# Diagnostic Accuracy of Visual Inspection with Acetic Acid (VIA) and Conventional Pap Smear in Detecting Cervical Intraepithelial Neoplasia (CIN) in Women of Reproductive Age at a Tertiary Care Hospital

Saba Khalid[1], Ayesha Azhar Khan[2], Muhammad Azeem Gulzar[3], Hafsa Hafeez[4], and Zunaira Aslam[5]

[1]Senior Registrar, Arif Memorial Teaching Hospital, Lahore, Pakistan.
[2]Senior Registrar, Arif Memorial Teaching Hospital, Lahore, Pakistan
[3]Medical Officer, DHQ Okara City, Okara, Pakistan.
[4]Postgraduate Resident, Sir Ganga Ram Hospital, Lahore, Pakistan.
[5]Sarwar Foundation, Rai Nawaz Hospital, Chichawatni, Pakistan.

**Correspondence:**
Muhammad Azeem Gulzar: azeem.gulzar1@gmail.com

**Article Link:** https://journals.brainetwork.org/index.php/jcihs/article/view/64
**DOI**: https://doi.org/10.69591/jcihs.2.2.2


**Volume 2, Issue 2, 2024**

**Funding**
No



**Citation:** Khalid, S., Khan, A. A., Gulzar, M.A., Hafeez, H., & Aslam, Z. (2024). Diagnostic Accuracy of Visual Inspection with Acetic Acid (VIA) and Conventional Pap Smear in Detecting Cervical Intraepithelial Neoplasia (CIN) in Women of Reproductive Age at a Tertiary Care Hospital, *Journal of Contemporary Insights in Health Sciences, 2(2)*, 22-32.

**Conflict of Interest:** Authors declared no Conflict of Interest

**Acknowledgment:** No administrative and technical support was taken for this research

**Article History**
**Submitted:** Aug 26, 2024
**Last Revised:** Oct 12, 2024
**Accepted:** Dec 22, 2024

**An official Publication of**
**Beyond Research Advancement & Innovation Network, Islamabad, Pakistan**

Original Research Article

# Diagnostic Accuracy of Visual Inspection with Acetic Acid (VIA) and Conventional Pap Smear in Detecting Cervical Intraepithelial Neoplasia (CIN) in Women of Reproductive Age at a Tertiary Care Hospital

**Saba Khalid**
Senior Registrar, Arif Memorial Teaching Hospital, Lahore, Pakistan

**Ayesha Azhar Khan**
Senior Registrar, Arif Memorial Teaching Hospital, Lahore, Pakistan

**Muhammad Azeem Gulzar** (Corresponding Author)
Medical Officer, DHQ Okara City, Okara, Pakistan
Email: azeem.gulzar1@gmail.com

**Hafsa Hafeez**
Postgraduate Resident, Sir Ganga Ram Hospital, Lahore, Pakistan

**Zunaira Aslam**
Sarwar Foundation, Rai Nawaz Hospital, Chichawatni, Pakistan

***ABSTRACT***

**Background:** Cervical cancer, the second leading cause of cancer-related morbidity and mortality among women globally, requires timely diagnosis at its precancerous stage to reduce disease severity and mortality rates. Histopathology, though the gold standard for diagnosis, is invasive and costly. This study aimed to assess the diagnostic accuracy of two less invasive procedures, i.e., Visual Inspection with Acetic Acid (VIA) and Pap smear against histopathology, to identify the most accurate early cervical cancer detection method.

**Objective:** To compare the diagnostic accuracy of Visual Inspection with Acetic Acid (VIA) and Pap smear for detecting cervical lesions, using histopathology as a gold standard.

**Study Design:** A cross-sectional study

**Duration and Setting:** Arif Memorial Teaching Hospital, Lahore, from January 2024 to September 2024.

**Methods:** This study was conducted with 290 women of reproductive age. Following cervical visualization and inspection, Pap smears and VIA tests were performed. Positive findings on VIA and Pap smear prompted biopsy. Sensitivity, specificity, positive and negative predictive values, and the overall accuracy of VIA and Pap smear were calculated relative to histopathology results.

