is a useful diagnostic tool for evaluating clinically unhealthy cervices, but histopathological confirmation remains essential for definitive diagnosis.

Keywords: Clinically unhealthy cervix; Colposcopy; Histopathology; Cervical intraepithelial neoplasia; Cervical cancer.

INTRODUCTION

Cervical cancer remains a major global public health problem despite being largely preventable through human papillomavirus (HPV) vaccination, effective screening, and treatment of precancerous lesions. In 2022, approximately 660,000 women were diagnosed with cervical cancer and nearly 350,000 died from the disease worldwide, with the overwhelming majority of cases and deaths occurring in low- and middle-income countries [1]. Persistent infection with high-risk HPV is the principal etiological factor for cervical cancer, and progression from persistent HPV infection through cervical intraepithelial neoplasia (CIN) to invasive carcinoma generally occurs over several years, providing an important opportunity for early detection and treatment [1,2]. Despite advances in HPV-based screening, delayed presentation, inadequate screening coverage, and limited access to diagnostic services continue to contribute substantially to cervical cancer morbidity and mortality in resource-limited settings [3,4].

A clinically unhealthy cervix is characterized by abnormal findings on speculum examination, including cervical erosion or ectropion, ulceration, friability, hypertrophy, irregular or nodular surface, contact bleeding, abnormal discharge, or a suspicious cervical growth. Although many of these findings may result from benign inflammatory, infectious, or hormonal conditions, similar clinical appearances may also be associated with premalignant or malignant cervical lesions [2,5 6]. Consequently, visual assessment alone cannot reliably differentiate benign cervical abnormalities from CIN or invasive carcinoma. This represents an important diagnostic challenge,

particularly in settings where women commonly present with symptomatic or visibly abnormal cervical lesions rather than through organized cervical cancer screening programmes [3,5].

Colposcopy provides magnified visualization of the cervix and enables systematic assessment of the transformation zone, squamocolumnar junction, acetowhitening, vascular abnormalities, lesion margins, surface characteristics, and other features associated with cervical neoplasia. Standardized colposcopic assessment facilitates recognition of suspicious lesions and allows targeted biopsy from the most abnormal areas [6,7]. Colposcopy is particularly useful as a diagnostic or triage procedure following abnormal screening results and can complement HPV testing and cytological assessment [2,8]. Recent evidence demonstrates that colposcopy has moderate-to-high diagnostic performance for detecting CIN2+ lesions. A large systematic review and meta-analysis involving 141,355 colposcopic examinations reported pooled sensitivity of 74.5% and specificity of 83.1% for CIN2+ [9]. Another recent meta-analysis evaluating HPV-positive women reported good sensitivity for detecting CIN2+ and CIN3+, although specificity was comparatively lower, highlighting the importance of appropriate clinical thresholds and standardized assessment [10].

The diagnostic performance of colposcopy is influenced by several factors, including the experience of the examiner, visibility of the transformation zone, quality of the examination, and criteria used to classify colposcopic abnormalities [9,10]. Standardized scoring systems, including the Reid colposcopic index and Swede score, have therefore been developed to improve objective assessment of cervical lesions and assist in identifying women who require biopsy or treatment [11]. Nevertheless, colposcopy remains a subjective examination, and interobserver variation and false-negative findings may occur. Appropriate training, standardized terminology, and the use of adjunctive methods such as HPV testing and histopathological assessment are consequently important for improving diagnostic accuracy [7,9,11].

Histopathological examination of cervical biopsy tissue remains essential for establishing the definitive diagnosis of CIN and invasive malignancy. Histology allows direct evaluation of epithelial architecture, maturation, cellular atypia, and stromal invasion and therefore provides the reference standard against which colposcopic impressions can be evaluated. However, colposcopic and histopathological findings are not always concordant. Benign inflammatory changes may mimic dysplastic lesions, whereas small, endocervical, or inadequately visualized lesions may be missed during colposcopy [7,12]. Recent evidence has also demonstrated that clinically important cervical lesions may occasionally be detected by random biopsy or endocervical curettage despite apparently normal colposcopic findings, emphasizing the limitations of visual assessment alone [12,13].

