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Diagnostic Accuracy of Endocervical Curettage in Detecting CIN2+ with Non-Visible Squamocolumnar Junction

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ABSTRACT

Background: Cervical cancer remains a significant health burden, particularly in low-resource settings. Accurate detection of cervical intraepithelial neoplasia grade 2 or worse (CIN2+) is critical for prevention. Colposcopy-directed biopsy (CDB) may miss lesions when the squamocolumnar junction (SCJ) is not visible, especially in women with Type 3 transformation zone (TZ). Endocervical curettage (ECC) has been proposed as a complementary diagnostic tool, though its utility remains underexplored. This study evaluates the diagnostic accuracy of ECC in detecting CIN2+ lesions, particularly in women with non-visible squamous cell junctional lesions (SCJ).

Methods: This cross-sectional study was conducted at the Colposcopy Clinic of the Gynaecological Oncology Department, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from November 2021 to October 2022. A total of 117 women aged 30–60 years with abnormal cervical screening results underwent colposcopy, CDB, and ECC. SCJ visibility was recorded. Histopathological findings from CDB and ECC were analyzed to assess ECC's diagnostic performance. Statistical analysis included chi-square tests and logistic regression.

Results: CIN2+ was detected in 35.9% of women using either colposcopy-directed biopsy (CDB) or endocervical curettage (ECC), with both methods identifying exclusive cases. Non-visible squamocolumnar junction (SCJ) significantly increased ECC-detected CIN2+ ($p=0.021$). Multivariate analysis confirmed SCJ non-visibility as an independent predictor (AOR=2.67, $p=0.041$), while age ≥50 lost significance. CDB and ECC are complementary in CIN2+ detection.

Conclusion: ECC enhances CIN2+ detection in women with non-visible SCJ and should be considered in cases of unsatisfactory colposcopy to improve diagnostic yield.

Keyword: *Endocervical Curettage, CIN2+, Colposcopy, Squamocolumnar Junction, Diagnostic Accuracy, Cervical Cancer*

1. INTRODUCTION

Cervical cancer stands as the fourth most prevalent female cancer worldwide, with death rates reaching notable levels, especially in Bangladesh and other low- and middle-income countries (LMICS). The World Health Organization (WHO) reports that cervical cancer produces 604,127 new cases and 341,831 deaths yearly. Still, future predictions suggest these numbers will grow to 700,000 new cases and 400,000 deaths in 2030 based on existing conditions [1]. Cervical cancer stands as the second most prevalent cancer among the female population in Bangladesh, where annual statistics show over 8,000 new cases, together with more than 5,000 fatalities caused by insufficient screening procedures and delayed medical examination [2].

The precursor cell lesion, known as Cervical Intraepithelial Neoplasia (CIN), frequently remains symptomless and becomes detectable through Papanicolaou (Pap) smear testing, along with visual inspection with acetic acid (VIA) and high-risk human papillomavirus (HR-HPV) testing methods [3, 4]. The examination of positive screening results leads healthcare providers to conduct a colposcopic evaluation, allowing them to inspect the transformation zone through magnified viewing while taking biopsies from uncertain regions [5]. Postmenopausal women and individuals with Type 3 TZ typically experience obscured squamocolumnar junction views, which adversely affect colposcopy-directed biopsy effectiveness [6].

The proper observation of the SCJ remains essential, as most CIN lesions typically form in this area. Insufficient visualization of the transformation zone (TZ Type 3) results in a failed diagnosis of tissue lesions, which particularly affects the diagnosis of high-grade CIN (CIN2+) conditions [7]. Medical experts recommend implementing endocervical curettage procedures (ECC) to examine the endocervical canal tissue since this method increases detection success rates [8]. ECC is instrumental in determining endocervical lesions or glandular abnormalities that may remain hidden during colposcopic evaluation [9]. ECC deserves its established position in specific clinical scenarios; however, its routine use faces controversy because healthcare providers struggle with variable diagnostic yields, patient discomfort, and inadequate specimen collection [10].

