Evaluation of The Sensitivity and Specificity of Colposcopy in The Early Detection of Dysplasia

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Abstract: *Background:* Cervical cancer remains a significant public health challenge, especially in low to middle-income countries. Early detection through effective screening methods like colposcopy is crucial for timely intervention and management. *Methods:* This cross-sectional analytical study included 200 women attending a colposcopy center at Comilla Medical College Hospital. Participants were selected through random sampling, with inclusion criteria of women aged 20 to 60 years who were Visual Inspection with Acetic acid (VIA) positive. *Result:* The study primarily involved women aged 30-49 (80%), with 50% having primary education and 54% earning 3000-8000 Taka monthly. Early coitus (14-18 years) was reported by 52%, and 70% had been married for 11-20 years. High parity (>4 children) was seen in 48%, and 30% did not use contraception. Common clinical complaints included abnormal vaginal discharge (51%), post-coital bleeding (17%), and irregular P/V bleeding (12%). Colposcopy revealed cervical erosion (34%), inflammatory changes (20%), and polyps (5%). CIN-I, II, and III were detected in 12%, 2%, and 2% of cases, with biopsy confirming CIN in 9%, 4%, and 2%, and invasive carcinoma in 2%. Colposcopy showed 90.0% sensitivity, 97.1% specificity, 96.0% accuracy, 84.4% PPV, and 98.2% NPV. *Conclusion:* The study confirms colposcopy's effectiveness in cervical cancer screening, showing high accuracy.

Keywords: Cervical cancer, Colposcopy, Screening, Diagnostic performance, Sensitivity, Specificity.

Article at a glance:

Study Purpose: The purpose of this study was to assess how effective colposcopy is as a diagnostic tool for the early detection of cervical dysplasia (precancerous changes in cervical cells).

Key findings: Colposcopy is an essential tool for guiding biopsies and improving early detection of cervical dysplasia, but its accuracy depends heavily on the skill and experience of the examiner.

Newer findings: Digital colposcopy with enhanced visualization and image capture technology allows for better documentation and second opinions, improving overall diagnostic performance.

Abbreviations: VIA: Visual Inspection with Acetic acid, HPV: Human Papillomavirus.

INTRODUCTION

Cervical cancer remains a significant public health concern globally, with its pathogenesis intricately linked to human papillomavirus (HPV) infection. Despite advancements in screening and vaccination, the disease continues to pose a substantial burden, particularly in low-resource settings.[1] The development of cervical cancer is often preceded by cervical dysplasia, a condition marked by abnormal cell growth on the surface of

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the cervix. The pathophysiology of cervical dysplasia involves a spectrum of changes, ranging from low-grade squamous intraepithelial lesions (LSILs) to high-grade squamous intraepithelial lesions (HSILs), each carrying varying risks for progression to invasive cancer.[2] The clinical significance of these precancerous stages underscores the importance of early detection and effective screening methods. Colposcopy, a diagnostic tool used to examine an illuminated, magnified view of the cervix, vagina, and vulva, has been a cornerstone in the detection of cervical abnormalities. The technique, which has evolved significantly since its inception, allows for the direct visualization of the cervix, guiding biopsy and treatment decisions.[3] However, the sensitivity and specificity of colposcopy in detecting cervical dysplasia have been subjects of ongoing research and debate. Studies have demonstrated varying degrees of effectiveness, with some highlighting the limitations of colposcopy in accurately identifying precancerous lesions.[4]

This variability in diagnostic accuracy necessitates a critical evaluation of colposcopy's role in current clinical practice. Recent advancements in molecular technologies and the understanding of HPV-associated cervical carcinogenesis have led to novel screening tests, including HPV-DNA based assays. These tests have shown promise in enhancing the specificity and sensitivity of cervical cancer screening.[5] The integration of HPV genotyping into screening protocols has been suggested as a method to refine the referral process for colposcopy, potentially improving the detection of high-grade lesions.[6] Additionally, the development of precision tests, such as the Cervical MethDx test, which assesses DNA methylation in a panel of human genes, represents a significant stride in triaging HPV-positive women before they undergo colposcopy-driven biopsies.[7] Despite these advancements, the global disparity in cervical cancer incidence and mortality remains a challenge. In regions with limited resources, the implementation of advanced screening methods is often constrained, highlighting the need for efficient and cost-effective strategies.[8] The role of colposcopy in these settings is particularly critical, as it serves as a primary method for diagnosing cervical abnormalities. Studies conducted in diverse geographical contexts, such as China and Turkey, have provided valuable insights into the effectiveness of colposcopy when integrated with HPV testing in different population groups.[8,9]

