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"COMPARING THE EFFICACY OF VISUAL INSPECTION OF CERVIX WITH ACETIC ACID (VIA) AND LUGOL'S IODINE (VILI) WITH PAP SMEAR CYTOLOGY IN SCREENING FOR CANCER CERVIX IN ASYMPTOMATIC WOMEN"

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ABSTRACT

Cervical cancer has attracted the concern of medical and related authority bodies. It has become a greater concern in areas that have low-resources for cytology-based screening programs and other advanced forms of medical research. Cervical cancer is a graver disease amongst women who do not show prior symptoms of it. Thus, the study has adopted a comparative analysis of how cervical cancer can be screened and identified among asymptomatic women. This would be done through Visual Inspection with Acetic Acid (VIA), Lugol's Iodine (VILI), and Pap smear cytology. The study is conducted at Krishna Mohan Medical College & Hospital in Mathura, and has involved a participant size of two hundred gynecological patients. There were established inclusion criteria and exclusion criteria based on which women participants have been chosen for the study and taken consent for participation as well. The following study has provided a literature review that has highlighted findings from multiple studies and results of the study have indicated that VIA is probably the more viable screening tool.

KEYWORDS

cervical cancer, VIA, VILI, Visual Inspection with Acetic Acid, Lugol's Iodine, Pap Smear, disease, prevention, cure, women, asymptomatic women, cancer screening method

1. INTRODUCTION

Among women, cervical cancer has come out as the fourth most common disease. Around the globe, there are more than six lakh cases that account for more than three lakh deaths in the year 2022 (WHO.int 2024). Most of these cases take place around the low- and middle-income countries who do not have the advanced means (Olubodun et al. 2022). Reports by the World Health Organisation have also accounted for 'human papillomavirus' (HPV) as one of the most primary reasons behind cervical cancer among women. It is a type of infection that gets transmitted sexually and develops in the form of cervical cancer. Cervical cancer has been recognised as a preventable disease that can be cured and treated through early detection (Kakotkin et al. 2023). For this, women must be indulged in precancerous lesions through regular screening. The 'Papanicolaou test' or the Pap test can be used and must be recommended from age 21. It is believed that an early screening age can reduce the risk of cervical cancer by 80% and mortality by 60–90% in developed countries (WHO.int 2024). However, in developing nations, only 5% of eligible women are active and aware of it and undergo screening, as services are limited to urban hospitals. This lack of unawareness is also a connected issue with the rise of the rate of cervical cancer.

The following study has thus looked into three different screening methods that are capable of detecting precancerous and cancerous lesions. First is, Pap Smear Cytology that is used in microscopic examination of exfoliated cervical cells. It is very effective but its results are constrained to how skilled the medical practitioner is in conducting the screening. The second screening method is 'Visual Inspection with Acetic Acid' (VIA), which is a simple and cost-effective screening method (Taha et al. 2021). In this case, a cervix is treated with acetic acid, whose coloration changes are checked visually. Another method that was examined in this research is VILI, or "Lugol's Iodine," which aids in the detection of abnormal growths (Yusuf 2024).

The study objective is focused on screening methods that are available and cross-comparing them to establish effectiveness for cervical carcinoma. Thus, the study's scope included trying all methods identified in order to determine usefulness in diagnosing precancerous conditions before cervical cancer becomes invasive.The aim of the study is to find out the best screening method and evaluate the accuracy and feasibility of VIA and Lugol's Iodine in comparison to Pap smear.

2. Literature Review

VIA And Pap Smear Cytology

A number of researches that have been conducted on 'Visual Inspection with Acetic Acid' (VIA) has indicated VIA to be a potential bracketing technique for cervical carcinoma. The study that was carried out at the Fatima Jinnah Medical College, Lahore, where testing and screening VIA against Pap smear was done on 501 women. The researchers havediscovered abnormal behavior in 28.96% of cases through VIA while only 14.4% were detected with Pap smear (Tayyeb et al. 2003). As a result, it can be concluded that VIA is more accurate than Pap smear by more than 52.8%. Similar studies have reflected on how VIA is a more sensitive and specific method that can easily help at detecting precancerous and malignant cervical lesions.