The importance of correlating clinical and colposcopic findings with histopathology is particularly relevant in Bangladesh, where cervical cancer screening and diagnostic follow-up remain challenging. Recent evidence from Bangladesh has highlighted limitations in screening coverage, follow-up, and access to appropriate diagnostic facilities [3,14]. In resource-limited settings, VIA followed by colposcopy may provide a feasible approach for identifying women requiring further evaluation, particularly where HPV testing and conventional cytology are not readily accessible [4]. Recent Bangladeshi evidence also suggests that colposcopy can be integrated into cervical cancer screening pathways in rural and resource-constrained settings [14]. Furthermore, a prospective study of women with a clinically unhealthy cervix demonstrated that colposcopic evaluation followed by biopsy could identify CIN and other clinically significant cervical lesions, supporting the value of systematic assessment of an abnormal cervix [4].

Therefore, systematic colposcopic evaluation followed by histopathological confirmation may facilitate early identification of cervical precancer and cancer among women presenting with a clinically unhealthy cervix. Determining the correlation between colposcopic impressions and histopathological diagnoses is important for assessing the diagnostic usefulness of colposcopy and identifying situations in which biopsy is particularly necessary. The present study was therefore undertaken to evaluate the colposcopic findings among women with a clinically unhealthy cervix and determine their correlation with histopathological findings, thereby assessing the usefulness of colposcopy as an intermediate diagnostic tool for identifying clinically significant cervical lesions.

METHODOLOGY & MATERIALS

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Dhaka Medical College Hospital, Dhaka, Bangladesh, over a period of six months from January 2026 to June 2026.

A total of 150 women presenting with a clinically unhealthy cervix were included in the study. Patients were selected consecutively after detailed history taking, clinical examination, and relevant investigations according to predefined inclusion and exclusion criteria. Ethical approval was obtained from the appropriate Institutional Ethical Review Committee of Dhaka Medical College Hospital, and written informed consent was obtained from all participants before enrollment in the study.

Women aged 18 years or above who presented with a clinically unhealthy cervix on speculum

examination were included. A clinically unhealthy cervix was defined by the presence of one or more abnormal cervical findings, including cervical erosion or ectropion, ulceration, friability, hypertrophy, contact bleeding, irregular or nodular cervical surface, abnormal cervical discharge, or a suspicious cervical growth. Women with previously diagnosed cervical cancer or known cervical intraepithelial neoplasia who were already receiving treatment, those with a history of previous treatment for CIN or cervical cancer, pregnant women, women with severe active pelvic infection or excessive vaginal bleeding preventing adequate examination, and those unwilling to undergo colposcopy or cervical biopsy were excluded from the study.

All enrolled participants underwent detailed clinical evaluation. Relevant demographic and clinical information was recorded using a structured questionnaire, including age, parity, presenting complaints, duration of symptoms, menstrual history, obstetric history, history of abnormal vaginal discharge, postcoital bleeding, intermenstrual bleeding, and previous cervical screening history. A pelvic examination was performed using a sterile Cusco's speculum. The cervix was inspected carefully for abnormalities such as erosion or ectropion, ulceration, hypertrophy, friability, contact bleeding, irregularity, nodularity, abnormal discharge, or suspicious growth. The clinical appearance of the cervix was documented before proceeding to colposcopic examination.

Colposcopic examination was performed in all study participants using a standard colposcope after adequate visualization of the cervix with a speculum. The cervix was initially examined under low-power magnification to assess the cervical surface, squamocolumnar junction, transformation zone, vascular pattern, and presence of any gross abnormality. Following the initial examination, 5% acetic acid was applied to the cervix and the area was examined under magnification for acetowhite changes, their intensity and distribution, lesion margins, surface characteristics, and abnormal vascular patterns including punctation and mosaicism. Lugol's iodine solution was subsequently applied when appropriate, and iodine-negative areas were documented. The visibility of the squamocolumnar junction and transformation zone was also recorded. Colposcopic findings were categorized as normal or benign, low-grade lesion, high-grade lesion, or suspicious for invasive carcinoma according to standard colposcopic criteria. A standardized colposcopic scoring system, where applicable, was used to assess the severity of the observed lesion.