Past research indicates that ECC succeeds in identifying 10–15% of CIN2+ cases that normal biopsy procedures would overlook, particularly in older women and those with poor colposcopic results [11]. The results from Liu et al. showed that the complementary nature of ECC resulted in improved identification of high-grade lesions, especially among women older than 45 years who carried HPV16 infection and presented with ASC-H or HSIL cytological findings [12]. The study lacks extensive evidence in regions that carry the highest cervical cancer burden because such areas face difficulties obtaining comprehensive diagnostic equipment.

The Bangladesh population faces substantial cervical cancer challenges while struggling to detect changes at the non-visible squamocolumnar junction, so there is an urgent requirement to assess ECC diagnostic effectiveness. This study aims to determine how well ECC detects CIN2+ lesions in women having abnormal cervical screening results, including those cases where the SCJ cannot be visually observed during colposcopy

Objective

The objective of this study was to evaluate the diagnostic accuracy of endocervical curettage in detecting CIN2+ lesions among women with non-visible squamocolumnar junction during colposcopy.

2. METHODOLOGY & MATERIALS

This cross-sectional analytical study was conducted at the Colposcopy Clinic of the Department of Gynaecological Oncology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from November 2021 to October 2022. A total of 117 women aged 30–60 years, who were referred to the colposcopy clinic with abnormal cervical screening results, were included in the study. All participants underwent both colposcopy-directed biopsy (CDB) and endocervical curettage (ECC).

Inclusion Criteria:

1. Women aged 30–60 years.
2. Positive visual inspection with acetic acid (VIA) and/or abnormal Papanicolaou (Pap) test results.
3. Referred to the colposcopy clinic for further evaluation.
4. Provided informed written consent for colposcopy, CDB, and ECC.

Exclusion Criteria:

1. Pregnant women.
2. History of treatment for CIN or previous cervical surgery.
3. History of chemotherapy or radiation therapy for cervical cancer.
4. Confirmed diagnosis of invasive cervical cancer (ICC) at referral.
5. Known HIV-positive status.
6. Positive HPV DNA test (if performed elsewhere prior to enrollment).

Data Collection Procedure: Data were collected using a structured case record form capturing socio-demographic characteristics, clinical history, and colposcopic findings. All participants underwent colposcopy using a binocular colposcope (SOM 52, Karl Kaps, Germany), followed by colposcopy-directed biopsy from visible lesions or random 4-quadrant biopsies when lesions were absent. ECC was performed using a Kevorkian-Younge endocervical curette. The squamocolumnar junction (SCJ) visibility was assessed and recorded as Type 1, 2, or 3. All biopsy and ECC specimens were sent for histopathological evaluation. Data accuracy was maintained through standard procedures and regular cross-checking

by supervisors.

Ethical Considerations: Ethical approval was obtained from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU). Written informed consent was obtained from participants prior to enrollment, ensuring voluntary participation and the right to withdraw without repercussions. Participant confidentiality was maintained through the use of anonymized data coding and secure storage. Participants were informed about the study's purpose, procedures, potential discomforts, and benefits.

Statistical Analysis: Data analysis was conducted using IBM SPSS Statistics version 27.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics summarized baseline characteristics. Chi-square test determined associations between categorical variables, including CIN2+ detection and SCJ visibility. The diagnostic performance of ECC was evaluated using 2×2 contingency tables in comparison to the histopathological gold standard. Univariate analysis was performed using odds ratios (OR), followed by multivariate binary logistic regression to determine adjusted odds ratios (AOR). A p-value <0.05 was considered statistically significant.