Another study was conducted at University of Zimbabwe under the name of 'JHPIEGO Cervical Cancer Project'. The project had constituted 1090 women under observation and the experiment had succeeded in confirming the high sensitivity of VIA in detecting precancerous cervical lesions (Shree et al. 2021). As VIA is less expensive, has an easy screening procedure and can be used in limited resource settings as well, though it must be taken care of that VIA has a lower rate of giving false positive which is why it is a more effective, than other screening methods. Thus, it has been identified to be better than other screening methods for cervical cancer among asymptomatic women.

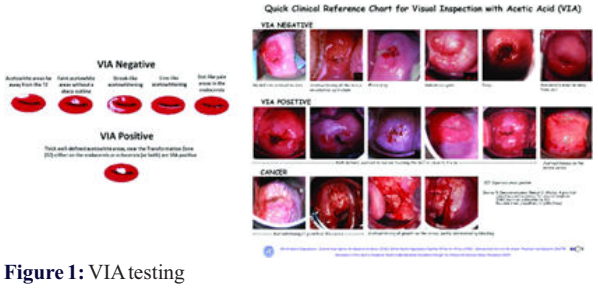

Figure 1: VIA testing
(**Source:** Runge et al. 2019)

Lugol's Iodine and Pap smear

As an alternative screening method, Lugol's Iodine (VILI) is a useful process too. It is done by staining normal 'glycogen-rich squamous epithelium' into dark brown colour (Yang et al. 2023). The precancerous region in the body is kept without a stain that usually appears yellow. Thus, it is a cost-effective method that provides immediate results in a place that does not have advanced technology and ample resources. However, VILI is a very sensitive method and the wrong amount of staining can lead to a higher rate of false positives. In comparison to VILI, Pap smear is a much more capable and reliable method. It has been a gold standard for detecting subtle cellular changes and only requires laboratory processing and trained personnel (Yang et al. 2023). Thus, it can be performed in remote areas. The only limitation that arises with Pap Smear is that it cannot provide visual diagnosis like VILI. Thus, it is important to find out which of the screening methods of the two (VILI and VIA) can be most suitable in

Pap smear cytology for screening cervical cancer among asymptomatic women.

Role of HPV Testing and Sequential Screening

HPV testing is integral to normal cervix cancer screening, especially when combined with visual inspection methods. As identified, it is one of the primary reasons behind cervical cancer, a study under the Johns Hopkins Medical Centre, Baltimore has given breakthrough results. It involved a total of 2,199 women in a sequential screening test that was based on first using a visual inspection followed by an HPV test (Kessler and Auwerter 2023). This has improved the testing accuracy in settings with low resources. By this means, it was possible to reduce the false positive rates. After this, fewer women underwent unnecessary follow-ups or treatments, whilst still effectively identifying women at high risk. HPV testing would help to identify the presence of high-risk HPV strains associated with cervical cancer providing an objective and accurate method of screening (IARC.fr 2020). However, its practical application is limited in some low-resource settings due to infrastructure and funding. On the other hand by combining this technology with VIA, the tests can quickly provide visual assessment and allow clinic staff to triage women. Women with a positive VIA are referred for HPV tests to confirm a positive result, which will increase specificity by reducing false positive referrals.

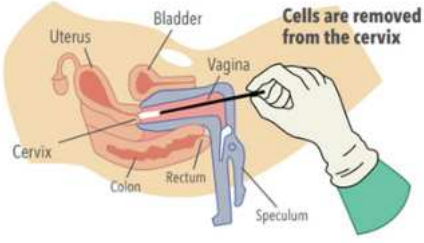

Figure 2: HPV Tests
(**Source:** IARC.fr 2020)

Thus, with a sequential approach the countries and regions with low-income groups can get an effective screening. HPV testing with VIA can allow for early detection and timely intervention. As such, it has the potential to decrease cervical cancer unwholesomeness and deadliness. The study has also shed light on the importance of implementing cost-effective, high-accuracy screening strategies in public health settings that have the power and potential to improve women's health outcomes globally.