Colposcopy-directed cervical biopsy was performed from the most abnormal or suspicious area identified during colposcopic examination. In women with suspicious endocervical findings or an inadequately visualized transformation zone, endocervical sampling was performed when clinically indicated. The biopsy specimens were collected using appropriate cervical biopsy forceps and immediately placed in 10% neutral buffered formalin. The specimens were subsequently sent to the Department of Pathology for histopathological examination. The tissue samples were processed, embedded in paraffin, sectioned, and stained with hematoxylin and eosin (H&E). Histopathological examination was performed by an experienced pathologist who evaluated the cervical epithelium for architectural abnormalities, cellular atypia, maturation defects, and evidence of stromal invasion.

Histopathological findings were categorized as normal or benign/inflammatory lesion, cervical intraepithelial neoplasia grade 1 (CIN 1), CIN grade 2 (CIN 2), CIN grade 3 (CIN 3), and invasive cervical carcinoma. For comparative analysis, histopathological findings were also grouped into no significant lesion/benign pathology, low-grade lesion (CIN 1), and high-grade lesion (CIN 2/CIN 3) or invasive carcinoma, where appropriate. The histopathological diagnosis was considered the reference standard for evaluating the correlation and diagnostic performance of colposcopy.

All participants were followed during the diagnostic process until the histopathological diagnosis was established. Women diagnosed with premalignant or malignant cervical lesions were referred for appropriate further evaluation and management according to institutional protocols. The principal outcomes assessed in the study were the pattern of colposcopic findings, distribution of histopathological diagnoses, and the correlation between colposcopic impressions and histopathological findings. The diagnostic performance of colposcopy for detection of clinically significant cervical lesions was also assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy, using histopathology as the reference standard.

Statistical Analysis:

All collected data were checked, verified, coded, and entered into the Statistical Package for Social Sciences (SPSS) version 26.0 for analysis. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. The association between categorical variables was assessed using the Chi-square test or Fisher's exact test where appropriate. Continuous variables were compared using the independent-samples Student's t-test where applicable. The agreement between colposcopic findings and histopathological diagnoses was assessed using an appropriate measure of agreement, such as the kappa coefficient. Diagnostic performance of colposcopy was evaluated by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy. A p-value <0.05 was considered statistically significant. The findings were presented in appropriate tables and graphical forms.

RESULTS

Table 1: Sociodemographic and clinical characteristics of the study participants (n=150)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
18–30	24	16
31–40	43	28.7
41–50	47	31.3
51–60	25	16.7
>60	11	7.3
Mean age ± SD (years)	44.1 ± 10.2	
Parity		
Nulliparous	12	8
Primiparous	22	14.7
Multiparous	91	60.7
Grand multiparous	25	16.7
Residence		
Urban	68	45.3
Rural	82	54.7

Table 1 shows the sociodemographic and clinical characteristics of the study participants. The mean age was 44.1 ± 10.2 years, with the largest proportion belonging to the 41–50 years age group (31.3%), followed by 31–40 years (28.7%). Most participants were multiparous (60.7%), while 16.7% were grand multiparous. Rural residents constituted 54.7% of the participants, compared with 45.3% from urban areas.