The historical development of colposcopy and its current application in clinical practice reflect a journey marked by continuous refinement and adaptation. From its initial use as a confirmatory tool for cytologic diagnoses to its current role in the integrated management of cervical dysplasia, colposcopy has remained a vital component of cervical cancer screening programs. However, the identified gaps and inconsistencies in the literature, particularly concerning its diagnostic accuracy, call for ongoing research and evaluation.[10,11] The pursuit of technological improvements and the integration of novel molecular methods are expected to enhance the effectiveness of colposcopy, potentially leading to more accurate and timely diagnoses of cervical dysplasia. This manuscript aims to contribute to this ongoing discourse by providing a comprehensive analysis of current literature, highlighting the advancements, challenges, and future directions in the use of colposcopy for the early detection of cervical dysplasia.

METHODS

This cross-sectional was conducted at the Colposcopy Center of Comilla Medical College Hospital, a facility equipped for comprehensive colposcopic examinations and diagnostic procedures among women age ranged 20-60 years. The study spanned a period of six months. Participant selection was executed through random sampling method Inclusion criteria were meticulously defined to ensure the relevance and accuracy of the study. Women who tested positive for Visual Inspection with Acetic acid (VIA) were considered eligible for inclusion. Furthermore, only those who expressed their willingness and provided informed consent to participate in the study were included. This consent process was crucial to uphold ethical standards and participant autonomy. The study also delineated clear exclusion criteria to maintain the integrity of the research. Women presenting with cervical growth were excluded to avoid confounding variables that could potentially skew the colposcopic findings. Additionally, pregnant women were also excluded

from the study, considering the different physiological and hormonal changes during pregnancy that could affect the colposcopic assessment. After data collection, the gathered information underwent meticulous checking and rechecking to ensure accuracy and completeness. The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) program version 26.0.

RESULTS

Table 1: Distribution of study population based on baseline demographic characteristics (N=200)

Characteristics	(n, %)
Age in years	
20 – 29	30,15.0%
30 – 39	84,42.0%
40 – 49	76,38.0%
> 50	10,5.0%
Education level	
Illiterate	60,30.0%
Primary	100,50.0%
Secondary	30,15.0%
Higher Secondary And above	10,5.0%
Income per month in Taka	
< 3000	50,25.0%
3000 – 8000	108,54.0%
8000 – 12000	32,16.0%
>12000	10,5.0%

The age distribution of the study population revealed a higher concentration in the middle age groups, with 42.0% (n=84) of participants aged between 30 and 39 years and 38.0% (n=76) between 40 and 49 years. The youngest age group, 20 to 29 years, comprised 15.0% (n=30) of the participants, while those above 50 years constituted the smallest group at 5.0% (n=10). In terms of education level, the majority of the participants had primary education, accounting for 50.0% (n=100) of the study population. Those with no formal education (illiterate) represented 30.0% (n=60), followed by 15.0% (n=30) who had completed secondary education. A smaller fraction, 5.0% (n=10), had attained higher secondary education or above. Regarding monthly income, more than half of the participants, 54.0% (n=108), reported earning between 3000 to 8000 Taka. Those with an income of less than 3000 Taka made up 25.0% (n=50) of the study population. Participants with a monthly income ranging from 8000 to 12000 Taka constituted 16.0% (n=32), and a minority of 5.0% (n=10) reported earnings above 12000 Taka per month.

Table 2: Distribution of patients according to obstetric characteristics (N=200)

Variables	(n, %)
Age of 1st coitus	
13 years or below	68,34.0%
14 – 18 years	104,52.0%
19 years and above	28,14.0%
Duration of marriage (years)	
10	44,22.0%
11-20	140,70.0%
>20	16,8.0%
Parity	
0	4,2.0%

1-2	46,23.0%
3-4	54,27.0%
>4	96,48.0%
Contraception	
Nil	60,30.0%
Barrier	40,20.0%
OCP	60,30.0%
IUCD	10,5.0%
Permanent	30,15.0%