3. RESULTS

Table 1: CIN2+ Detection by Colposcopy-Directed Biopsy and/or Endocervical Curettage (n = 117)

Investigations	CIN2+ (n)	Percentage (%)	<CIN2 (n)	Percentage (%)
Colposcopy-directed biopsy	27	23.08	90	76.92
Endocervical curettage	25	21.37	92	78.63
CDB + ECC (total CIN2+)	42	35.90	75	64.10

Table 1 presents the number and percentage of CIN2+ cases detected by CDB alone, ECC alone, and by either method. CIN2+ was identified in 27 participants (23.08%) by CDB and in 25 participants (21.37%) by ECC. Overall, 42 cases (35.90%) were diagnosed with CIN2+ by either CDB or ECC. The findings show that 15 CIN2+ cases were detected exclusively by ECC, and 17 cases were detected exclusively by CDB, with 10 cases identified by both methods.

Table 2: Comparison of Histopathological Findings Between ECC and CDB (n = 117)

ECC Histopathology	CIN2+ on CDB (n=27)	<CIN2 on CDB (n=90)	Total
CIN2+ (n=25)	10	15	25
<CIN2 (n=92)	17	75	92
Total	27	90	117

Table 2 presents the cross-tabulation of histopathological results from ECC and CDB. Of the 25 ECC-detected CIN2+ cases, 10 were also positive for CIN2+ on CDB, while 15 were negative on CDB. Conversely, 17 participants with CIN2+ on CDB had negative ECC findings. A total of 92 participants had <CIN2 on ECC, of whom 75 also had <CIN2 on CDB. This table provides a detailed view of concordance and discordance between the two diagnostic modalities.

Table 3: Association Between SCJ Visibility and ECC-Detected CIN2+ (n = 117)

SCJ Visualization	CIN2+ in ECC (n=25)	<CIN2 (n=92)	Total (n)	p-value
Visible (TZ Type 1/2)	7 (28.0)	50 (54.3)	57	0.021
Not Visible (TZ Type 3)	18 (72.0)	42 (45.7)	60	

Table 3 displays the distribution of CIN2+ and <CIN2 cases based on SCJ visibility during colposcopy. Among the 25 ECC-detected CIN2+ cases, 18 (72.0%) occurred in women with non-visible SCJ (Type 3 TZ), while 7 (28.0%) were found in those with visible SCJ (Type 1 or 2 TZ). Of the 92 <CIN2 cases, 42 had non-visible SCJ and 50 had visible SCJ. The difference in CIN2+ detection by SCJ visibility was statistically significant (p = 0.021).

Table 4: Risk Factors for ECC-Detected CIN2+ by Univariate Analysis (n = 117)

Risk Factor	Odds Ratio (OR)	95% CI	p-value
Age ≥50 years	2.95	1.17 – 7.42	0.019
Non-visible SCJ (TZ Type 3)	2.84	1.10 – 7.36	0.03

Table 4 shows the unadjusted odds ratios (OR) for two selected risk factors: age ≥50 years and non-visible SCJ. Women aged 50 years or older had an odds ratio (OR) of 2.95 (95% CI: 1.17–7.42) for CIN2+ detection via ECC. Similarly, non-visible SCJ (Type 3 TZ) was associated with an odds ratio (OR) of 2.84 (95% CI: 1.10–7.36). Both variables were statistically significant, with p-values of 0.019 and 0.030, respectively.