Table 2. Presenting complaints and clinical findings of an unhealthy cervix (n=150)

Variable	Frequency (n)	Percentage (%)
Presenting complaints		
Abnormal vaginal discharge	91	60.7
Postcoital bleeding	47	31.3
Intermenstrual bleeding	26	17.3
Postmenopausal bleeding	18	12
Lower abdominal/pelvic pain	39	26
Foul-smelling vaginal discharge	34	22.7
Contact bleeding	42	28
No specific symptoms	13	8.7
Clinical findings on speculum examination		
Cervical erosion/ectropion	67	44.7
Friable cervix	42	28
Contact bleeding	38	25.3
Cervical hypertrophy	29	19.3
Irregular cervical surface	24	16
Cervical ulceration	18	12
Abnormal cervical discharge	76	50.7
Nodular cervix	11	7.3
Suspicious cervical growth	14	9.3

Table 2 shows the presenting complaints and clinical findings of women with an unhealthy cervix. The most common presenting complaint was abnormal vaginal discharge (60.7%), followed by postcoital bleeding (31.3%) and contact bleeding (28.0%). On speculum examination, abnormal cervical discharge (50.7%) and cervical erosion/ectropion (44.7%) were the most frequent findings.

Table 3: Colposcopic findings among women with a clinically unhealthy cervix (n=150)

Colposcopic finding	Frequency (n)	Percentage (%)
Normal/benign appearance	30	20
Inflammatory changes	35	23.3
Acetowhite epithelium	73	48.7

Colposcopic finding	Frequency (n)	Percentage (%)
Dense acetowhitening	31	20.7
Punctation	27	18
Mosaic pattern	21	14
Abnormal vascular pattern	15	10
Iodine-negative area	61	40.7
Irregular lesion margin	19	12.7
Suspicious lesion for invasion	10	6.7

Table 3 shows the colposcopic findings among women with a clinically unhealthy cervix. Acetowhite epithelium was the most common finding (48.7%), followed by iodine-negative areas (40.7%). Dense acetowhitening was observed in 20.7%, while punctation and mosaic patterns were present in 18.0% and 14.0%, respectively. A suspicious lesion for invasion was identified in 6.7% of participants.

Table 4: Colposcopic impression and transformation zone characteristics (n=150)

Variable	Frequency (n)	Percentage (%)
Colposcopic impression		
Normal/benign	45	30
Low-grade lesion	52	34.7
High-grade lesion	43	28.7
Suspicious for invasive carcinoma	10	6.7
Transformation zone		
Type 1	58	38.7
Type 2	61	40.7
Type 3	31	20.7
Squamocolumnar junction		
Completely visible	104	69.3
Partially visible	29	19.3
Not visible	17	11.3

Table 4 shows the colposcopic impression and transformation zone characteristics of the study participants. Low-grade lesions were the most common colposcopic impression (34.7%), followed by high-grade lesions (28.7%). Suspicion of invasive carcinoma was reported in 6.7% of participants. Type 2 transformation zone was most frequent (40.7%), and the squamocolumnar junction was completely visible in 69.3% of cases.

Table 5: Histopathological findings of cervical biopsy specimens (n=150)

Histopathological diagnosis	Frequency (n)	Percentage (%)
Normal/benign cervical tissue	20	13.3
Chronic cervicitis/inflammatory lesion	52	34.7
Cervical polyp/other benign lesion	8	5.3
CIN 1	29	19.3
CIN 2	17	11.3
CIN 3	14	9.3
Invasive squamous cell carcinoma	10	6.7
Total	**150**	**100**

Table 5 shows the histopathological findings of cervical biopsy specimens. Chronic cervicitis/inflammatory lesions were the most common histopathological diagnosis (34.7%), followed by CIN 1 (19.3%). CIN 2 and CIN 3 were detected in 11.3% and 9.3% of participants, respectively, while invasive squamous cell carcinoma was found in 6.7%. Overall, CIN 2+ lesions were identified in 27.3% of participants.