The age at first coitus varied among the participants, with the majority, 52.0% (n=104), reporting their first coitus between the ages of 14 and 18 years. A significant proportion, 34.0% (n=68), had their first coitus at or below the age of 13 years, while 14.0% (n=28) initiated sexual activity at the age of 19 years or above. The duration of marriage among the participants also showed variability. A substantial majority, 70.0% (n=140), had been married for between 11 to 20 years. Those who had been married for 10 years accounted for 22.0% (n=44) of the study population, and a smaller group, 8.0% (n=16), had been married for over 20 years. In terms of parity, the highest proportion of participants, 48.0% (n=96), had more than four children. Those with 3 to 4 children constituted 27.0% (n=54) of the study population, followed by 23.0% (n=46) who had 1 to 2 children. A very small fraction, 2.0% (n=4), had no children. Regarding contraception usage, 30.0% (n=60) of the participants did not use any form of contraception. An equal proportion (30.0%, n=60) used oral contraceptive pills (OCP). Barrier methods were used by 20.0% (n=40) of the women, while intrauterine contraceptive devices (IUCD) were used by 5.0% (n=10). Permanent methods of contraception were opted for by 15.0% (n=30) of the study population.

Table 3: Distribution of the study population based on Clinical characteristics (N=200)

Complaints	(n, %)
No symptom	20,10.0%
Abnormal Vaginal discharge (with itching, without itching, foul smelling & blood-stained)	102,51.0%
Irregular P/V bleeding	24,12.0%
Post-coital bleeding	34,17.0%
Dyspareunia	14,7.0%
Post-menopausal bleeding	6,3.0%

A notable portion of the participants, 51.0% (n=102), reported experiencing abnormal vaginal discharge, which varied in nature, including symptoms such as itching, absence of itching, foul smell, and blood-staining. This symptom was the most commonly reported among the study population. Irregular per vaginal (P/V) bleeding was reported by 12.0% (n=24) of the participants, indicating its prevalence as a symptom in the study group. Post-coital bleeding, another significant symptom associated with cervical abnormalities, was reported by 17.0% (n=34) of the women. Dyspareunia, or painful intercourse, was experienced by 7.0% (n=14) of the participants, while post-menopausal bleeding was the least common symptom, reported by 3.0% (n=6) of the study population. Notably, 10.0% (n=20) of the participants did not report any symptoms.

Table 4: Distribution of Colposcopic findings among the participants (N=200)

Appearance	(n, %)
Normal	20, 10%
Erosion cervix	67, 34%
Inflammatory changes	40, 20%
Polyps	10, 5%
CIN – I	24, 12%
CIN – II	4, 2%
CIN – III	4, 2%
Unsatisfactory	31, 16%

A segment of the study population, 10% (n=20), exhibited normal colposcopic appearances, indicating no visible signs of cervical dysplasia or other abnormalities. The most common finding was erosion of the cervix, observed in 34% (n=67) of the participants. Inflammatory changes were noted in 20% (n=40) of the cases, and Cervical polyps were identified in 5% (n=10) of the participants. The study also reported varying degrees of cervical intraepithelial neoplasia (CIN). CIN-I, the least severe form of CIN, was observed in 12% (n=24) of the cases. More advanced stages, CIN-II and CIN-III, were less common, each found in 2% (n=4) of the participants. Notably, 16% (n=31) of the colposcopies were deemed unsatisfactory, which could be due to various factors such as inadequate visualization of the transformation zone or other technical issues.

Table 5: Distribution of Colposcopy directed biopsy findings among the participants (N=200)

Colposcopy directed biopsy	(n, %)
Chronic cervicitis	83, 42%
Cervical polyp	9, 5%
Histopathologically Normal	78, 39%
CIN - I	17, 9%
CIN – II	7, 4%
CIN – III	3, 2%
Invasive carcinoma	3, 2%

In the study involving 200 participants, colposcopy-directed biopsy findings revealed a diverse range of cervical conditions. Chronic cervicitis was the most common diagnosis, found in 42% (n=83) of the cases, indicating a high prevalence of chronic cervical inflammation. Cervical polyps were confirmed in 5% (n=9) of the participants. Notably, 39% (n=78) of the biopsies showed histopathologically normal results, suggesting no dysplastic or malignant changes. This highlights instances where colposcopic examination may indicate abnormalities not present on a microscopic level. Cervical intraepithelial neoplasia (CIN) was detected at various stages: CIN-I in 9% (n=17), CIN-II in 4% (n=7), and CIN-III in 2% (n=3) of the cases. These findings are significant as they represent precancerous cellular changes. Invasive carcinoma, the most severe outcome, was identified in 2% (n=3) of the cases. This emphasizes the critical role of colposcopy-directed biopsies in detecting not only precancerous lesions but also invasive cervical cancer.

