RESEARCH
O&G Forum 2024; 34-3s : 873-876

A COMPARATIVE ANALYSIS OF EFFECTIVENESS OF PAP SMEAR, ACETIC ACID TEST AND COLPOSCOPY IN CERVICAL CANCER SCREENING

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Abstract
Introduction: In developing nations, approximately 80% of cervical cancer cases are diagnosed at an advanced stage, underscoring the need for a cost-effective approach suitable for mass screening programs aimed at effective cervical cancer detection. Various screening and assessment tools have been developed, including colposcopy, Pap smear, and VIA (Visual Inspection with Acetic Acid). Consequently, this investigation was undertaken to assess the comparative efficacy of these screening methods for detecting cervical cancer.
Material and Methods: This prospective study enrolled 143 women aged between 20 and 70 years who visited the gynecology department at an Indian tertiary care teaching hospital. Eligible participants included sexually active, non-pregnant women with no active cervical diseases, no history of cervical conization, cryotherapy, or other invasive treatments for cervical cancer, no prior history of pre-invasive lesions, and no previous diagnosis of cervical cancer.
Results: The majority of participants in the study fell within the age range of 31 to 50 years. Among the three procedures, colposcopy was found to be more sensitive and specific compared to pap smear procedure and visual inspection with acetic acid procedure.
Conclusion: Cervical cancer, when identified and managed at an early stage, can be prevented and successfully treated. Therefore, regular mandatory screening is essential for females aged 40 years and above. Our research demonstrates that colposcopy is a more precise and sensitive tool compared to Pap smear and VIA for screening purposes.
Keywords: Cervical Cancer, Colposcopy, Pap smear, Visual Inspection with Acetic Acid.

INTRODUCTION

Globally, cervical cancer ranks as the fourth most common cancer among women, with approximately 570,000 new cases reported in 2018, accounting for 7.5% of all female cancer-related deaths. India contributes significantly to these statistics, with one-fourth of the world's cervical cancer deaths (60,078) and 96,922 new cases reported in the same year. It is noteworthy that cervical cancer is the second leading cause of cancer-related deaths among Indian women, despite being largely preventable [1-4].

The multifactorial etiology of cervical cancer is associated with various factors such as human papillomavirus infection, multiple sexual partners, early sexual debut, multiparity, prolonged use of oral contraceptives, tobacco use, low socioeconomic status, Chlamydia trachomatis infection, inadequate intake of micronutrients, and a diet lacking in fruits and vegetables. In developing nations, approximately 80% of cervical cancer cases are diagnosed at an advanced stage, necessitating cost-effective and scalable approaches for effective cervical cancer screening programs [5-8].

Globally, Pap smear tests have been instrumental in cervical cancer prevention programs. In resource-limited settings where basic healthcare infrastructure is lacking, Visual Inspection with Acetic Acid (VIA) and Pap smear are the primary screening methods employed. Early detection through screening aids in identifying precancerous lesions, thereby preventing the progression to invasive cervical cancer. Several screening and

assessment tools have been developed, including colposcopy, Pap smear, and VIA, to enhance the efficacy of cervical cancer screening [9-13].

Hence, this study was designed to evaluate the comparative efficacy of visual inspection with acetic acid, Pap smear, and colposcopy in screening for cervical cancer, with the aim of determining the optimal screening method among these three approaches.

MATERIAL AND METHODS

This prospective study enrolled 143 women aged between 20 and 70 years who visited the gynecology department at an Indian tertiary care teaching hospital. Participants were sexually active and non-pregnant, with no active cervical diseases, history of cervical conization, cryotherapy, other invasive cervical cancer treatments, pre-invasive lesions, or previous cervical cancer diagnoses. Patients with unsatisfactory Pap smear results were excluded from the study. Following proper written and informed consent, participants underwent Pap tests, visual inspection with acetic acid, and colposcopy, with all results recorded for analysis. Descriptive indices were used to assess the sensitivity, specificity, positive and negative predictive values, and accuracy of each screening method: conventional Pap smear, visual inspection with acetic acid, and colposcopy. EPi Info 6 software was used for data analysis.

RESULTS

The data from Table 1 indicates that most participants in the study were between the ages of 31 and 50 years, had a positive history of cervical bleeding, and were second-parous in terms of parity.