**Results:** The study included women with a mean age of 35.18 ± 8.29 years. VIA showed sensitivity, specificity, PPV, NPV, and accuracy of 91.86%, 95.59%, 89.77%, 96.53%, and 94.48%, respectively, while the Pap smear exhibited values of 83.72%, 94.61%, 86.75%, 93.24%, and 91.38%, respectively.

**Conclusion:** VIA demonstrated higher diagnostic accuracy than the Pap smear in detecting cervical malignancy, suggesting it as a cost-effective, non-invasive option for early screening in resource-limited settings.

**Keywords:** Cervical Cancer, Diagnostic Accuracy, Visual Inspection with Acetic Acid, Pap Smear, Histopathology

## 1. INTRODUCTION

Cervical cancer is a leading cause of cancer-related morbidity and mortality among women, especially in developing countries, where it accounts for about 87% of deaths.[1,2] In these regions, limited resources and healthcare infrastructure hinder effective screening, contributing to the high incidence of advanced cervical cancer diagnoses.[3] In South Asia, cervical cancer is particularly prevalent, with an estimated 122,844 cases and 67,477 deaths annually in India,[4] and approximately 5,601 new cases and 3,861 deaths each year in Pakistan.[5] Among women aged 15-44 years in Pakistan, cervical cancer ranks as the second most common cancer, highlighting the urgent need for accessible screening strategies.[6]

Cervical cancer typically progresses slowly through precancerous lesions over 7–20 years, providing a critical window for early detection and intervention.[7] Established screening methods, such as the Papanicolaou (Pap) smear and liquid-based cytology (LBC), have effectively reduced cervical cancer rates in developed countries by approximately 50% over the last four decades.[8] In contrast, screening coverage remains low in low-resource countries, with only

about 5% of women undergoing routine screening.[9] This leads to most diagnoses being made at advanced stages, and in Pakistan, this coverage is even lower, at just 2%.[9]

The Pap smear has been shown to have a sensitivity of 70–80% for detecting cervical intraepithelial neoplasia (CIN), while LBC demonstrates higher sensitivity, reaching 85–95%.[10] However, both methods require laboratory infrastructure and trained personnel, which limits their feasibility in settings with limited resources. Visual inspection with acetic acid (VIA) presents a viable alternative for initial screening, as it is cost-effective, does not require laboratory facilities, and yields immediate results.[9] Studies have shown that VIA has a sensitivity of up to 88.9% and a specificity of 80%, making it a practical option in settings where only opportunistic screening is available.[11]

A range of studies have evaluated the diagnostic accuracy of VIA and Pap smear, often showing variability in sensitivity and specificity. In a study by Hemida AS et al., VIA demonstrated a sensitivity of 86.11%, specificity of 89.23%, positive predictive value (PPV) of 43.05%, and negative predictive value (NPV) of 98.56%.[12] A study in Egypt by Begum KN et al. reported that VIA had a sensitivity of 84% and specificity of 67%, with a PPV of 80.5% and NPV of 73%.[13] In contrast, Pap smear was shown to have a higher sensitivity and specificity, with one study indicating 88% sensitivity, 79% specificity, PPV of 55%, and NPV of 95%, and test accuracy of 81%.[14]

Cervical cancer is a significant health issue in Pakistan, where limited resources hinder early diagnosis and screening, with only 2% of women screened.[9] VIA is a low-cost, accessible screening method suitable for low-resource settings like Pakistan, but studies show mixed results regarding its diagnostic accuracy. Some report VIA sensitivity and specificity as high as 86% and 74%, respectively[15], while others find lower values with a sensitivity of 20% and specificity of 96%, respectively.[16] In comparison, the Pap smear consistently shows higher sensitivity (80%) and specificity (90%) but is less accessible.[15] These findings illustrate that while the Pap smear remains superior in diagnostic accuracy. VIA offers an effective, accessible alternative for cervical cancer screening in resource-constrained settings. This study aims to assess the diagnostic accuracy of VIA in comparison to Pap smear, using histopathology as the gold standard. The results could support the role of VIA as a first-line

screening tool, which may help expand screening coverage and improve early detection in low-resource settings.