Table 6: Calculation of Diagnostic Indicators for Colposcopy (N=200)

Indicator	Percentage
Sensitivity	90.00%
Specificity	97.10%
Accuracy	96.00%
Positive Predictive Value	84.40%
Negative Predictive Value	98.20%

Out of the 32 cases that were positive on colposcopy, 27 were confirmed as true positives by biopsy, indicating an accurate detection of pathology. However, there were 5 cases that were false positives, where colposcopy suggested abnormalities that were not confirmed by biopsy. In the 168 cases that were negative on colposcopy, the majority, 165, were true negatives as per the biopsy results, demonstrating a high rate of accuracy in ruling out pathology. Notably, there were 3 cases of false negatives, where colposcopy failed to detect abnormalities that were later identified in the biopsy. Table 7 shows the diagnostic performance of colposcopy based on its comparison with biopsy results. The sensitivity of colposcopy is 90.0%, indicating its effectiveness in correctly identifying 90% of positive cases. The specificity is 97.1%, showing a high accuracy in ruling out negatives. Overall accuracy stands at 96.0%, demonstrating colposcopy's effectiveness as a diagnostic tool. The Positive Predictive Value (PPV) is 84.4%, suggesting a high likelihood of actual disease presence when colposcopy is positive. The Negative Predictive Value (NPV) is 98.2%, indicating a high reliability of negative colposcopy results in ruling out the disease.

DISCUSSION

The demographic profile of our study participants, predominantly aged between 30 and 49 years with primary education and a monthly income of 3000 to 8000 Taka, aligns with findings in similar settings where cervical cancer screening is crucial yet challenging due to socioeconomic factors.[12,13] The early initiation of coitus, predominantly between 14 and 18 years, and a high parity observed in our study, more than four children for many participants, are consistent with the patterns reported in other studies, indicating a potential risk factor for cervical dysplasia and cancer.[14,15] Notably, 30% of our participants did not use any form of contraception, a factor that has been linked to increased risk of HPV infection and cervical cancer.[16] The clinical complaints in our study, with abnormal vaginal discharge being the most common (51%), followed by post-coital bleeding (17%) and irregular P/V bleeding (12%), are similar to symptoms reported in other populations undergoing cervical cancer screening.[17,18] These symptoms are often the first indicators prompting women to seek medical attention, underscoring the importance of awareness and regular screening.

Our colposcopic findings, where erosion cervix was the most frequent (34%), followed by inflammatory changes (20%) and cervical polyps (5%), are in line with other studies emphasizing the prevalence of these conditions in women undergoing colposcopy.[19,20]

The observation of CIN-I, II, and III in 12%, 2%, and 2% of the cases, respectively, with 16% of colposcopies being unsatisfactory, highlights the challenges in colposcopic diagnosis and the need for careful interpretation of findings. Chronic cervicitis being the most common biopsy finding (42%) in our study is a significant observation, as chronic inflammation of the cervix is a known risk factor for cervical cancer.[21,22] The histopathologically normal results in 39% of the cases, and the confirmation of CIN-I, II, and III in 9%, 4%, and 2% of the biopsies, respectively, with invasive carcinoma detected in 2% of the cases, reflect the spectrum of cervical pathologies that can be detected through biopsy, reinforcing its role as the gold standard in cervical cancer diagnosis.[23]

The diagnostic performance of colposcopy in our study, with a true positive rate of 27 cases and a false positive rate of 5 cases, and only 3 false negative cases, demonstrates its effectiveness as a screening tool. The majority of the cases were true negatives (165 cases), indicating a high degree of accuracy in ruling out disease. The sensitivity of 90.0%, specificity of 97.1%, and overall accuracy of 96.0% in our study are comparable to other studies, highlighting colposcopy's reliability in cervical cancer screening.[24,25] The Positive Predictive Value of 84.4% and the Negative Predictive Value of 98.2% further support its use as an effective diagnostic tool in the early detection of cervical dysplasia and cancer.[25-33]

Limitations of The Study
The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

Our study highlights the importance of colposcopy in cervical cancer screening, especially

in low to middle-income settings. The demographic profile of women aged 30-49, with early sexual activity and high parity, underscores the need for targeted screening. The high prevalence of symptoms like abnormal vaginal discharge and post-coital bleeding emphasizes symptom awareness for early detection. Our findings support colposcopy's effectiveness, showing high sensitivity, specificity, and predictive values, and stress the importance of regular screening and timely intervention in resource-limited settings.