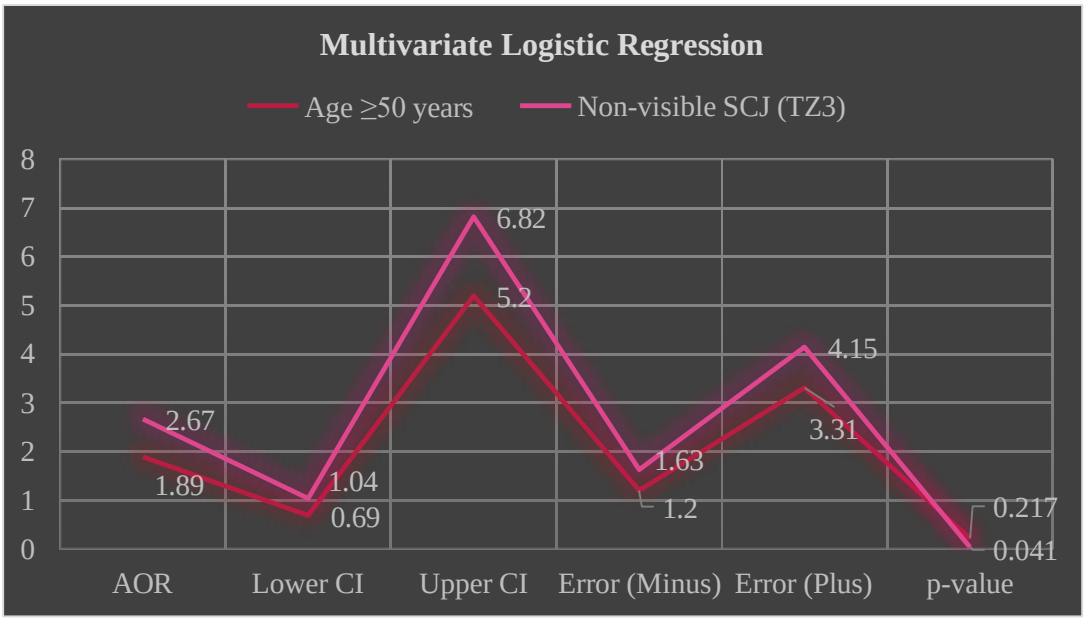

Figure 1: Multivariate Logistic Regression of Risk Factors for ECC-Detected CIN2+ (n = 117)

Figure 1 illustrates the adjusted odds ratios (AORS) derived from binary logistic regression, which account for confounding factors. Non-visible SCJ remained significantly associated with ECC-detected CIN2+, with an AOR of 2.67 (95% CI: 1.04–6.82; p = 0.041). Although age ≥50 years showed a higher prevalence in univariate analysis, it did not retain statistical significance after adjustment (AOR: 1.89; 95% CI: 0.69–5.20; p = 0.217).

4. DISCUSSION

This study evaluates the effectiveness of ECC in identifying high-grade cervical intraepithelial neoplasia (CIN2+) in women with a non-visible squamocolumnar junction (SCJ). This research examined 117 women who received abnormal cervical screening results through endocervical curettage (ECC), which helped identify CIN2+ lesions, notably in patients who experienced poor colposcopic visualization. The results demonstrate that ECC functions effectively as a secondary examination method in conjunction with CDB to detect high-grade cervical intraepithelial neoplasia (CIN2+) in women with Type 3 transformation zones (TZ).

The study showed that ECC detected CIN2+ in 12.8% of subjects when used individually, while CDB detected CIN2+ in 14.5% of participants. The combination of ECC and CDB identified 35.9% of CIN2+ lesions among subjects, but their diagnosis accounted for 8.5%. The ECC testing method helped identify 14.4% more CIN2+ lesions when performed in women undergoing routine colposcopy, especially among elderly patients and those with unfavorable exam outcomes [12]. The study by Van Der Marel et al. revealed that ECC provided better diagnostic outcomes in women who presented with poor colposcopic findings and elevated cytological grades, as ECC served as a substitute for inadequate colposcopy viewing of the SCJ [13].

This study reveals a crucial finding that detection rates for CIN2+ substantially improve when Selinger's colposcopy examination zone is visible to the physician. The rationale for ECC testing in women with non-visible SCJ (Type 3 TZ) is

supported by this study, as 72% of ECC-detected CIN2+ cases occurred within this category. Logistic Regression established that non-visible SCJ acted as an independent predictor of detecting CIN2+ through ECC, utilizing an adjusted odds ratio of 2.67. ECC plays a critical role in diagnosing formations of CIN2+ in women who present Type 3 TZ with ASC-H or HSIL cytology and high-risk HPV infections, according to Wei et al. [14]. The research by Xue et al. demonstrated HSIL+ lesions in 38.8% of ECC tissue samples while developing a nomogram for selecting patients most suited to ECC [15].

