Original Article

Evaluation of The Efficacy of PAP Smear and VIA as Screening Tools for Cervical Cancer and to Correlate the Findings of PAP Smear, VIA with Colposcopy Guided Biopsy and HPV Testing in VIA Positive Case

Dr. Sangeeta Shah[1], Dr. Shravani B.A.[2], Dr. Jayini Munisha[3]

[1] Professor & HOD, Department of OBG, GMC-MBNR
[2] Final year Resident, Department of OBG, GMC-MBNR
[3] Final year Resident, GMC-MBNR

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Corresponding Author:

Dr. Sangeeta Shah
Professor & HOD, Department of OBG, GMC-MBNR.

ABSTRACT

Background: Cervical cancer is the second most common cancer among women in India. While Pap smear screening has reduced cervical cancer mortality in developed countries, its effectiveness in low-resource settings is limited due to infrastructural constraints. Visual Inspection with Acetic Acid (VIA) offers a simple and cost-effective alternative.

Objectives: To evaluate the efficacy of Pap smear and VIA as screening tools for cervical cancer and to correlate their findings with colposcopy-guided biopsy and HPV testing in VIA-positive cases.

Materials and Methods: This hospital-based cross-sectional study was conducted over 12 months at a tertiary care teaching hospital in Telangana. A total of 275 sexually active women aged 20–60 years were screened using Pap smear and VIA. VIA-positive cases underwent colposcopy-guided biopsy and HPV testing.

Results: Abnormal Pap smear findings were observed in 14.55% cases, while VIA positivity was 21.82%. High-risk HPV was detected in 10.91% women. Pap smear showed sensitivity of 60% and specificity of 90%, whereas VIA demonstrated higher sensitivity (80%) with specificity of 84%. Both screening tests showed significant correlation with biopsy findings.

Conclusion: VIA is a sensitive and feasible screening tool for low-resource settings, while Pap smear remains more specific. Combined screening improves early detection of cervical cancer.

Keywords: Cervical cancer, Pap smear, Visual inspection with acetic acid (VIA), Colposcopy-guided biopsy, HPV testing.

INTRODUCTION

Cervical cancer poses a significant public health challenge in India, where it ranks as the second most common cancer among women, accounting for approximately 123,000 new cases and 67,000 deaths annually. The introduction of screening programs utilizing Papanicolaou (Pap) smears has been instrumental in reducing cervical cancer mortality rates by 70-80% in developed nations. However, the effectiveness of Pap smears in India is hindered by various factors, including limited access to trained cytopathologists and the need for laboratory infrastructure and lost to follow-up.

Consequently, alternative screening methods such as visual inspection with acetic acid (VIA) have gained attraction, as VIA offers immediate results at the point of care, making it a more practical option for widespread implementation particularly in rural health care and underserved areas. For women who test positive via VIA, colposcopy-guided biopsy is crucial for accurate diagnosis.

AIMS AND OBJECTIVES:

- To determine the efficacy of PAP smear and VIA as screening tools for cervical cancer
- To correlate the findings of PAP smear, VIA with Colposcopy guided biopsy and HPV testing in VIA positive cases

MATERIALS AND METHODS

This is an cross-sectional study conducted in a tertiary care teaching hospital in Telangana carried out over **a** a period of 12 months (January 2024 to December 2024) after taking approval from the Institutional Ethics Committee**.** Those included in the study were, sexually active women aged between 20 to 60 years and those who gave written informed consent. Those women with menstrual bleeding at the time of examination, women with severe debilitating diseases, women who previously underwent any cervical procedures and those who were pregnant were excluded from the study. The sample size was taken as 275. The tools used in this study were PAP smear kit (gloves, cervical speculum, Ayer's spatula, Cytobrush, fixative, normal saline, glass slides, hanging drop slides and cover slips) VIA kit (Speculum, light source, gloves, acetic acid solution, cotton swabs) HPV testing, Colposcope, Biopsy instruments.

The demographic details and relevant history were collected using a pretested semi-structured questionnaire proforma.