Tables 2-4 outline the comparisons between Pap smear, VIA (Visual Inspection with Acetic Acid), Colposcopy and biopsy results in terms of positive and negative findings. The study revealed that colposcopy exhibited a sensitivity and specificity of 96.43% and 91.43%, respectively. Pap smear demonstrated a sensitivity and specificity of 48.94% and 56.25%,

Table 1: Clinicodemographics of study population

Variable	n	%
Age Group (Years)		
21-30	11	7.69
31-40	54	37.76
41-50	51	35.66
51-60	24	16.78
61-70	3	2.10
Parity		
P0	3	2.10
P1	16	11.19
P2	88	61.54
P3	29	20.28
P4	7	4.90
Cervical Bleeding		
Yes	136	95.10
No	7	4.90

Table 2: Pap smear Vs Biopsy

	Biopsy Abnormal	Biopsy Normal	Total	Total
Pap Smear Abnormal	23	24	47	<0.05
Pap Smear Normal	7	9	16	
Total	30	33	63	

Table 3: Colposcopy Vs Biopsy

	Biopsy Abnormal	Biopsy Normal	Total	Total
Colposcopy Abnormal	27	1	28	<0.05
Colposcopy Normal	3	32	35	
Total	30	33	63	

Table 4: VIA Vs Biopsy

	Biopsy Abnormal	Biopsy Normal	Tot al	Total
VIA Abnormal	21	7	28	<0.05
VIA Normal	9	26	35	
Total	30	33	63	

Statistic	VIA	Pap Smear	Colposcop y
Sensitivity %	75	48.94	96.43
Specificity %	74.29	56.25	91.43
Positive predictive value (PPV) %	70	76.67	90
Negative predictive value (NPV) %	78.79	27.27	96.97
Accuracy %	74.6	50.79	93.65

Table 5: Comparison of the three methods vs Biopsy (Gold Standard)

DISCUSSION

In developing countries like India, cervical cancer is a prevalent cause of cancer-related deaths among women. Manju Talathi et al. [14] conducted a prospective observational study in Pune, comparing the efficacy of Pap smear, Visual Inspection with Acetic Acid (VIA), and colposcopy for mass screening of precancerous and cancerous cervix lesions.

They found that colposcopy exhibited a sensitivity close to 100%, while Pap smear showed a sensitivity of 90.2%, which aligns with our study results. They concluded that colposcopy is the most accurate tool among the three screening methods, although VIA can still play a role in screening for pre-malignant and malignant cervix lesions. Our study also showed similar sensitivity between VIA and Pap smear, but Pap smear had lower specificity compared to VIA, suggesting that VIA can be considered as an

adjunct to colposcopy for detecting pre-cancerous conditions of the cervix.

They recommended that all VIA-positive subjects should undergo colposcopy for better accuracy, a recommendation supported by our study's findings where VIA alongside colposcopy achieved better diagnostic results.

Singh M et al. [15] conducted a study involving 100 women with Pap smear and colposcopy, finding higher sensitivity for colposcopy at 95% compared to Pap smear at 20%, which is consistent with our study's sensitivity rates for colposcopy (90.48%) and Pap smear (76.19%). However, Pap smear showed higher specificity in Singh's study (91.25%), whereas our study found higher specificity for colposcopy (95.65%) compared to Pap smear (26.09%).

Ashmita et al. [9] conducted a prospective observational study assessing Pap smear, colposcopy, and histopathology for detecting precancerous cervix lesions, reporting higher sensitivity for colposcopy (90.24%) compared to Pap smear (19.5%), similar to our study's findings.

Jyothi Gandavaram et al. [16] conducted a prospective study correlating Pap smear with colposcopy and biopsy findings, showing higher sensitivity for colposcopy (80.2%) compared to Pap smear (28%) and higher specificity for Pap smear (99.32%) compared to colposcopy (82.14%). However, our study found higher accuracy for colposcopy (93.18%) compared to Pap smear (50%).

Dipali et al. [17] reported higher sensitivity for colposcopy (91.7%) and lower specificity (72.2%) compared to Pap smear (83.3% sensitivity and 45.45% specificity), similar to our study's sensitivity for colposcopy (90.48%) and Pap smear (76.19%), with lower specificity for Pap smear (26.09%) compared to colposcopy (95.65%). Overall, these studies support colposcopy as the most accurate diagnostic tool for detecting precancerous and cancerous cervix lesions.

CONCLUSION

Cervical cancer, when identified and managed at an early stage, can be prevented and successfully treated. However, the challenge lies in detecting these early-stage lesions, as they often present without symptoms. Therefore, regular mandatory screening is essential for females aged 40 years and above. In countries like India, where resources are limited, Pap smear remains a widely used screening method. Our research demonstrates that colposcopy is a more precise and sensitive tool compared to Pap smear and VIA (Visual Inspection with Acetic Acid) for screening purposes. Our findings suggest that colposcopy, particularly when combined with colposcopy-directed biopsy, improves the accuracy of detecting cervical abnormalities. Colposcopy can effectively identify even low-grade lesions indicated by VIA and enable early management of higher-grade lesions.

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