## 2. MATERIAL AND METHOD

This cross-sectional study was conducted over six months in the Department of Obstetrics & Gynecology, Arif Memorial Teaching Hospital, Lahore, from January 2024 to September 2024. A sample size of 290 cases was determined using a 95% confidence level, a 15% margin of error, and an expected cervical cancer prevalence of 85%, with VIA sensitivity and specificity assumed to be 84.2% ± 12% and 55.2% ± 13%, respectively. Non-probability purposive sampling was used to select participants, including married women aged 15–49 years who exhibited symptoms suggestive of cervical malignancy, such as post-coital bleeding persisting for over four weeks, irregular bleeding with a disrupted cycle pattern for over three months, and foul-smelling vaginal discharge with associated itching or burning for at least six months. Exclusion criteria included unmarried women, those with active bleeding or PID (per clinical evaluation), and pregnant women.

After obtaining informed consent, demographic details (name, age, parity, and contact information) were recorded. A Pap smear was collected from each participant, fixed in 95% ethanol, and sent for cytology. Following this, 5% acetic acid was applied to the ectocervix, and acetowhite areas were identified. All participants underwent biopsy for histopathological evaluation. Biopsies were obtained from suspicious areas in patients with positive VIA or Pap smear results and also from VIA- or Pap smear-negative cases, with histopathology serving as the gold standard for diagnostic comparison. Pap smear and VIA results were subsequently compared to histopathology findings, and all information was recorded in a structured proforma.

Data were analyzed using SPSS version 27. Age was expressed as mean ± SD, while categorical variables such as cervical conditions (malignant or benign) detected by VIA, Pap smear, and histopathology were presented as frequencies and percentages. Multiple 2×2 tables were used to calculate sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy of VIA and Pap smear against histopathology as the gold standard.

## 3. RESULTS

A comprehensive analysis was conducted to evaluate the diagnostic accuracy of Visual Inspection with Acetic Acid (VIA) and the Pap smear for detecting Cervical Intraepithelial Neoplasia (CIN).

**Table 1: Summary of Descriptive Statistics**

| Variable | N | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|---|
| Age (years) | 290 | 35.18 | 8.29 | 20.00 | 49.00 |
| Duration of Marriage (years) | 290 | 12.02 | 7.32 | 1.00 | 30.00 |

Source: Author's own calculations.

A total of 290 women participated in the study, with a mean age of 35.18 ± 8.29 years and a mean marriage duration of 12.02 ± 7.32 years. The Pap smear was positive in 28.62% of cases, and VIA was positive in 30.3%. Histopathology, the gold standard, identified 29.66% of cases as positive.

**Table 2: Frequency Distribution of VIA Test Results**

| VIA Result | Frequency | Percentage (%) |
|---|---|---|
| Positive | 88 | 30.3 |
| Negative | 202 | 69.7 |
| **Total** | **290** | **100.0** |

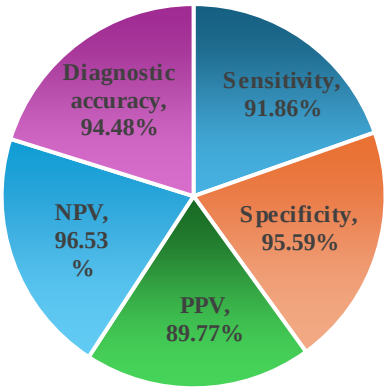
Source: Author's own calculations.

