Original Article

Visual Inspection with Acetic Acid, a Low-Cost Screening Method for Cervical Cancer in Low Resource Settings, and Low Socioeconomic Strata: Primary Health Care Physicians and General Practitioners; An Appropriate Entry Point for Screening

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Abstract

Objective: To evaluate the feasibility and effectiveness of visual inspection with acetic acid (VIA) for cervical cancer screening in a primary health care setting for low-resource areas, also aiming to assess the awareness, and risk factors of cervical cancer (CC) among the target population.

Methodology: This cross-sectional study was conducted at Ziauddin University and Chiniot General Hospital in Karachi, Pakistan, from May 2022 to May 2023, study included 200 married, non- pregnant, and sexually active women aged 21-59 years using convenience sampling. Participants underwent history taking, Cusco's speculum examination, and VIA using 5% acetic acid. Acetowhite changes were observed for one minute, and positive results were confirmed with a pap smear and referred for colposcopy. Diagnostic accuracy parameters, including sensitivity, specificity, positive predictive value, negative predictive value, overall diagnostic accuracy, and logistic regression were assessed using SPSS-20.

Results: The mean age of the participants was 34.79± 7.42 years. VIA demonstrated a sensitivity of 50%, specificity of 83.3%, positive predictive value of 2.9%, negative predictive value of 99.4%, and an overall diagnostic accuracy of 83%. The logistic regression model revealed statistical significance (Chi2(19) = 39.07, p = .004, n = 200), indicating that the independent variables collectively influenced VIA results.

Conclusion: Although VIA may not match the robustness of advanced CC screening methods, it remains a promising and feasible technique for low-resource settings due to its simplicity, affordability, and reasonable accuracy. Integrating VIA as a screening tool with primary health care services can strengthen healthcare systems and contribute to reducing the burden of CC.

Keywords: cervical cancer, Visual Inspection with Acetic Acid, primary health care, screening, prevention, human papilloma virus

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Introduction

Globally, cervical cancer (CC) is a significant public health concern, ranking as the fourth most common cancer in women [1,2] According to the World Health Organization (WHO), approximately 604,000 new cases of cervical cancer were reported in 2020, resulting in 342,000 deaths. In Pakistan, cervical cancer is the third most frequent cancer among women and the second mostfrequent among women aged 15 to 44. [3,4]

This specific age group comprises approximately 73.8 million women out of the total population of Pakistan, which stands at 233,280,651 million.[5] Each year, around 5008 women are diagnosed with cervical cancer, and 3197 lose their lives to the disease. [5] The high mortality rate in Pakistan can be attributed primarily to the fact that over 70% of cancer patients are diagnosed at an advanced stage of malignancy.[2,6] It is estimated that

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around 0.5% of women in the general population are infected with cervical Human papilloma virus (HPV) 16–18, with 88.1% of invasive cervical cancers are due to these types of HPV, primarily transmitted through sexual contact.[7] While most HPV infections resolve spontaneously, persistent infections can lead to cervical cancer. [8] Factors that elevate the risk, such as having numerous sexual partners, engaging in early sexual activity, not using barrier protection consistently, presence of other sexually transmitted infections (including HIV), weakened immune system, alcohol consumption, and smoking, all play a role in the persistence of HPV infection.[9]

The challenges faced by women in low-middle-income countries and within LMICs, particularly low socioeconomic strata, are financial constraints, geographical limitations such as living in remote areas where limited transportation options hinder them from reaching healthcare facilities, especially for regular screenings or follow-up appointments. Lack of awareness, cultural practices and language barriers are few other limitations experienced by these communities.[10] To address these barriers, Primary health care and general practitioners should serve as the main entry points for cervical cancer screening, playing a vital role in the early detection and prevention of CC.[11] The screening of CC can be conveniently performed in various other healthcare settings, for instance, community health centers, and outreach programmes.[11,12]

