

Accuracy of Digital Colposcopy in Diagnosis of Cervical Pathology

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Abstract

Background: Digital colposcopy is a novel diagnostic approach that offers enhanced visualization and documentation of cervical abnormalities compared to traditional colposcopy. The conventional methods for diagnosing cervical pathology, including Pap smear (cytology) and classic histopathological examination of excised cervix have been the standard techniques for decades. **This study aimed to** evaluate the usefulness and accuracy of digital colposcopy as a comparable tool to the conventional pap smear (cytology) and the classic histopathological examination. **Methods:** This cross-sectional study was carried out on 77 sexually active women, aged 20 to 65 years, presenting with chronic leucorrhoea, post-coital bleeding/spotting, or intermenstrual bleeding/spotting. All participants underwent comprehensive assessments, including history taking, general and abdominal examinations and pelvic ultrasound. Pap smears were collected from the ectocervix and endocervix, while digital colposcopy utilizing equipment categorized colposcopic findings as "normal," "abnormal", or "miscellaneous". Digital colposcopy-directed biopsies were conducted for major findings or suspicious for invasion cases. **Results:** The digital colposcope demonstrated 76.9% sensitivity and a 72% specificity for detecting the condition according to histopathology. The PPV was 85.1%, and the NPV was 60%, resulting in an overall accuracy of 75.3%. On the other hand, the PAP smear exhibited higher performance with a sensitivity of 98.1% and a specificity of 84%. The PPV for the PAP smear was 92.7%, and the NPV was 95.5%, leading to an overall accuracy of 93.5%. **Conclusion:** Digital colposcopy holds promise as a valuable adjunct to conventional screening methods, such as the Pap smear, in diagnosing cervical pathology.

Keywords: Accuracy; Digital Colposcopy; Diagnosis; Cervical Pathology.

Introduction

Cervical carcinoma is considered the fourth most common cancer worldwide among women globally. It accounts for 7% of all female malignancies in developed countries against 24% in developing countries. In 2020 there were 604,000 new cases were diagnosed and 342,000 deaths were related to it. About 90% of the new cases & deaths worldwide in 2020 occurred in low and middle income countries (1).

Cervical carcinoma is a preventable condition and there is considerable effort goes to detect and treat the pre invasive disease (2).

Lack of education and empowerment of women and inadequate screening programs for cervical cancer in these countries also affect this high burden. Cervical carcinoma is a preventable condition, and considerable efforts are made to detect and treat the pre-invasive disease (3).

Since 1943, PAP smear cytology had been used for the screening of cervical carcinoma. However, the best method of cervical cancer screening is still unclear. Literature recommends different methods for screening ranging from simple cytology (pap smear), colposcopy, and human papillomavirus (HPV) deoxyribonucleic acid (DNA) testing, or even repeat cytology (4).

Developed countries currently rely on cytological screening and treatment of high-grade cervical Intra-epithelial neoplasia (CIN2, CIN3), which is a precursor for cancer. However, in developing countries, no proper cytological screening protocols are available. Also, cytological screening is

not sufficient for the successful identification of cancer precursors. Hence, a large number of women in the pre-invasive stage are being missed (5).

Digital colposcopy is used now as a triage test in cervical cancer prevention. It helps to diagnose patients in the pre-invasive stage and categorizes women more effectively related to the way of treatment. Digital colposcopy is the gold standard next step for abnormal Pap smear findings (6).

This study aimed to evaluate the usefulness and accuracy of digital colposcopy as a comparable tool to the conventional pap smear (cytology) and the classic histopathological examination of excised cervix.

Patients and methods

This cross-sectional study was conducted at Benha University Hospital, in the department of obstetrics and gynecology, early cancer detection unit (BUECDU). The study enrolled 77 sexually active women, aged between 20 and 65 years, who presented with chronic leucorrhoea or post-coital bleeding/spotting and intermenstrual bleeding/spotting. The study was conducted from May 2022 to May 2023.

Informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number. The study was done after being approved by the Research Ethics Committee (**Ms.24.7.2022**), Faculty of Medicine, Benha University.