Table 2 presents the frequency and percentage distribution of Visual Inspection with Acetic Acid (VIA) test results among the 290 women included in the study. The results indicate that 88 women (30.3%) tested positive for VIA, suggesting the presence of potential cervical abnormalities. In contrast, 202 women (69.7%) had negative VIA results, indicating no visible precancerous or cancerous lesions. These findings highlight that VIA identified a substantial proportion of suspected cases, reinforcing its potential as a screening tool for detecting Cervical Intraepithelial Neoplasia (CIN) in women of reproductive age**.**

**Table 3: Diagnostic Accuracy of PAP and VIA in Comparison to Histopathology**

| (a) PAP Smear | | | |
|---|---|---|---|
| **PAP vs. Histopathology** | **Histopathology Positive** | **Histopathology Negative** | **Total** |
| PAP Positive | 72 | 11 | 83 |
| PAP Negative | 14 | 193 | 207 |
| **Total** | **86** | **204** | **290** |
| **(b) VIA** | | | |
| **VIA vs. Histopathology** | **Histopathology Positive** | **Histopathology Negative** | **Total** |
| VIA Positive | 79 | 9 | 88 |
| VIA Negative | 7 | 195 | 202 |
| **Total** | **86** | **204** | **290** |

Source: Author's own calculations.



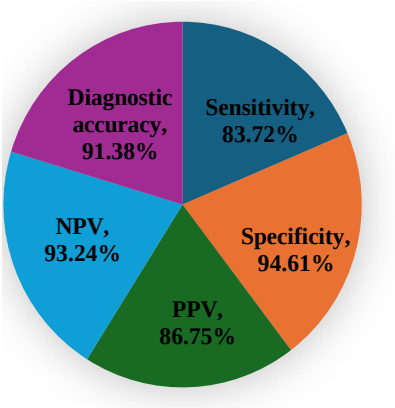




**Figure 1: Diagnostic Accuracy of VIA** **Figure 2: Diagnostic Accuracy of Pap Smear**

VIA showed a higher sensitivity of 91.86%, specificity of 95.59%, PPV of 89.77%, NPV of 96.53%, and diagnostic accuracy of 94.48%. For the Pap smear, sensitivity was 83.72%, specificity was 94.61%, positive predictive value (PPV) was 86.75%, negative predictive value (NPV) was 93.24%, and diagnostic accuracy was 91.38%.

## 4. DISCUSSION

Our study results provide insights into the diagnostic efficacy of Pap smear and VIA for detecting cervical lesions. By comparing these results with findings from previous studies, we can better understand the variability in test performance across different settings and populations. Our study results on the diagnostic performance of VIA and Pap smear provide insightful comparisons with existing literature, highlighting the variability in test accuracy across different populations and clinical settings. In our study, Pap smear showed a sensitivity of 83.72% and a specificity of 94.61%, with a PPV of 86.75% and a NPV of 93.24%. VIA, on the other hand, demonstrated slightly higher sensitivity (91.86%) and specificity (95.59%), yielding a PPV of 89.77% and NPV of 96.53%. These results are consistent with previous findings but also reveal some key differences.

In our study, Pap smear demonstrated sensitivity of 83.72% and specificity of 94.61%, whereas Hemida et al. reported a lower sensitivity of 52.78% and a similar specificity of 94.27%. This difference in sensitivity could be due to differences in sample characteristics or screening protocol standardization, which may impact the ability of Pap smears to detect lesions effectively. For VIA, our study found a sensitivity of 91.86% and specificity of 95.59%, which aligns closely with Hemida et al. study showing a sensitivity of 86.11% and specificity of 89.32%. This similarity in VIA results across both studies supports the reliability of VIA, particularly in primary screenings.[12]

In comparison to the study by Sinha P et al., which reported a VIA sensitivity of 93.3%, specificity of 60%, PPV of 36.8%, NPV of 97.3%, and diagnostic accuracy of 77.3%, our study demonstrated a sensitivity of 91.86%, specificity of 95.59%, PPV of 89.77%, NPV of 96.53%, and diagnostic accuracy of 94.48%. Both studies show high sensitivity, indicating that VIA is effective in detecting cervical abnormalities. However, our study stands out with a significantly higher specificity and PPV of VIA, suggesting better accuracy in identifying true negatives and minimizing false positives. While both studies demonstrate that VIA has a high NPV, our study showed superior diagnostic accuracy, highlighting VIA as a stronger method in our population. These differences underscore the need for further exploration to optimize the use of VIA in cervical screening in diverse settings.[14]