Table 6: Association between colposcopic impression and histopathological severity (n=150)

Colposcopic impression	Benign/no lesion n (%)	CIN 1 n (%)	CIN 2/CIN 3 n (%)	Invasive carcinoma n (%)	Total	p-value
Normal/benign	38 (84.4)	6 (13.3)	1 (2.2)	0 (0.0)	45	<0.001
Low-grade lesion	32 (61.5)	15 (28.8)	5 (9.6)	0 (0.0)	52	
High-grade lesion	10 (23.3)	7 (16.3)	23 (53.5)	3 (7.0)	43	

Colposcopic impression	Benign/no lesion n (%)	CIN 1 n (%)	CIN 2/CIN 3 n (%)	Invasive carcinoma n (%)	Total	p-value
Suspicious for invasive carcinoma	0 (0.0)	1 (10.0)	2 (20.0)	7 (70.0)	10	
Total	**80 (53.3)**	**29 (19.3)**	**31 (20.7)**	**10 (6.7)**	**150**	

Table 6 shows the association between colposcopic impression and histopathological severity. A statistically significant association was observed between colposcopic impression and histopathological severity ($p < 0.001$). Among participants with a normal/benign impression, 84.4% had benign/no lesion, whereas 53.5% of those with a high-grade impression had CIN 2/CIN 3. Among women suspicious for invasive carcinoma, 70.0% had histopathologically confirmed invasive carcinoma.

Table 7: Association between grouped colposcopic impression and CIN 2+ lesions (n=150)

Colposcopic impression	CIN 2+ n (%)	<CIN 2 n (%)	Total	p-value
Normal/benign	1 (2.2)	44 (97.8)	45	<0.001
Low-grade lesion	5 (9.6)	47 (90.4)	52	
High-grade/suspicious for invasion	35 (66.0)	18 (34.0)	53	
Total	**41 (27.3)**	**109 (72.7)**	**150**	

Table 7 shows the association between grouped colposcopic impression and CIN 2+ lesions. A statistically significant association was observed ($p < 0.001$). CIN 2+ lesions were detected in 2.2% of participants with a normal/benign impression and 9.6% with a low-grade impression, compared with 66.0% among those with a high-grade or suspicious impression.

Table 8: Relationship between age and significant histopathological lesions (n=150)

Age group	CIN 2+/invasive carcinoma n (%)	No CIN 2+ n (%)	Total	p-value
18–30 years	2 (8.3)	22 (91.7)	24	**0.067**
31–40 years	9 (20.9)	34 (79.1)	43	
41–50 years	16 (34.0)	31 (66.0)	47	
51–60 years	10 (40.0)	15 (60.0)	25	
>60 years	4 (36.4)	7 (63.6)	11	
Total	**41 (27.3)**	**109 (72.7)**	**150**	

Table 8 shows the relationship between age group and significant histopathological lesions. The proportion of CIN 2+/invasive carcinoma increased from 8.3% among women aged 18–30 years to 40.0% among those aged 51–60 years. However, the association between age group and CIN 2+/invasive carcinoma was not statistically significant ($p = 0.067$).

Table 9: Diagnostic performance of colposcopy for detection of CIN 2+ lesions (n=150)

Diagnostic parameter	Value (%)
Sensitivity	85.4
Specificity	83.5
Positive predictive value	66
Negative predictive value	93.8
Diagnostic accuracy	84
Positive likelihood ratio	5.17
Negative likelihood ratio	0.18

Table 9 shows the diagnostic performance of colposcopy for detecting CIN 2+ lesions. Colposcopy demonstrated a sensitivity of 85.4% and specificity of 83.5%. The positive predictive value was 66.0%, while the negative predictive value was 93.8%. The overall diagnostic accuracy was 84.0%, with a positive likelihood ratio of 5.17 and a negative likelihood ratio of 0.18.

Table 10: Agreement between colposcopic impression and histopathological diagnosis (n=150)

Measure	Result
Observed agreement	55.30%
Cohen's kappa (κ)	0.37
Standard error	0.055

Measure	Result
95% confidence interval	0.262–0.478
Z value	7.67
p-value	<0.001
Interpretation	Fair agreement

Table 10 shows the agreement between colposcopic impression and histopathological diagnosis. The observed agreement was 55.3%, with a Cohen's kappa coefficient of 0.37 (95% CI: 0.262–0.478), indicating fair agreement. The agreement was statistically significant ($p < 0.001$).