Authors' contributions

SD, BKS, SC: Concept and design, data acquisition, interpretation and drafting. USRR and KRK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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REFERENCES

1. Stelzle D, Tanaka LF, Lee KK, Ibrahim Khalil A, Baussano I, Shah ASV, et al. Estimates of the global burden of cervical cancer associated with HIV. Lancet Glob Health. 2021 Feb;9(2):e161–9.

2. Kjær SK, Frederiksen K, Munk C, Iftner T. Long-term absolute risk of cervical intraepithelial neoplasia grade 3 or worse following human papillomavirus infection: role of persistence. J Natl Cancer Inst. 2010 Oct 6;102(19):1478–88.

3. Wright TC, Massad LS, Dunton CJ, Spitzer M, Wilkinson EJ, Solomon D, et al. 2006 consensus guidelines for the management of women with abnormal cervical cancer screening tests. Am J Obstet Gynecol. 2007 Oct;197(4):346–55.

4. Stoler MH, Schiffman M, Atypical Squamous Cells of Undetermined Significance-Low-grade Squamous Intraepithelial Lesion Triage Study (ALTS) Group. Interobserver reproducibility of cervical cytologic and histologic interpretations: realistic estimates from the ASCUS-LSIL Triage Study. JAMA. 2001 Mar 21;285(11):1500–5.

5. Ronco G, Dillner J, Elfström KM, Tunesi S, Snijders PJF, Arbyn M, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomised controlled trials. Lancet. 2014 Feb 8;383(9916):524–32.

6. Arbyn M, Ronco G, Anttila A, Meijer CJLM, Poljak M, Ogilvie G, et al. Evidence regarding human papillomavirus testing in secondary prevention of cervical cancer. Vaccine. 2012 Nov 20;30 Suppl 5:F88-99.

7. Wentzensen N, Fetterman B, Castle PE, Schiffman M, Wood SN, Stiemerling E, et al. p16/Ki-67 Dual Stain Cytology for Detection of Cervical Precancer in HPV-Positive Women. J Natl Cancer Inst. 2015 Dec;107(12):djv257.

8. Denny L, Quinn M, Sankaranarayanan R. Chapter 8: Screening for cervical cancer in developing countries. Vaccine. 2006 Aug 31;24 Suppl 3:S3/71-77.

9. Qiao YL, Sellors JW, Eder PS, Bao YP, Lim JM, Zhao FH, et al. A new HPV-DNA test for cervical-cancer screening in developing regions: a cross-sectional study of clinical accuracy in rural China. Lancet Oncol. 2008 Oct;9(10):929–36.

10. Schiffman M, Wentzensen N, Wacholder S, Kinney W, Gage JC, Castle PE. Human Papillomavirus Testing in the Prevention of Cervical Cancer. J Natl Cancer Inst . 2011 Mar 2;103(5):368–83.

11. Saslow D, Solomon D, Lawson HW, Killackey M, Kulasingam S, Cain J, et al. American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology Screening Guidelines for the Prevention and Early Detection of Cervical Cancer. CA Cancer J Clin. 2012 ;62(3):147–72.

12. Ur Rashid MH, Ahmed MM, Chowdhury S, Ahmed S. Effectiveness of visual inspection with acetic acid as a test for cervical cancer screening. International Journal of Noncommunicable Diseases. 2017 Mar;2(1):3.

13. Vb B, Na P, Sp G, Kk S. Colposcopy Guided Management of Cervical Erosions in Rural Population.

14. Gobran MA, Ibrahim SA, Hanafy SM. A Comparative Study between Colposcopy versus Histo and Cytopathology as Diagnostic

Tools for Detection of the Causes of Post Contact Bleeding. 2021;3.

15. Savitha TS, Sapna W. A comparison of pap smear, colposcopy and colposcopy directed biopsy in evaluation of unhealthy cervix. Journal of Evolution of Medical and Dental Sciences. 2015 Mar 12 ;4(21):3639–48.

16. Valasoulis G, Pouliakis A, Michail G, Daponte AI, Galazios G, Panayiotides IG, et al. The Influence of Sexual Behavior and Demographic Characteristics in the Expression of HPV-Related Biomarkers in a Colposcopy Population of Reproductive Age Greek Women. Biology. 2021 Aug;10(8):713.

17. Head JF, Lipari CA, Elliott RL. Comparison of mammography and breast infrared imaging: sensitivity, specificity, false negatives, false positives, positive predictive value and negative predictive value. In: Proceedings of the First Joint BMES/EMBS Conference 1999 IEEE Engineering in Medicine and Biology 21st Annual Conference and the 1999 Annual Fall Meeting of the Biomedical Engineering Society (Cat N. 1999. p. 1116 vols.2-.