STATISTICAL METHODS

The required sample size for this study was estimated by the formula $n = Z^2pq/d^2$ where Z = 1.96, p = 59.79% (based on previous study, 59.79% women has CIN or Invasive Carcinoma of the cervix), q = (100-p) = 40.21%, and d = 10% of p = 5.97.

Therefore, the required sample size was:
n = (1.96 x 1.96 x 59.79 x 40.21) / (5.97 x 5.97) = 258.77 ~ 259. Adding 10% non-response, the total required sample was **275**.

The data from each enrolled subject was entered using Microsoft Excel 2010. Descriptive and inferential statistical analysis was done using IBM SPSS version 27. Continuous variables were presented as mean $\pm$ standard deviation (SD) whereas categorical variables were presented as absolute numbers and proportions. The continuous variables were compared using unpaired t-test, whereas Chi^2 test was used for comparing the categorical variables.

RESULTS

1. Age-wise distribution of the study population: In Present study 27.3% subjects were in the age group of <30 years, 36.4% were in the age group 30-39 years, 36.4% were in age group of >40 years with maximum number of subjects in 30-39 and >40 years. Mean age of subjects in the study was 37.1 years.

2. Geographical Distribution of the study population: In Present study 54.5% subjects were from Rural area and 45.4% subjects were from Urban area.

3. Distribution of study population based on Education: In Present study 90.18% subjects were literate and 9.82% were illiterate.

4. Distribution of study population based on socio economic status: In present study 54.5% were from low socio economic status.

5. Distribution of study population based on age of menarche: In present study 65.45% subjects attained menarche below 13 years, 24% subjects attained menarche between 13-15 years,10.55% subjects attained menarche above 15 years.

7. Distribution of study population based on Marital status: In present study 93.45% subjects are married and leading an active sexual life.

8. Distribution of study population based on Parity: In present study 70.55% subjects are having 1-2 children ,12% are having more than 3 Children ,17.45% are nulliparous.

9. Distribution of study population based on HPV Vaccination status : In present study 92.36% 254 subjects are not vaccinated.

10. Distribution according to Presenting symptoms : 45.1% subjects are having white discharge and 8% are having post coital bleeding

TABLE 1: RELATION BETWEEN PARITY & VIA

		VIA findings		
		Negative	Positive	Total
Parity	Nil	46	2	48
	1 - 2 children	150	44	194
	3 or more children	19	14	33
	Total	215	60	275

TABLE-2:Distribution of subjects according to Pap smear results:

Pap smear	No of subjects
Normal	235(85.45%)
Abnormal	40(14.55%)
LSIL	21(7.6%)
HSIL	12(4.3%)
ASCUS	7(2.5%)

TABLE-3 Evaluation of Pap smear in relation to biopsy

PAP findings	Biopsy result			Odds ratio	P value
	Positive	Negative	Total		
Abnormal	15	25	40		<0.001
Normal	10	225	235	13.5	
Total	25	250	275		

TABLE - 4 Types of Pap test results :

Pap smear Results	No of cases (%)
TEST POSITIVE	40(14.55%)
TEST NEGATIVE	235(85.45%)
TRUE POSITIVE(Pap +ve, biopsy+ve)	15(5.45%)
TRUE NEGATIVE (Pap-ve, biopsy-ve)	225(81.81%)
FALSE POSITIVE (Pap+ve, biopsy-ve)	25(9.09%)
FALSE NEGATIVE (Pap-ve, biopsy+ve)	10(3.63%)

TABLE-5 Distribution of subjects according to VIA results:

VIA findings	Frequency	Percentage
Positive	60	21.82%
Negative	215	78.18%
Total	275	100%

TABLE- 6 Evaluation of VIA in relation to biopsy

		Biopsy result				Odds Ratio	p value
		Positive		Negative	Total		
		CIN-1	CIN2/3			21	< 0.001
VIA findings	Positive	15	5	40	60		
	Negative	5		210	215		
	Total	20	5	250	275		