DISCUSSION

The present study evaluated 150 women with a clinically unhealthy cervix and assessed the correlation between colposcopic impressions and histopathological findings. The mean age of the participants was 44.1 ± 10.2 years, with the largest proportion belonging to the 41–50-year age group (31.3%). Most participants were multiparous (60.7%), and 54.7% were from rural areas. These findings indicate that clinically abnormal cervical findings are frequently encountered among women in the middle and later reproductive years, particularly in populations where access to organized cervical cancer screening may be limited. The predominance of rural participants in the present study is also relevant in the context of Bangladesh, where geographic and socioeconomic barriers remain important challenges for cervical cancer prevention. The World Health Organization emphasizes accessible, high-performance cervical cancer screening and appropriate diagnostic follow-up, particularly in low- and middle-income countries [2,15].

In the present study, abnormal vaginal discharge was the most common presenting complaint (60.7%), followed by postcoital bleeding (31.3%) and contact bleeding (28.0%). On speculum examination, abnormal cervical discharge (50.7%) and cervical erosion/ectropion (44.7%) were the predominant findings. These findings are clinically important because an apparently unhealthy cervix can represent a spectrum ranging from benign inflammatory conditions to cervical intraepithelial neoplasia and invasive carcinoma. A recent Bangladeshi study specifically evaluating clinically unhealthy cervices similarly demonstrated a substantial proportion of women with histologically confirmed cervical lesions and emphasized the importance of colposcopic evaluation and biopsy for definitive diagnosis [16].

The colposcopic findings in the present study demonstrated that acetowhite epithelium was the most frequent abnormality (48.7%), followed by iodine-negative areas (40.7%), dense acetowhitening (20.7%), punctation (18.0%), and mosaic pattern (14.0%). These findings are consistent with established colposcopic principles, in which acetowhitening, vascular abnormalities, punctation, mosaicism, and lesion characteristics are important features for identifying areas requiring biopsy. Contemporary colposcopy guidelines emphasize standardized terminology and systematic assessment because interpretation of these findings can be subjective and influenced by examiner experience [17,18].

In the current study, low-grade lesion was the most frequent colposcopic impression (34.7%), followed by high-grade lesion (28.7%), while 6.7% of women were considered suspicious for invasive carcinoma. Type 2 transformation zone was the most frequent transformation-zone category (40.7%), while the squamocolumnar junction was completely visible in 69.3% of participants. These findings have practical diagnostic implications because visibility of the transformation zone affects the ability of colposcopy to detect cervical lesions accurately. In particular, type 3 transformation zones may conceal endocervical lesions and increase the possibility of underdiagnosis by visual examination alone. Recent evidence has demonstrated that clinically significant histological lesions may be identified in women with type 3 transformation zones despite limited or less impressive colposcopic findings, emphasizing the importance of adequate endocervical assessment in selected women [19].

Histopathological examination in the present study revealed chronic cervicitis/inflammatory lesions as the most common diagnosis (34.7%), followed by CIN 1 (19.3%), CIN 2 (11.3%), CIN 3 (9.3%), and invasive squamous cell carcinoma (6.7%). Overall, CIN 2+ lesions were identified in 27.3% of participants. This relatively substantial proportion of clinically significant lesions highlights the importance of investigating an unhealthy cervix rather than assuming that visible abnormalities are benign. A prospective study by Kori *et al.,* involving 150 women with clinically unhealthy cervices reported cervical intraepithelial neoplasia in 21.3% of participants, demonstrating a comparable burden of histologically confirmed cervical disease [5].

The proportion of clinically significant lesions in the present study was also broadly comparable with findings from Bangladesh and other resource-limited settings. Siddiqui *et al.,* in a study conducted in Chattogram, Bangladesh, evaluated cervical lesions using colposcopy, VIA, Pap smear, and histopathology and reported a significant correlation between colposcopic findings and histopathological diagnosis [20]. Similarly, a study conducted at Dhaka National Medical College among VIA-positive women demonstrated that colposcopy could identify clinically

significant cervical lesions, although diagnostic performance varied according to the reference standard and study population [21]. These findings support the usefulness of colposcopy as an important diagnostic step in women with abnormal cervical findings, although differences in screening status, disease prevalence, referral criteria, and diagnostic thresholds can produce variation between studies.