Efficacy of VIA in Large-Scale Screening

A study that was conducted at University Teaching Hospitals, Yaoundé, Cameroon has shown that VIA is a very cost-friendly and easy to conduct screening method (Roux et al. 2021). The University had analysed 5,010 women who were within the age group of 30–60 years. The study has also found that the results which are achieved in a VIA screening method seldom have quality issues and are mostly correct. Thus, it is a reliable and large-scale screening method that does not require much infrastructure for showing results. Besides, patients who undergo the VIA treatment can also opt for same-day treatment as they would get immediate results.

Another study at the Cleveland Clinic Foundation that was conducted by involving 1,997 women within the age group of 35 to 45 years has also shown results in the favour of VIA (Bobart et al. 2022). The study has shown that VIA is very effective in the detection of cervical abnormalities. The findings of the study have indicated that VIA is very effective for women who were diagnosed with abnormalities. There were 26% women who were identified as low-grade intraepithelial neoplasia, 1% women who had high-grade intraepithelial neoplasia, and 0.3% women who had cervical cancer.

This must serve as further testimony to VIA's ability for the sake of early detection of precancerous lesions which is integral in reversing the trend to later invasive cancer of the cervix. This research has outlined details around screening programs based on VIA, focusing on requiring training and care that would enable augmenting the screening programs accuracy and reproducibility. VIA differs from Pap smears, which involve data processing and laboratory staff (Maina 2023). However, healthcare personnel at the primary healthcare level can also perform VIA as it is a point-of-care test. This enhances its effectiveness for large-scale screening in rural and neglected populations. Furthermore, the use of VIA combined with some other methods such as cryotherapy has been associated with lower incidences of cervical cancer.

Summary Of Academic Studies

The literature review has shown that 'Visual Inspection with Acetic Acid' (VIA) is more sensitive than Pap smear. This is so because VIA is considered to be more efficient in identifying early cervical lesions. Its high sensitivity allows VIA to pick out more precancerous cases much earlier and provides the way for timely interventions and treatments. At the same time, VIA has a larger rate of specificness and thus, can provide more false positives (Taha et al. 2021). This saves patients and doctors from being involved in unnecessary follow-ups and treatments in some cases. Despite this, VIA is a very useful screening tool that can be used in places where resources are not in ample amounts.

Thus, VIA can be used in places that have no cytological screening programs. Several studies show that the combination of VIA testing and HPV testing would greatly improve specificity and would lower the false-positive result, thereby increasing the overall screening accuracy. When sequentially combined, such as VIA, then HPV testing, this became viable in a way that is affordable for the prevention of cervical cancer in those areas where HPV testing is ready. V.I.A is simple to carry out, cheap, easy to read immediately, and provides an option in low-resource settings. Pap smears require laboratory processing and trained personnel, whereas VIA can be performed in primary healthcare centers by trained nurses or midwives. Thus beg to differ that it becomes a feasible possibility for mass screening programs and to provide a greater coverage area and early diagnosis of cervical cancer thereby reducing mortality.

3. MATERIALS AND METHODS

The research was done at the Krishna Mohan Medical College and Hospital, Mathura. It is an institution of tertiary care with a developed gynecological unit (Agarwal et al. 2025). For the study, a period between December 2022 and January 2025 was selected for the purposes of this study as a prospective one. The study sought to assess and analyse the effectiveness of the Pap smear, VIA, and VILI techniques in screening cervical cancer. The study seeks to evaluate the sensitivity, accuracy, and specificity of the new techniques employed in their workup of precursors to cervical cancers and other related malignances in the cervix.

Sample Selection

In two hundred women who came to the gynecological outpatient department, a selection has been made from a closed population of females on the basis of a comprehensive listing of inclusion and exclusion criteria. The purpose of these criteria is to ensure that the researchers and clinicians stay away from an inappropriate set of subjects who tend to cloud the quality of the findings.