TABLE-7 Types of VIA test results

VIA Results	No of cases (%)
TEST POSITIVE	60(21.82%)
TEST NEGATIVE	215(78.45%)
TRUE POSITIVE (VIA +ve, biopsy+ve)	20(7.27%)
TRUE NEGATIVE (VIA-ve, biopsy-ve)	210(76.36%)
FALSE POSITIVE (VIA+ve, biopsy-ve)	40(14.54%)
FALSE NEGATIVE (VIA-ve, biopsy+ve)	5(1.81%)

TABLE-8 Comparison between Screening test Variables of Pap smear and VIA test

	PAP SMEAR	VIA
sensitivity	60%	80%
specificity	90%	84%
Positive predictive value	37.5%	33.4%
Negative predictive value	95.7%	97.6%
Accuracy	87.3%	83.63%

TABLE-8   HPV Test Results

HPV testing	Frequency	Percentage
Positive	30	10.91%
Negative	245	89.09%
Total	275	100%

DISCUSSION

This cross-sectional study, conducted over an 12-month period, meticulously examined the effectiveness of two distinct cervical cancer screening methods – the Papanicolaou (PAP) smear and Visual Inspection with Acetic acid (VIA). The research was carried out within the obstetrics and gynecology department of a tertiary care teaching hospital, involving a cohort of 275 sexually active women. Beyond evaluating the individual efficacy of PAP smear and VIA, the study aimed to establish correlations between these screening tools and more definitive diagnostic procedures such as colposcopy-guided biopsy and HPV testing, particularly in cases where VIA results were positive.

In Present study 27.3% subjects were in the age group of <30 years, 36.4% were in the age group 30-39 years, 36.4% were in age group of >40 years with maximum number of subjects in 30-39 and >40 years. Mean age of study was 37.1 years. Women aged above 40 years showed a higher incidence of VIA positivity. In Ameena et al (1) study 35 .85 % of women were in the age group of 31 – 40yrs , the study done by Niyodusenga A et al(2) 32.3% of women were in age group 41- 50 yrs . By a study done by Zahan .N et al (3) 25 .7 % women were in the age group of 26-30 years .

Based on Socio economic status the study found a statistically significant association between higher SES and increased positivity rates for both Pap smear and VIA tests, which may reflect increased screening frequency and early detection arun et al study .In Bhattacharya et al(4) there is higher incidence of CIN in lower socio economic status .In present study 54.5% were from income less than 10000/month low socio economic status.

Distribution of study population based on Parity : In present study 70.55% subjects are having 1-2 children. .In Bhattacharya et al(5) incidence of CIN was more in >2parity.

TABLE-9: Comparison of Diagnostic value of Pap smear

Pap smear	SENSITIVITY	SPECIFICITY	PPV	NPV
Ameena 2021et al(1)	70.83%	55.56%	45.95%	78.13%
Sinha.S et al 2020(5)	88%	52.63%	47.05%	90.9%
Present study	60%	90%	37.5%	95.74%

TABLE -10 Comparison of Diagnostic value of VIA

VIA	SENSITIVITY	SPECIFICITY	PPV	NPV
Ameena 2021et al(1)	87.5%	31.11%	40.38%	82.35%
Sinha.S et al 2020(5)	88.23%	78.68%	53.57%	96%
Present study	80%	84%	33.33%	97.67%

CONCLUSIONS

The study involved 275 sexually active women. Abnormal PAP smear findings were 14.55%.High-risk HPV was detected in 10.9% of women.VIA sensitivity: 80%, specificity: 84%.PAP smear sensitivity: 60%, specificity: 90%.Older age (>=40 years) was significantly correlated with positive VIA results Higher parity was significantly correlated with positive VIA findings.Positive VIA and PAP results significantly correlated with biopsy-confirmed abnormalities. Overall, VIA and PAP smears demonstrate efficacy as cervical cancer screening methods, with VIA showing higher sensitivity and PAP smears showing higher specificity. VIA is a sensitive, accessible screening tool, but Pap smear remains more specific.Colposcopy and biopsy are essential for confirmation, especially for low-grade lesions.

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