However, current screening methods for cervical cancer, such as pap smear, HPV testing, and colposcopy, face challenges related to cost, accessibility, and resource requirements. To improve CC screening rates in low-middle-income countries, innovative, cost-effective approaches are needed.[11] VIA could be a valuable screening tool in Pakistan, primarily because of its low cost, non- invasive nature, and ease of application, which provide immediate results.[4] By integrating VIA into primary health care services, more women can be reached and screened for cervical cancer, leading to improved overall screening coverage and timely intervention.[2] Although HPV testing offers high sensitivity and negative predictive value, it is not cost-effective and poses logistic burdens.[11] The World Health Organization (WHO) suggests employing HPV-DNA testing or cytology as the primary screening methods for cervical cancer, considering the available measures.[13]

Methodology

This cross-sectional study was conducted at Ziauddin University, Family Medicine Department, Gynecology and Obstetrics Department (Kemari campus), and Gynecology & Obstetrics Department, Chiniot General Hospital, Korangi Karachi, from June 2022 to June 2023.

The study participants were selected using a non-probability convenience sampling method. The inclusion criteria comprised women who were married, not pregnant, and sexually active, falling within the age range of 21 to 59 years. Demographic information and relevant history were taken, followed by per abdominal, bimanual exam and finally the Cusco's speculum exam to assess the cervix for any gross abnormalities. Then 5% acetic acid was applied to the cervix with the help of cotton swabs and observed for acetowhite changes for one minute under a good light source. The appearance of any distinct acetowhite changes at the cervix was considered positive, while no change in the color was considered negative. All the information, examination findings and the results of VIA were documented on the questionnaire paper later transferred to the software. All positive VIAs were confirmed with a pap smear and were referred for colposcopy. Conducting pap testing on all VIA negative participants was cost- prohibitive or impractical due to budget constraints. Therefore, a random selection approach was implemented to ensure that a subset of participants from the VIA negative group could still undergo further testing with the pap smear allowing to counter check the results of VIA with a more sophisticated test. Mean±SD were calculated (age, age of marriage, duration of marriage and age at first pregnancy). Socioeconomic status, education level, knowledge about cervical cancer and HPV, pap test done in the past, number of marriages, use of OCP, circumcision status of husband was presented as percentages. A logistic regression analysis was performed to examine the relationship between independent variables and VIA result. SPSS version 20 was used for statistical analysis.

Results

There were 200 participants in the study, with a mean age of 34.79 ± 7.42. Out of 200 participants, 34 were VIA positive, and 166 were negative. Mean age of marriage is 19.63±3.29 SD. We have considered age of marriage as age of first intercourse. Most of the population in our study belonged to low socioeconomic status (98.5%).

Other risk factors like smokers (female) were 4% and non-circumcised males were 5%.

Women never used oral combined oral contraceptive pills were 97%. Positive VIA'swere sent for pap testing, and 1 result showed ASCUS positive. Among VIA negative's- when random samples were sent for pap testing, one was found ASCUSpositive. Participants with positive test results were sent to higher center for further evaluation. Specificity of the test was 83.3% and negative predictive value (NPV) 99.4%. These results of our study indicate that VIA screening can identify individual without condition (true negatives) 83.3% of the times and is effective in ruling out the condition.

Whereas NPV of 99.4% indicates individuals tested negative for the condition 99.4% of the times. Overall, the results indicate goodaccuracy (83%) in identifying individuals without the condition. In our study, the calculated negative likelihood ratio (LR-) is approximately 0.6. This means that individuals with a negative test result are approximately 0.6 times as likely to have the condition compared to those with a positive test result. A lower LR- indicates a stronger association between the negative test result and the absence of the condition.