Inclusion Criteria And Exclusion Criteria

In deciding on the inclusion criteria for each selected individual, it was noted that the screening was plausible and at reasonable limits. Further, a separate criterion was created to define the refusal for data selection clearly, so as to enlighten the research staff about those to be excluded from the study. The criterion of age for selection of the 200 gynecological patients was that they belonged to the age group of 30 to 60 years. Patients were selected who had a prior history of reproductive health issues or complaints of abnormal vaginal discharge. Patients who are suffering from postcoital bleeding, or irregular menstrual cycles were also included in the study. They must have not undergone any cervical cancer screening in the last three years and must have given the consent of being included in the study. Apart from this, an exclusion criterion made sure that no pregnant women were made a part of the study. Unmarried women were also excluded considering that cervical cancer occurs among sexually active women and thus, its screening is generally recommended for the same only (Perkins et al. 2023). Other than this, women who had a history of cervical lesion treatments, hysterectomy, or prior radiation therapy were also excluded to avoid confounding results.

Screening Methodology

The women participants had to go through a systematic cervical cancer screening process. Their diagnosis was divided into three different techniques (Pap Smear, VIA and VILI). Other than that, biopsy was done for women with abnormal cases. For participants in Pap Smear diagnosis, a sample was fixed and collected on a glass slide that was

sent for cytological examination. The results were interpreted based on the 'Bethesda System', that helped in categorising the samples as 'normal', 'atypical squamous cells', 'low-grade squamous intraepithelial lesions' (LSIL), or 'high-grade squamous intraepithelial lesions' (HSIL) (Alrajjal et al. 2021). For participants under the VIA test, an acetic solution was applied to their cervix. After a minute the same area was examined under proper lighting. The diagnostician marked a positive result if there was formation of acetowhite lesions. In the VILI test, a solution was applied to the cervix that under the result would show a mustard-yellow discoloration (Daniel 2021). Other than these, women with abnormal results from any of the three screening methods were further examined under cervical biopsy to confirm the diagnosis.

4. RESULTS AND DISCUSSION

Comparison Of Positive Detection Rates

As found in academic studies and experimental data, the VIA test has shown a larger rate of positive cases. It is more versatile than Pap Smear as it gives fewer false positives. Out of the 200 women that have been screened for the study, VIA has detected 28.5% of positive cases, whereas Pap smear has identified only 14.8% of cases. Thus, it can be said that it aligns with previous studies which have also indicated that VIA has a higher sensitivity in detecting cervical abnormalities (Chandran et al. 2021). In contrast to it, is the VILI test which has shown a positive detection rate of 27.9%. Although both the methods are visual and can be implemented in settings that are low in resources, one problem that has been identified with them is that some cells which were marked as weak might not turn to cancer cells in due course of time.

Implications For Clinical Practice

As a result of its high sensitivity and cost effectiveness, VIA is useful in sites without cytology services. It can offer immediate results and would leave a scope for doctors to send their patients for same day visit to treatment in a screen and treat strategy (Yadav et al. 2022). However, due to lower specificity, optimal diagnostic accuracy with minimal false positives as well as high risk case selection for further assessment is possible when VIA is combined with HPV testing.

Limitations And Challenges

The efficacy of VIA diagnostic is largely determined by the skills of the examiner. This means that each diagnostician can interpret a different result and the final outcome is dependent on inter-observer differences (Pitchika et al. 2024). Trained healthcare workers are important in making the correct diagnosis because incorrect interpretation of results could lead to over treatment or under treatment. To ensure improvement of VIA as the primary screening method, inescapable standardised programs and quality assurance controls should be used.

5. CONCLUSION AND RECOMMENDATIONS

Key Findings

The overall analysis of the three screening methods side by side has given a favourable result for the VIA test. It has come out as a valuable tool not only because of its easy handling, low-cost maintenance and less need for unnecessary follow-ups. But, VIA also provides accurate screening results and can be more specific about each result. A reliable alternative to VIA is VILI that can be used where resources are scarce.

Practical Implications

VIA has come out as an excellent screening method. In a medical setting, where resources and technologies are not fully provided, diagnosticians can opt for VIA tests and provide their patients a screen-and-treat approach. As such, the patients can get treated in a single visit. This would not only reduce patient dropout rates but also ensures timely intervention for those who are at risk.

Future Research Scope

VIA is able to provide a correct diagnosis and thus researchers can delve in further examining how AI facilitated image analysis can increase the rate of VIA's accuracy. This would be done forreducing human errors and also the inter observer differences. They are also encouraged to investigate the possibility of automation of VIA aided by AI to improve its specificity and as a method for screening without false positives.

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