A major finding of the present study was the statistically significant association between colposcopic impression and histopathological severity ($p<0.001$). Among women with a normal/benign colposcopic impression, 84.4% had benign/no lesion on histopathology, whereas 53.5% of those with a high-grade colposcopic impression had CIN 2/CIN 3. Furthermore, 70.0% of women considered suspicious for invasive carcinoma on colposcopy were confirmed to have invasive carcinoma histopathologically. This progressive relationship between increasing colposcopic severity and increasing histopathological severity supports the clinical value of colposcopy for risk stratification. Similar relationships between colposcopic assessment and histopathological diagnosis have been reported in studies evaluating cervical precancerous lesions [20,22].

The diagnostic performance observed in the present study was favorable. Colposcopy demonstrated a sensitivity of 85.4%, specificity of 83.5%, positive predictive value of 66.0%, negative predictive value of 93.8%, and overall diagnostic accuracy of 84.0% for detection of CIN 2+. These findings indicate that colposcopy was particularly effective for excluding clinically significant disease, as demonstrated by the high negative predictive value. The findings are comparable with recent international evidence. A 2026 systematic review and meta-analysis involving 49 studies and 141,355 colposcopic examinations reported pooled sensitivity of 74.5% and specificity of 83.1% for CIN2+, with a positive likelihood ratio of 4.42 and negative likelihood ratio of 0.31 [9]. Thus, the sensitivity observed in the present study (85.4%) was higher than the pooled estimate, whereas the specificity was almost identical to that reported in the meta-analysis.

The findings are also comparable with a recent systematic review evaluating colposcopy for triage of HPV-positive women, which reported pooled sensitivity of 84.4% for CIN2+ and specificity of 64.3% [10]. The sensitivity in the present study was almost identical to this pooled estimate, while specificity was considerably higher. The higher specificity observed in the current study may partly reflect differences in the study population, as the present study included women with a clinically unhealthy cervix rather than an exclusively HPV-positive screening population. Differences in disease prevalence, referral criteria, colposcopic thresholds, and biopsy protocols may also account for variation between studies.

A study from Bhutan involving 299 women reported overall colposcopic sensitivity of 66.67%, specificity of 73.73%, and accuracy of 72.24% for CIN2+. Among senior colposcopists, sensitivity increased to 80.0%, while specificity was 71.07% [23]. The higher sensitivity and specificity found in the present study may indicate the value of systematic colposcopic assessment in a population specifically selected for clinically abnormal cervical findings. However, differences in operator expertise and patient selection should be considered when comparing these results.

The present study's findings are also consistent with evidence that standardized scoring systems can improve the identification of high-grade cervical disease. A 2024 study comparing the Modified Swede Colposcopic Index with the Modified Reid Index reported high sensitivity with moderate specificity for CIN2+ using an optimized Modified Swede Index threshold [11]. Although the sensitivity in that study was higher than in the present study, its specificity was lower. This difference illustrates the inherent trade-off between sensitivity and specificity according to the threshold used for classifying a colposcopic examination as positive. It also supports the importance of structured colposcopic assessment rather than relying solely on subjective visual impressions.

An important observation in the present study was that 2.2% of women with a normal/benign colposcopic impression and 9.6% with a low-grade impression nevertheless had CIN2+ lesions. This finding demonstrates that a reassuring colposcopic appearance does not completely exclude clinically significant cervical disease. Recent evidence strongly supports this observation. In a 2024 study of women with normal colposcopy, random biopsy and endocervical curettage identified histologically significant lesions that could otherwise have been missed [13]. Similarly, Behrens *et al.,* reported that endocervical sampling could detect cervical intraepithelial lesions in women in whom colposcopy did not demonstrate a clear ectocervical lesion, particularly in women with type 3 transformation zones [12]. These findings reinforce the role of histopathological assessment in women with persistent clinical or screening abnormalities, particularly when the transformation zone cannot be fully assessed.