Overall Characteristics	
Variable (n = 100)	Mean ± SD/%
Age	35.25 ± 8.367
Age at marriage	20.22 ± 4.044
Duration of marriage	15.03 ± 8.292
Age at first pregnancy	21.51 ± 4.128
Below Grade-6 level education	71
Poor socio-economic status	97
Lack of cervical cancer program screening awareness	94
Lack of HPV vaccination awareness	100
Do not use OCPs	95
Non-smokers	93
Male circumcision	91
Genital warts in partner	6
Positive history of STI	10
No history of uterine and cervical cancer in family	89
Never had pap smear in the past	100

On the other hand, the calculated LR+ is approximately 3. This means that individuals with a positive test result are approximately 3 times more likely to have the condition compared to those with a negative test result. A higher LR+ indicates astronger association between the positive test result and the presence of the condition. A logistic regression analysis was performed to examine the relationship between the independent variables and theVIA result. The overall model of the study, which included the independent variables being analyzed, was found to be statisticallysignificant. This was determined through a chi-square test, which yielded a chi-square value of 39.07 with 19 degrees of freedom. The resulting p-value was 0.004, indicating that the likelihood of obtaining the observed results by chance alone is very low.

Discussion

Cervical cancer is one of the primary public health concerns, particularly in low socioeconomic nations where access to reliable screening and diagnostic tools is constrained and where there is also a serious lack of awareness and understanding regarding cancer screening.[14] The effectiveness of CC screening and its significant impact on reducing cervical cancer-related deaths have highlighted the importance of addressing screening failures as the main reason for ongoing fatalities where approximately 60% of cervical cancer cases can be attributed to insufficient or lacking screening practices.[15] Although the occurrence of cervical cancer in Pakistan is relatively less frequent in comparison to other nations, the mortality rate remains high due to a lack of awareness, the unavailability of low-cost screening tools, inadequate follow-up, and delayed presentation of CC.[6] As, CC has an indolent course, there is a 10–20-year delay betweenthe pre-cancerous stage and cervical cancer. Therefore, taking advantage of the time delay, early detection and prevention of CC is possible.[16] The detection of late- stage cases highlight the urgent need for a nationwide screening program and enhanced public health education. [2,4]

Specificity and NPV values of 83.3% and 99.4% respectively of VIA in our study indicate that the screening test has a good accuracy in identifying individuals without the condition (high specificity) and has a high ability to correctly classify individuals as negative for the condition (high NPV).[17] Whereas the low sensitivity and PPV in our study demonstrate that it may not be a powerful screening tool but considering its non-invasive nature, low cost, and easy accessibility through primary health care makes it an acceptable screening.[14] The PPV or NPV are frequently regarded as the most important aspects of a screening program.[17] It is important to keep in mind that the PPV or NPV depends on both the research population and the technical specifications of the screening test.[17] If the population prevalence is sufficiently low, a screening test with reasonably good sensitivity and specificity may

nonetheless have a low PPV. Therefore, it is vital to consider both the technical and population aspects of a proposed screening test.[17]

In this investigation, a noteworthy deficiency in formal education and knowledge regarding cancer screening, particularly the pap test, was observed among participants. Approximately 97% of the individuals lacked awareness about strategies for screening and preventing cervical cancer, contributing to low screening rates. This lack of awareness could result in a diminished motivation for screening, leading to missed opportunities for early diagnosis and intervention.[4] The absence of adequate awareness campaigns and educational initiatives leaves the general population uninformed about the significance of cervical cancer and the potential advantages of screening.[18] Bridging this knowledge gap is vital to enhance screening rates and empower individuals to take proactive measures in preventing cervical cancer.[12]

Cervical cancer is preventable, and recognizing potential risk factors is crucial for fostering awareness, enabling women to adopt risk-reducing behaviors. Regrettably, our study revealed that none of the women had undergone pap testing previously, mirroring similar patterns in other low- and middle-income countries such as Malawi, Ethiopia, and Bangladesh.[14] Improving women's access to healthcare services is paramount for the success of any screening program. Primary health care physicians and general practitioners, acting as frontline healthcare providers, are strategically positioned to play a pivotal role in cervical cancer screening.[11]

Various studies have explored the effectiveness, accuracy, and acceptability of visual inspection with acetic acid (VIA) for cervical cancer screening.[2,12,13,19–22] While VIA is considered less reliable than laboratory-based HPV testing by WHO, global strategy[7,23], it has shown promise in certain contexts. For example, in Bangladesh, VIA demonstrated a sensitivity of 93.6% and specificity of 58.2% when administered to many women by trained staff. [14] Our study's findings align with these results, indicating similar outcomes. However, comprehensive training for healthcare providers is necessary to ensure the quality and reproducibility of VIA results.[14]