Inclusion criteria for participant selection were based on a history of

chronic leucorrhoea or abnormal bleeding, along with examination findings of erosion, an unhealthy cervix, a lesion bleeding on touch, or an abnormal/suspicious Papanicolaou smear. Exclusion criteria included previous procedures such as LEEP (Loop Electrosurgical Excision Procedure) or LEETZ (Large Loop Excision of the Transformation Zone) and cervical conization.

Each participant underwent a full history taking, general and abdominal examination, pelvic ultrasound to detect co-pathology, and Pap smears for cytological assessment.

In cases of leucorrhoea, vaginal smears were also examined to rule out infections like candidiasis or trichomonas vaginalis. Patients with specific or non-specific infections were treated with appropriate anti-fungal and anti-protozoal agents. Pap smears were taken from the ectocervix and endocervix using an Ayres spatula and cyto-brush, fixed immediately in 95% absolute alcohol.

Digital colposcopy and Pap smear examinations were performed for most of the women during the same session. However, those with an abnormal Pap smear were referred for colposcopy separately (7). Digital colposcopy was carried out using the Karl Kaps GmbH & Co.Kg 35614 Asslar/Wetzlar instrument, following the 2011 International Federation for Cervical Pathology and Colposcopy (IFCPC) guidelines.

Digital colposcopic findings were classified as "normal," "abnormal," "minor," "major," or "suspicious for invasion/cancer." Biopsies were taken from the most suspicious part of any

major finding or lesion suspicious for invasion. If multifocal lesions were present, multiple biopsies were taken (8).

Statistical analysis

The collected data was processed using the Statistical Package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Descriptive statistics, including the mean and standard deviation (\pm SD), were calculated for numerical data, while frequency and percentage were determined for non-numerical data. The Chi-Square test was used to examine the relationship between two qualitative variables. Validity of colposcope and PAP smear were also performed. A p-value below this threshold was considered statistically significant.

Results

Age distribution, parity, medical disorders and Contraception in the studied patients were illustrated in **Table 1**.

Among the study participants, the most commonly reported symptom was discharge, accounting for 77.9% of the total sample. Among participants with this symptom, 30% exhibited premalignant or malignant cervical pathology.

Intermenstrual spotting/bleeding was reported by 26% of the participants, with 60% of them displaying premalignant or malignant cervical pathology. Post-coital spotting/bleeding was reported by 24.7% of participants and 42.1% of them exhibited premalignant or malignant cervical pathology. Asymptomatic participants accounted for 7.8% of the sample, with 16.7% of them displaying

pre-malignant or malignant cervical pathology. Participants who reported something coming out per vagina constituted 3.9% of the sample, but none of them exhibited pre-malignant or malignant cervical pathology. **Figure 1**

Among the digital colposcopic findings, the most frequently observed was a normal cervix, accounting for 33.8% of the cases. Following this, atypical vessels were identified in 20.8% of the cases, while thin aceto-whitening and dense aceto-whitening were observed in 19.5% and 15.6% of the cases, respectively. Punctation and mosaic patterns were present in 10.4% of the cases, and genital warts were detected in 9.1% of the cases. Polyps were found in 6.5% of the cases. Regarding cervical conditions, cervical erosion was the most prevalent finding, observed in 35.1% of the cases. **Figure 2 A)**

The most common PAP smear finding was cervicitis, which was present in 54.5% of the cases. Following this, mild dysplasia was observed in 12.9% of the cases, while moderate dysplasia and cervicitis with koilocytes were found in 9.1% and 6.5% of the cases, respectively. Among the other PAP smear findings, severe dysplasia was identified in 3.9% of the cases, while atypical glandular cells were detected in 2.6% of the cases. ASC-US (Atypical

Squamous Cells of Undetermined Significance) and normal PAP smear results were less common, accounting for 1.3% and 9.1% of the cases, respectively. **Figure 2 B)**

Among the histopathological results, cervicitis was the most commonly observed finding, present in 39% of the cases. This was followed by squamous metaplasia in association with cervicitis, which was found in 18.2% of the cases. Other histopathological findings included cervical polyps (3.9%), normal cervical tissue (6.5%), and various grades of cervical intraepithelial neoplasia (CIN). CIN1 was observed in 18.2% of the cases, CIN2 in 11.7% of the cases, and CIN3 in 1.3% of the cases. Additionally, cervical carcinoma was detected in 1.3% of the cases. **Figure 3**