The agreement analysis in the present study demonstrated an observed agreement of 55.3% and a Cohen's kappa coefficient of 0.37 (95% CI: 0.262–0.478; $p<0.001$), indicating fair agreement between colposcopic impression and histopathological diagnosis. Although the association was statistically significant, the level of agreement was not strong. This is an important finding because it demonstrates that statistical association between colposcopy and histopathology does not necessarily mean complete diagnostic concordance. A previous tertiary-center study analyzing the agreement

between colposcopic impression and histopathological diagnosis reported a relatively low kappa coefficient, although substantial agreement was observed when diagnoses within one histological grade were considered [24]. This supports the broader evidence that colposcopy provides clinically useful information but remains imperfect and cannot replace histopathological confirmation.

The relatively modest agreement observed in the present study may be explained by several factors. First, inflammatory and reactive cervical changes can produce acetowhitening and other features that mimic neoplastic lesions. Second, small or endocervical lesions may be difficult to visualize. Third, colposcopic interpretation is operator-dependent and may vary according to examiner experience and the availability of standardized scoring systems. Recent research evaluating agreement between colposcopists has demonstrated variability in recognition and localization of cervical lesions, particularly for less severe lesions, further emphasizing the importance of standardized terminology, adequate training, and appropriate biopsy techniques [25].

The present study also has important implications for clinical practice in Bangladesh. Recent Bangladeshi research has shown that colposcopy can identify clinically important cervical abnormalities, but histopathological confirmation remains essential because the correlation between visual impressions and biopsy diagnosis may be imperfect [16,20,21]. The WHO recommends high-performance HPV-based screening as the preferred primary screening approach and emphasizes appropriate triage and diagnostic evaluation of women at increased risk [2,15]. Therefore, in women who present with a clinically unhealthy cervix, colposcopy can serve as an important intermediate diagnostic tool for identifying suspicious areas and directing biopsy, while histopathology remains the definitive method for establishing the grade of cervical intraepithelial neoplasia or confirming invasive carcinoma.

Overall, the present study demonstrates that colposcopy has good diagnostic performance for detecting CIN2+ among women with a clinically unhealthy cervix, with sensitivity of 85.4%, specificity of 83.5%, and diagnostic accuracy of 84.0%. However, the fair level of agreement with histopathology (κ=0.37) indicates that colposcopy should not be considered a substitute for tissue diagnosis. The presence of CIN2+ among a small proportion of women with normal or low-grade colposcopic impressions further emphasizes the importance of biopsy and histopathological evaluation in appropriate clinical circumstances. These findings support a diagnostic approach in which clinical examination identifies women requiring further evaluation, colposcopy localizes and grades suspicious lesions, and histopathology provides definitive diagnosis.

Limitations of the study

This study was conducted at a single tertiary-care hospital with a relatively small sample size of 150 participants and a short study period of six months, which may limit the generalizability of the findings. As the study included only women with a clinically unhealthy cervix, the results may not be applicable to the general screening population. Colposcopic interpretation is also operator-dependent and may be influenced by examiner experience. Furthermore, HPV testing and cervical cytology were not incorporated into the analysis, and long-term follow-up was not performed. Finally, biopsy-directed histopathology may miss small or endocervical lesions, particularly in women with an incompletely visualized transformation zone.

CONCLUSION

The present study demonstrated that a clinically unhealthy cervix may be associated with significant cervical pathology, including CIN 2+ and invasive carcinoma. Colposcopy showed good diagnostic performance for detecting CIN 2+, with 85.4% sensitivity, 83.5% specificity, and 84.0% diagnostic accuracy. A significant association was observed between colposcopic impression and histopathological diagnosis; however, the fair agreement (κ=0.37) indicates that colposcopy alone cannot replace histopathological confirmation. Therefore, colposcopy followed by appropriate biopsy and histopathological examination is an effective approach for the early detection and diagnosis of cervical precancerous and malignant lesions in women with a clinically unhealthy cervix.

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