Another study by Kakollu M et al., showed sensitivity of VIA 86%, specificity of 74%, and diagnostic accuracy of 80% and Pap smear sensitivity of 80% and specificity of 90%. This study reports a similar sensitivity for Pap smear of around 80% as in our study, but the higher specificity and diagnostic accuracy of VIA in our study highlight its potential as an effective alternative to Pap smear for CIN screening. These differences may reflect variations in the study populations, the methods used, and the healthcare settings, which warrant further investigation to confirm the role of VIA in cervical cancer detection.[15]

A study by Mrudula DM et al. reported that VIA had a higher sensitivity of 52.38% compared to Pap smear (40%), with Pap smear achieving higher specificity. In contrast, our study observed a substantially higher sensitivity for both tests. The specificity of the Pap smear in our study was also high, reinforcing its use as a confirmatory test. This discrepancy in sensitivity suggests that clinical setting, examiner proficiency, and test protocols can significantly influence diagnostic accuracy, especially for Pap smear.[17]

Basanna SK et al., demonstrated a very high sensitivity for VIA (92.8%), comparable with our study, but a low specificity (29.8%), indicating a high rate of false positives, is in contrast with our results. Pap smear sensitivity and specificity in our study were both higher than the sensitivity (64.2%) and specificity (76.4%) reported by Basanna for Pap smear. The low specificity for VIA in the Basanna et al. study may highlight a population or protocol-specific issue that could be mitigated by increased examiner training or stricter criteria for positive findings.[18]

Zawua Z et al. study observed a sensitivity of 43.8% and a specificity of 98.4% for Pap smear, indicating a high specificity but much lower sensitivity than our study. For VIA, their study found both sensitivity and specificity to be 43.8% and 86.0%, which are lower than those observed in our study. The higher diagnostic values in our study suggest that VIA may yield more accurate results when performed by trained clinicians and under standardized protocols.[19]

The variability in sensitivity and specificity of both VIA and Pap smear across these studies highlights how factors like patient demographics, examiner proficiency, and protocol standardization can influence outcomes. Our findings suggest that VIA, with its high sensitivity, is well-suited for initial screenings, while Pap smear's higher specificity makes it valuable for confirming positive

results. This sequential approach could enhance diagnostic accuracy, minimize unnecessary referrals, and optimize cervical cancer screening, especially in resource-limited settings.

## 5. CONCLUSION

Our study demonstrates that visual inspection with acetic acid (VIA) is a highly effective screening tool for detecting cervical abnormalities in women of reproductive age. With high diagnostic accuracy, VIA performs comparably to Pap smear, making it a valuable alternative, particularly in low-resource settings where access to Pap smear facilities may be limited, potentially reducing the burden of cervical cancer in underserved populations.

Our findings support the inclusion of VIA in cervical cancer screening programs, especially in developing countries, where it can serve as a reliable and accessible method for early detection and intervention. Further research and broader implementation could help optimize cervical cancer screening strategies, improving early diagnosis and outcomes for women at risk.

## 6. LIMITATIONS

While our study provides compelling data on the diagnostic accuracy of VIA and Pap smear, it is limited by its single center design, which may not reflect all demographics in Pakistan. Furthermore, histopathology was used as the sole confirmatory method, which may limit generalizability, as VIA results could vary by examiner experience and lighting conditions.

## REFERENCES

1. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. Lancet Glob Health. 2019;8(2):e191-e203.
2. Gurung TK, Adhikari SP, Adhikari A, Shrestha R, Pun CM. Conventional pap smear cytology in a tertiary care center. J Coll Med Sci Nepal. 2021;17(2):117-123.
3. Chanthavilay P, Mayxay M, Phongsavan K, Marsden DE, White LJ, Moore L, et al. Accuracy of combined visual inspection with acetic acid and cervical cytology testing as a primary screening tool for cervical cancer: a systematic review and meta-analysis. Asian Pac J Cancer Prev. 2015;16(14):5889-5897.