Additionally, other risk factors for cervical cancer, such as smoking in females and having uncircumcised male partners, were found to be negligible in our population of study. The prevalence of circumcised maleswas 95%, and the percentage of non- smoker females was 96%. It is worth noting that male circumcision and HPV vaccination are considered primary prevention measures for cervical cancer.[11] By promoting both HPV vaccination and male circumcision together, can maximize the overall effectiveness of prevention strategies.[17] One of the Australian studies estimated the lower cost of universal male infant circumcision compared to the HPV vaccine at the age of 11-15 years.[24]

Despite the average age of marriage being around 19 years in our studied population, certain protective factors such as male circumcision, low prevalence of smoking in females, and limited use of oral contraceptive pills [11] are culturally andreligiously practiced, playing a vital role in reducing the incidence of the disease. These primary prevention measures align with the recommendations of the World Health Organization (WHO), which include HPV vaccination for both boys and girls, health information campaigns to raise awareness about tobacco use, age-appropriate and culturally sensitive sexuality education, promotion of condom usage for individuals engaging in high-risk sexual behaviors, and male circumcision. [7,11]

Even with many protective elements in our society, if there are not extensive awareness drives and educational programs, most people will not understand the importance of cervical cancer or the advantages of screening.[10] Closing the gap in knowledge and enhancing awareness is crucial for elevating screening rates and ensuring individuals are well-informed and empowered to take measures for cervical cancer prevention.[25] Emphasis should be placed on implementing thorough education programs, targeted awareness campaigns, and readily available information to facilitate informed decision-making about screening and prevention strategies. Tackling this knowledge deficit and fostering awareness is fundamental for enhancing screening rates and ensuring individuals are equipped to take proactive measures toward preventing cervical cancer.[10]

From our study and observations, several recommendations emerge. Implementing targeted strategies is imperative to encourage cervical cancer screening in low-income communities. These strategies encompass the organization of community health camps, educational sessions, and the utilization of peer educators. Mobile health initiatives, including text messaging and mobile applications, prove effective in

disseminating information. Media campaigns through television, radio, print media, and social platforms can further heighten awareness.

Crucial to this effort is providing comprehensive training for healthcare workers, incorporating culturally sensitive approaches that address language barriers and involve community leaders. These strategies aim to bridge the knowledge gap, enhance awareness, and elevate cervical cancer screening rates in low-income communities.

Conclusion

This research paper sought to investigate the efficacy of VIA (Visual Inspection with Acetic Acid) as a cost-effective screening method compared to pap smear cytology in Pakistan. Additionally, it sheds light on the dire lack of awareness and knowledge regarding cervical cancer and its screening methods within low-income communities, further underscoring the importance of cost-effective solutions. It also sets the stage for further exploration and investigation of VIA in the context of primary health care physicians and general practitioners as appropriate entry points for screening and prevention of CC. This strategy can improve screening rates, enable early detection, and ultimately contribute to reducing disparities in cervical cancer outcomes. Further research is needed to explore ways to enhance VIA's performance and establish effective screening programs in resource-constrained environments.

It is imperative to articulate here, the renewed global interest in strengthening the primary healthcare for better health accessibility and patient centered care. GP's and Family physicians in Pakistan can also go beyond the traditional domain of practice and reduce the brunt on specialists (gynecologists) -bridge the gap between screening programs, HPV immunization programs, adolescent health services, HIV, and sexual and reproductive health services.

Limitations of the study: Some potential limitations of the study include the sample size and a specific population which may limit the generalizability of the findings to a broader population. Self-reported data on variables like age, STI status, number of marriages and circumcision status may be subject to social desirability bias. Further research is needed to explore ways to enhance VIA's performance and establish effective screening programs in resource-constrained environments.

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