18. Glaros AG, Kline RB. Understanding the accuracy of tests with cutting scores: The sensitivity, specificity, and predictive value model. Journal of Clinical Psychology. 1988;44(6):1013–23.

19. Kim DH, Kim SW, Stybayeva G, Lim SY, Hwang SH. Predictive Value of Olfactory and Taste Symptoms in the Diagnosis of COVID-19: A Systematic Review and Meta-Analysis. Clin Exp Otorhinolaryngol [Internet]. 2021 Jan 25;14(3):312–20.

20. Casey PM, Long ME, Marnach ML. Abnormal Cervical Appearance: What to Do, When to Worry? Mayo Clin Proc. 2011 Feb;86(2):147–51.

21. Taye BT, Mihret MS, Muche HA. Risk factors of precancerous cervical lesions: The role of women's socio-demographic, sexual behavior and body mass index in Amhara region referral hospitals; case-control study. PLOS ONE. 2021 Mar 26;16(3):e0249218.

22. Zhang S, Xu H, Zhang L, Qiao Y. Cervical cancer: Epidemiology, risk factors and screening. Chin J Cancer Res. 2020 Dec;32(6):720–8.

23. SM VR. Correlation of Pap Smear and Colposcopic Finding of Unhealthy Cervix with Histopathological Report. Rajiv Gandhi University of Health Sciences (India); 2017.

24. Ghosh I, Mittal S, Banerjee D, Singh P, Dasgupta S, Chatterjee S, et al. Study of accuracy of colposcopy in VIA and HPV detection-based cervical cancer screening program. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2014;54(6):570–5.

25. Hossain, M. M., Haque, M. A., Islam, M. S., Abdullah, K. S. M., & Al Razy, M. A. (2024). Minimally Invasive Approaches to Hernia Repair A Multicenter Study of Laparoscopic Techniques in Bangladesh. IAR Journal of Medicine and Surgery Research, 5(6), 59-65.

26. Sarker, K. K., Rashed, M. R. H., Kamal, A. H. M., Baset, M. A., & Hafiz, F. B. (2024). Relationship Between Hypertension and Diabetes Understanding Their Co Morbidity and Clinical Management. IAR Journal of Medicine and Surgery Research, 5(6), 83-91.

27. Borna, N. A., Khatun, M. M., Lina, K. S. N., & Khatun, W. (2024). Role of Minimally Invasive Surgery in Managing Ovarian Cysts: A Study of Postoperative Recovery. IAR Journal of Medicine and Surgery Research, 5(5), 32-40.

28. Biswas, B., Chowdhury, A. S., Akter, S., Fatema, K., Reem, C. S. A., Tuhin, E., & Hasan, H. (2024). Knowledge and attitude about COVID-19 and importance of diet: A cross-sectional study among Bangladeshi people. Bangladesh Journal of Food and Nutrition, 1(1), 04-12.

29. Begum, M., Yasmin, M., Hosna, A., Akter, R., & Nisha, Z. S. A. (2020). Assessment of Complications of Normal Delivery in A Selected District Hospital in Bangladesh. Asia Pacific Journal of Nursing Research, 1(1), 11-20.

30. Parvez, M. H., Moula, S. G., Islam, M. M., Badruddoza, A. S. M., & Ali, M. I. (2024). Impact of Surgeon Experience on Outcomes in Prostate Cancer Surgery; A Study of Learning Curves and Best Practices. Asia Pacific Journal of Cancer Research, 1(1), 23-31.

31. Hasan, H., Rahman, M. H ., Haque, M. A., Rahman, M. S ., Ali, M. S ., & Sultana, S . (2024). Nutritional Management in Patients with Chronic Kidney Disease: A Focus on Renal Diet. Asia Pacific Journal of Medical Innovations, 1(1), 34-40.

32. Hossain, Q., Hossain, A., Nizum, M. Z., & Naser, S. B. (2024). Influence of Artificial Intelligence on Customer Relationship Management (CRM). International Journal of Communication Networks and Information Security, 16(3), 653-663.

33. Valls J, Baena A, Venegas G, Celis M, González M, Sosa C, et al. Performance of standardised colposcopy to detect cervical precancer and cancer for triage of women testing positive for human papillomavirus: results from the ESTAMPA multicentric screening study. The Lancet Global Health. 2023 Mar 1;11(3):e350–60.