The digital colposcope demonstrated a sensitivity of 76.9% and a specificity of 72% for detecting the condition according to histopathology. The positive predictive value (PPV) was 85.1%, and the negative predictive value (NPV) was 60%, resulting in an overall accuracy of 75.3%. On the other hand, the PAP smear exhibited higher performance with a sensitivity of 98.1% and a specificity of 84%. The PPV for the PAP smear was 92.7%, and the NPV was 95.5%, leading to an overall accuracy of 93.5%. **Table 2**

Table 1: Age-wise distribution, parity, medical disorders and Contraception in the studied patients

	Total		Premalignant & malignant	
	No.	%	No.	%
21-30 Y	16	20.8	4	25
31-40 Y	28	36.4	5	17.9
41-50 Y	28	36.4	13	46.4
>50 Y	5	6.5	3	60
Parity	No.	%	No.	%
0	4	5.2	0	0
1	4	5.2	0	0
2	12	15.6	2	16.7
3	29	37.7	10	34.5
4	15	19.5	6	40
5	10	13	5	50
More	3	3.9	2	66.7
Medical disorders	No.	%	No.	%
None	55	71.4	14	25.5
HTN	8	10.4	5	62.5
DM	5	6.5	3	60
DM/HTN	5	6.5	3	60
Hypothyroidism	3	3.9	0	0
Anaemia	1	1.3	0	0
Contraception	No.	%	No.	%
None	8	10.4	3	37.5
IUCD	44	57.1	12	27.3
COCS	11	14.3	3	27.3
POPS	4	5.2	1	25
DMPA	4	5.2	1	25
Tubal ligation	4	5.2	3	75
Implanon	1	1.3	1	100
Misocept inj.	1	1.3	1	100

Table 2: Validity of colposcope and PAP smear in the studied patients

		Histopathology		Total
		Positive	Negative	
Colposcope	Positive	23	20	43
	Negative	2	32	34
	Total	25	52	77
Sensitivity		92	Specificity	61.5
PPV		53.4	NPV	94.1
Accuracy			71.4	
PAP	Positive	21	1	22
	Negative	4	51	55
	Total	25	52	77
Sensitivity		84	Specificity	98.1
PPV		95.5	NPV	92.7
Accuracy			93.5	