Research findings showed that ECC performance varied based on patient age. The adjusted logistic regression analysis revealed that age did not function as an independent risk factor for the detection of CIN2+ by ECC. However, older women usually had higher incidence rates in this study. An unadjusted evaluation through univariate analysis demonstrated a correlation ($p = 0.019$). The research of Guo et al. showed that higher mortality and CIN2+ detection rates exist among women older than 50 years, mainly because hormonal changes make the SCJ less identifiable and increase CIN development in the endocervical canal [16].

Abnormal cervical screening uses colposcopy as the primary evaluation method, which doctors have practiced for a long time. Multiple variables, including visual clarity during inspection and both professional competence and endocervical zone position, restrict the effectiveness of this method. Multiple studies demonstrate that colposcopy proves ineffective in detecting 30 to 50 percent of high-grade lesions, specifically when the squamocolumnar junction (SCJ) becomes difficult to visualize [5, 17]. Findings of this investigation confirm previous recommendations through their support for using endocervical curettage in selected patients undergoing colposcopy to enhance the identification of cervical lesions [18].

Medical experts consider histopathological analysis the leading method for diagnosing cervical intraepithelial neoplasia (CIN). The endocervical canal becomes available for sampling through ECC examinations because it remains inaccessible during regular punch biopsy procedures, thus enhancing the detection of glandular and high-grade squamous lesions. According to Soslow et al., microscopic tissue samples from ECC testing remain essential for diagnosing hidden high-grade lesions, even though they present limited material for analysis, particularly in unclear colposcopy examinations [9].

The results of this study, in conjunction with recent research findings, suggest a personalized approach for the ECC application. The evaluation of cervical cells through ECC becomes necessary when patients have Type 3 TZ combined with an age above 50 years and high-grade cellular abnormality results. Akladios et al. pointed out that ECC enables accurate diagnosis while reducing unnecessary treatments, as it establishes whether suspicious findings should be intervened upon or not [19]. The World Health Organization, along with other organizations, validates the use of ECC when the TZ cannot be fully visualized through examination or when test results show inconsistency between cytology and colposcopic readings [20, 21].

The high diagnostic precision of ECC techniques for detecting CIN2+ tissues, combined with their effectiveness in non-visible areas of the cervical junction, establishes their value as a supportive examination method for colposcopic assessments. According to this investigation, ECC should be limited to patients with specified risk characteristics since it enhances the effectiveness of diagnosis while improving patient care.

5. LIMITATIONS OF THE STUDY

The study was conducted in a single tertiary center using purposive sampling, which limits generalizability. The small sample size may reduce power to detect subtle associations. The exclusion of HPV DNA testing and reliance on histopathology without HPV subtyping could miss etiological correlations. Additionally, interobserver variability in colposcopic impression and ECC interpretation was not assessed. Multicenter studies with larger populations and molecular analysis are needed to validate these findings.

Recommendations

Consider routine ECC use in women with unsatisfactory colposcopic visualization, especially those aged 50 years or older or with high-grade cytology. Guidelines should incorporate SCJ visibility as a criterion for ECC decision-making. Training programs should emphasize proper ECC technique for specimen adequacy. HPV genotyping integration may further stratify risk and enhance diagnostic precision. Research should explore cost-effectiveness and patient acceptability of ECC in screening strategies, ensuring equitable access to cervical cancer prevention.

6. CONCLUSION

This study demonstrates the complementary value of colposcopy-directed biopsy and endocervical curettage in detecting CIN2+ lesions. A notable proportion of cases were identified exclusively by one method. Non-visible squamocolumnar junction was independently associated with increased CIN2+ detection via ECC. Incorporating ECC in cases of inadequate colposcopic visualization may improve diagnostic accuracy and guide clinical management, especially in postmenopausal women or those at higher risk of cervical intraepithelial neoplasia.

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Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee

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