4. Sreedevi A, Javed R, Dinesh A. Epidemiology of cervical cancer with special focus on India. Int J Women Health. 2015;7:405-414.
5. Human papillomavirus and related diseases report [online]. Pakistan ICO/IARC Information Centre on HPV and Cancer. June 17, 2019. Available from: https://hpvcentre.net/statistics/reports/PAK.pdf. Accessed July 6, 2021.
6. Mahmud G, Tasnim N, Iqbal S. Comparison of visual inspection with acetic acid and Pap smear in cervical cancer screening at a tertiary care hospital. J Pak Med Assoc. 2013;63(8):1013-1016.
7. Rajakeerthana R, Swarnapriya K, Kavitha G. Comparison of Pap smear and colposcopy in the evaluation of unhealthy cervix among women visiting a tertiary care center: a hospital-based descriptive observational study. Nepal J Obstet Gynaecol. 2023;18(1):13-19.
8. Ali F, Munim TF, Nadeem S, Khatoon A, Shaukat N. Visual inspection of cervix with acetic acid (VIA): an effective method of screening for cervical cancer. Ann Abbasi Shaheed Hosp Karachi Med Dent Coll. 2021;26(2):91-98.
9. Naz U, Hanif S. Agreement between visual inspection with acetic acid and Papanicolaou's smear as screening methods for cervical cancer. J Coll Physicians Surg Pak. 2014;24(4):228-231.
10. Patel SD, Airao BB. A study of Pap smear examination at a tertiary care hospital. Int J Reprod Contracept Obstet Gynecol. 2022;11(11):3063-3067.
11. Nur AN, Chowdhury SR, Ahmed N. Colposcopic detection of CIN in patients with clinically abnormal cervix at a tertiary care center in Bangladesh. Sch Int J Obstet Gynec. 2024;7(5):223-228.
12. Hemida AS, Mohamed AA, El-Khouly NI, El-Kelani OA. Comparison of visual inspection with acetic acid and Pap smear for cervical cancer screening. Menoufia Med J. 2022;35(1):245-249.
13. Begum KN, Shahanaz S, Rashid F, Rehena Z, Chowdhury S, Sharmin S, et al. Visual inspection of cervix with acetic acid as a method of cervical cancer screening in tertiary hospital. IAHS Med J. 2021;4(1):22-26.
14. Sinha P, Srivastava P, Srivastava A. Comparison of visual inspection with acetic acid and the Pap smear for cervical cancer screening. Acta Cytol. 2018;62(1):34-38.

15. Kakollu M, Biswas PK, Yadala A. 794P Comparative study of effectiveness of Pap smear and visual inspection with acetic acid for screening of premalignant and malignant lesion of cervix in a tertiary care setup. Ann Oncol. 2021;32(Suppl 7):S759.
16. Jeffries A, Beck-Sagué CM, Marroquin-Garcia AB, Dean M, McCoy V, Cordova-Toma DA, et al. Cervical visual inspection with acetic acid (VIA) and oncogenic human papillomavirus screening in rural indigenous Guatemalan women: time to rethink VIA. Int J Environ Res Public Health. 2021;18(23):12406.
17. Mrudula DM, Venkatalakshmi A, Sirisha G, Kumar SS, Atla B. Comparative study of effectiveness of Pap smear versus visual inspection with acetic acid for mass screening of lesions of cervix. Int J Res Med Sci. 2018;6(6):2042-2047.
18. Basanna SK, Charita U, Anuradha SN. Comparison of Pap smear with visual inspection with acetic acid in screening of carcinoma cervix. J Pharm Negat Results. 2022;13(1):4923-4933.
19. Zawua Z, Omietimi JE, Jeremiah I, Aigere S, Musa S, Osegi N, et al. 872P Comparison of colposcopy, Pap smear test and visual inspection with acetic acid (VIA) as screening tests for precancer of the cervix (CIN2+) in high-risk patients. Ann Oncol. 2020;31(Suppl 4):S642.