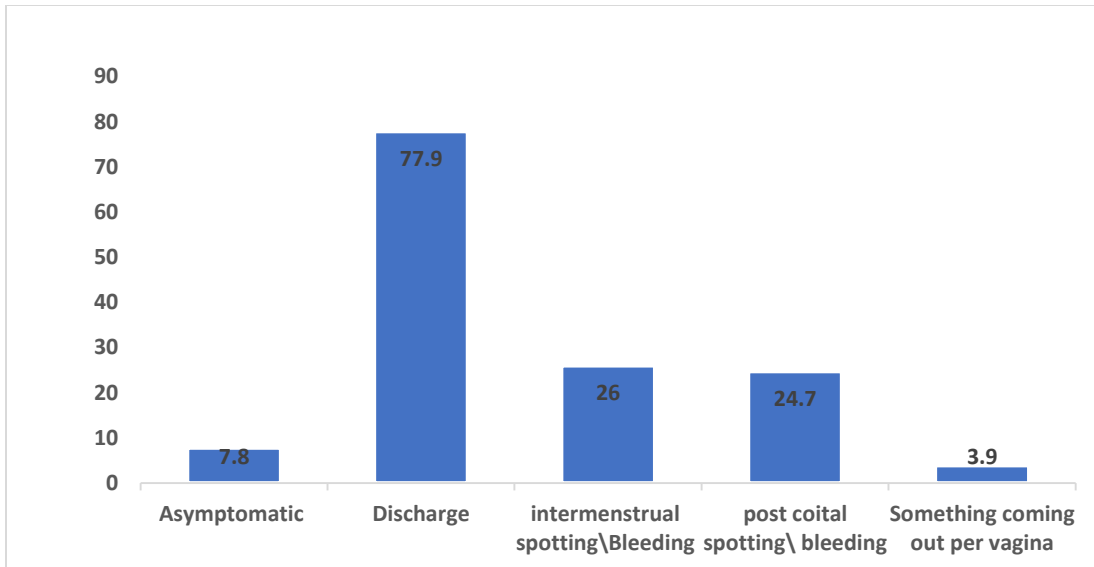


Figure 1: symptoms in the studied patients

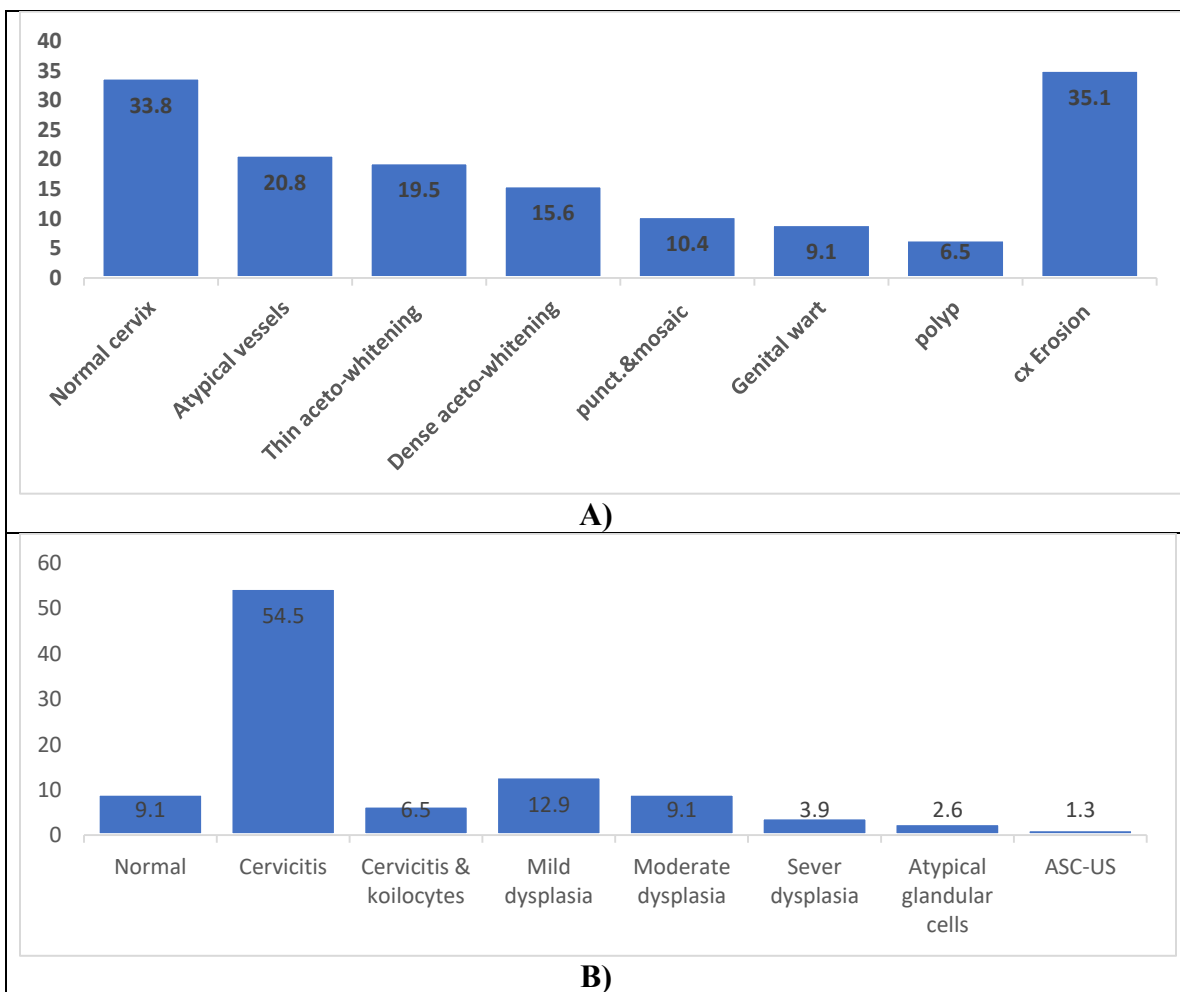


Figure 2: A) Colposcopic findings and B) PAP smear in the studied patients

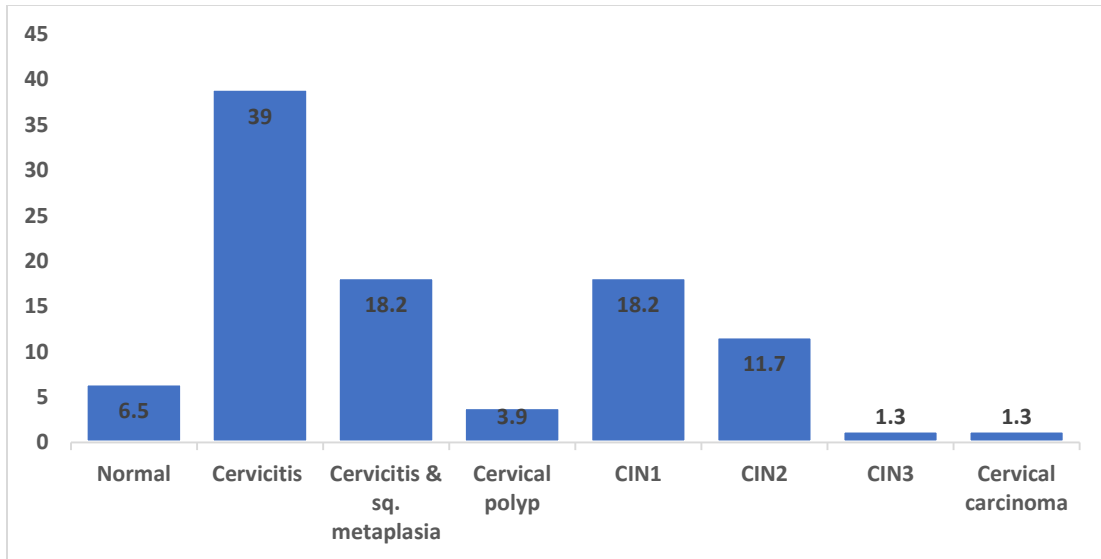


Figure 3: Histopathological results in the studied patients



Figure 4: Digital colposcope used in this study, Karl kaps GmbH, Germany, S-NO :0186.

Discussion

The study found that the majority of participants were aged between 31-50 years, with the highest prevalence of premalignant and malignant cervical pathology observed in the >50 years age group (60%). Participants with parity 0 and parity 1 showed no cervical pathology, while the prevalence increased with higher parity, reaching 66.7% in the group with parity >5.

Our results are compatible with a cross sectional study on women underwent cytology, colposcopy and cervical biopsy. The majority of the study population fell in the range of 31- 50 years (76.36%). Majority of the pre-malignant and malignant cases were seen in the age group of 31-40 years (7).

A cross-sectional study to correlate Pap smear and colposcopy in relation to histopathological findings in detection of preinvasive lesion of cervix. A total of 110 cases were enrolled based on the inclusion criteria. 51(46.36%) of cases were in 31-39 years age group followed in order by 30 years 12(10.9%), 40-49 years 31(28.18%) and 50-60 years 16(14.54%) (9). Also, they reported that the occurrence of pre-malignant and malignant lesions increases as parity increases (7).

Among the study participants, the most commonly reported symptom was discharge (77.9%), with 30% of those experiencing this symptom exhibiting premalignant or malignant cervical pathology. Intermenstrual spotting/bleeding was reported by 26% of participants, and 60% of them displayed premalignant or malignant cervical pathology. Post-coital spotting/bleeding was reported by 24.7%

of participants, and 42.1% of them exhibited premalignant or malignant cervical pathology. Asymptomatic participants accounted for 7.8% of the sample, with 16.7% of them displaying premalignant or malignant cervical pathology. Participants who reported something coming out per vagina constituted 3.9% of the sample, but none of them exhibited premalignant or malignant cervical pathology.

A study declared that white discharge was the most common clinical symptom 61(55.45%) among the cases and others were post coital bleeding 15(13.64%), pain in abdomen 10(9.09%) low backache 19(17.27%), postmenopausal bleeding 15(13.64%) and menstrual disorders 12(10.91%). A study found that the commonest complaint among all the women was in general leucorrhoea (49.09%) while intermenstrual bleeding and post-coital bleeding were the commonest complains in pre-malignant and malignant cases (7).

In the present work, punctuation and mosaic patterns were present in 10.4% of the cases, and genital warts were detected in 9.1% of the cases. Polyps were found in 6.5% of the cases. Regarding cervical conditions, cervical erosion was the most prevalent finding, observed in 35.1% of the cases. Interestingly, a study found that the majority of the patients in the study group had unhealthy cervix as the major clinical finding (40%). Erosion accounts for 34.55%, while inflammation, decubitus ulcer and polyp collectively account for 25.45%. None of the patients of decubitus ulcer, inflammation, polyp had pre-malignant or malignant lesion of cervix (7).

In the current study, the most common PAP smear finding was cervicitis, present in 54.5% of the cases, followed by mild dysplasia (12.9%), moderate dysplasia (9.1%), and cervicitis with koilocytes (6.5%). Severe dysplasia was identified in 3.9% of the cases, while atypical glandular cells were detected in 2.6% of the cases. ASC-US (Atypical Squamous Cells of Undetermined Significance) and normal PAP smear results accounted for 1.3% and 9.1% of the cases, respectively.

Our results are supported by a study reported that the most prevalent result was "Inflammatory," identified in 42 cases, representing 76.36% of the total. Other findings include "Erosion" with 2 cases (3.64%), "Mild dysplasia" with 4 cases (7.27%), "Moderate dysplasia" with 1 case (1.82%), "Severe dysplasia" with 3 cases (5.45%), "Carcinoma in-situ" with 1 case (1.82%), and "Malignancy" with 2 cases (3.64%). Another study conducted their study and reported the incidence of inflammatory Pap smear as 75% (10).

Regarding the histopathological results, a study showed that among the ten cases analyzed, two were normal, and one case each showed CIN I, CIN II, CIN III, and Carcinoma in situ (CIS). Notably, three cases displayed severe dysplasia, with one progressing to CIS and two to invasive carcinoma. Additionally, two cases were identified as malignant invasive carcinoma (7).

In this study, the digital colposcope demonstrated a sensitivity of 92% and a specificity of 61.5% for detecting the condition according to histopathology. The positive predictive value (PPV) was 53.4%, and the NPV was 94.1%, resulting in an overall accuracy of

71.4%. On the other hand, the PAP smear exhibited higher performance with a sensitivity of 84 % and a specificity of 98.1%. The PPV for the PAP smear was 95.5%, and the NPV was 92.7%, leading to an overall accuracy of 93.5%.

In harmony with our findings, a study reported that the sensitivity, specificity, PPV and NPV of colposcopy in detection of premalignant and malignant cases in this study was found to be 90%, 91.1%, 69.2% and 97.6% respectively. Also the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Pap smear in detection of premalignant and malignant cases in this study was found to be 70%, 91.1%, 63.6% and 93.2% respectively (7). A study found that the sensitivity of colposcopy in detection of low-grade lesions and above came out to be 65.38%, specificity 95.83%, positive predictive value 94.44%, negative predictive value 71.86% and accuracy of colposcopy in our study was 80.00% (9).

Another study included a total number of 160 patients with mean age of 37.6 ± 7.32 (ranging from 24 to 63) years. The sensitivity and specificity of pap smear were found to be 47.19% and 64.79%, respectively. The PPV and NPV of the pap smear were calculated to be 88.69% and 38.46%, respectively. The sensitivity and specificity, PPV, and NPV of the colposcopy were calculated as 64.72%, 52.74%, 76.32%, and 95.41%, respectively. The overall diagnostic accuracy of the pap smear and colposcopy was reported to be 82.2% and 96.3%, respectively. The results of this study demonstrate that colposcopy has a higher diagnostic accuracy in detecting cervical premalignant and malignant lesions compared to the pap smear (11).

Conclusion

Digital colposcopy holds promise as a valuable adjunct to conventional screening methods, such as the Pap smear, in diagnosing cervical pathology. While the Pap smear remains a reliable primary screening tool with high sensitivity, digital colposcopy's real-time imaging showed promising results in detecting cervical abnormalities.

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