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Original Research Article

Comparative Evaluation of Pap Smear and Colposcopy for Cervical Cancer Screening: A Tertiary Care Study in North India

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Abstract:

Background: Cervical cancer is a major global health challenge, particularly in developing regions. Early detection through effective screening is essential for reducing its prevalence and mortality. The Pap smear test, a widely used screening tool, has inherent limitations such as sensitivity and specificity concerns. Colposcopy, which offers a closer examination and guided biopsy, complements Pap smears. However, its accessibility and operator dependence vary. Histopathological examination, the gold standard, delivers detailed information but is invasive and may involve delays in results. Evaluating these screening methods is crucial for optimizing cervical cancer screening strategies, especially in diverse healthcare settings. This study aims to provide a comprehensive assessment of Pap smear cytology and colposcopy compared to cervical biopsy/histopathology as the reference standard for cervical carcinoma and precancerous lesions detection.

Methods: This cross-sectional comparative study was conducted over two years from July 2021 to June 2023 at a North Indian tertiary care hospital after obtaining ethical approval from the Institutional Review Board, adhering to the Declaration of Helsinki. The study included 143 women aged 18-55 years, focusing on high-risk clinical presentations related to cervical abnormalities. Data collected covered demographics, clinical history, and physical examinations. Statistical analysis, including sensitivity, and specificity, was performed using SPSS version 20.0 with a significance threshold of $p < 0.05$.

Results: The study included 143 women aged 18-55 years with high-risk clinical indications. Pap smear cytology demonstrated an overall positivity rate of 58.04%, with ASCUS (15.38%) and LSIL (19.58%) being the most common abnormalities. Colposcopy showed a higher positivity rate of 70.63%, with abnormal findings including inflammation (9.79%) and LSIL (14.00%). Histopathological examination confirmed cervical abnormalities in 69.23% of cases, with LSIL (16.78%) and HSIL (13.29%) being the most frequent. Sensitivity and specificity for Pap smear were 56.52% and 71.62%, respectively. For colposcopy, sensitivity and specificity were 98.55% and 82.43%, respectively.

Conclusion: A combination of both techniques could enhance early detection and intervention, thereby reducing the burden of cervical cancer in this region. As cervical cancer remains a significant public health issue in this region, the results of this study may contribute to the development of more effective cervical cancer screening programs and policies.

Keywords: Cervical cancer, Pap smear, Colposcopy, Biopsy, Sensitivity, Specificity.

Introduction

Cervical cancer ranks as one of the most prevalent and lethal malignancies affecting women worldwide, particularly in developing countries. This malignancy is largely preventable and curable if detected at an early stage. Given the gravity of this health issue, the development and implementation of effective screening strategies are pivotal to reduce its incidence and mortality [1].

Cervical cytology, most commonly through the Papanicolaou (Pap) smear test, has been the cornerstone of cervical cancer screening for several decades [2]. The Pap smear is a relatively simple and cost-effective procedure that involves collecting cervical cells and assessing them for abnormal morphological changes. However, it is not without limitations, including issues related to sensitivity and specificity, which may result in missed diagnoses or false-positive results [3].

Colposcopy, a diagnostic procedure utilizing a specialized microscope called a colposcope, has

emerged as a supplementary tool in the evaluation of cervical abnormalities detected during Pap smears or clinical examinations [4]. Colposcopy allows for detailed visualization of the cervix, and guided biopsy for histopathological assessment can be performed when necessary [5]. It offers the advantage of a closer and more precise examination, potentially aiding in the identification of high-grade lesions and guiding treatment decisions. Nevertheless, colposcopy is operator-dependent and may not be universally available or feasible in resource-limited settings [5].

Histopathological examination of cervical biopsies remains the gold standard for diagnosing cervical cancer and its precursor lesions [6]. This approach provides definitive and detailed information about the extent and severity of the disease, thus guiding appropriate clinical management. However, it is an invasive procedure, and the results may not be available immediately, which can lead to anxiety and delayed intervention [7].

As the landscape of cervical cancer screening continues to evolve, there is a pressing need to assess and compare the performance of various screening modalities, particularly in different healthcare settings [8]. The effectiveness of cervical cancer screening strategies is influenced by multiple factors, including the prevalence of the disease, the availability of healthcare resources, and the knowledge and skills of healthcare providers [9,10].

This study aimed to provide a comprehensive evaluation of the diagnostic accuracy and practical utility of Pap smear cytology and colposcopy compared to cervical biopsy/histopathology as the reference standard for the detection of cervical carcinoma and its precursors. By examining the strengths and limitations of each approach, this study seeks to inform evidence-based decisions in cervical cancer screening programs and guide healthcare practitioners in optimizing their diagnostic practices. Ultimately, this research contributes to the ongoing effort to reduce the burden of cervical cancer by improving the efficiency and accuracy of screening methods and facilitating early detection and intervention.

Materials and Methods

Study Design

This cross-sectional comparative study was conducted for 2 years between July 2021 and June 2023 at Venkateshwara Institute of Medical Science, Rajabpur, NH 24, Gajraula, U.P., India, after obtaining ethical approval from the Institutional Review Board. All study procedures adhered to the principles outlined in the Declaration of Helsinki.

Study Population

The study participants included 143 women aged (18-55 years) attending outpatient department for cervical cancer screening. The study included women who presented with specific clinical indications indicative of a high-risk profile. These clinical presentations encompassed: Hypertrophied cervix, Cervical ectropion, Any cervical growth, Abnormal vaginal discharge, Post-coital bleeding, Intermenstrual spotting/bleeding, Cervix that bleeds on touch, and Abnormal uterine bleeding. Women in an active state of pregnancy were excluded from the study due to the potential influence of pregnancy on cervical cytology and the need for specialized considerations during screening. Women with a documented history of cervical cancer or those who had undergone a total hysterectomy were excluded as these conditions would render the screening and diagnostic procedures redundant. Participants who presented with contraindications for colposcopy or cervical biopsy, such as known allergies to relevant substances or a medical history that posed significant risks, were deemed ineligible for this study to ensure their safety and well-being.

Data Collection

The data collection process encompassed a comprehensive set of aspects. Demographic and personal information, including age, presenting complaints, obstetric history (details on pregnancies and childbirths), marital status (age of marriage), use of contraceptives (including oral contraceptives or other methods), family history of cervical cancer or gynecological conditions, socioeconomic factors (including income, education, and employment status), and personal hygiene practices and any addictions, such as smoking or drug use, were inquired about and recorded. Additionally, a thorough physical examination was conducted to assess the overall health and well-being of the participants. A detailed systemic examination considered any signs or symptoms relevant to the study's objectives. Furthermore, participants underwent a per speculum examination, which involved the gentle insertion of a speculum into the vaginal canal for a direct visual inspection of the cervix. This examination was performed without magnification, and any abnormal findings, such as hypertrophied cervix, cervical ectropion, cervical growth, or other visible anomalies, were meticulously documented.

Pap Smear Cytology

Pap smear cytology, a pivotal component of this study's screening approach, involved a meticulous and standardized process. Healthcare professionals with specific training in cervical specimen collection were responsible for conducting Pap smears on all study participants. The procedure adhered to widely accepted standard protocols for Pap smear collection. Prior to the procedure, participants were informed about the Pap smear and provided with an explanation of its purpose. They were positioned comfortably on an examination table in a private and

well-lit clinical setting, ensuring their privacy and comfort. The healthcare professionals used a sterile cervical spatula, specially designed for this purpose, to collect cervical specimens. The cervical spatula was opened and inserted gently into the cervical canal, making contact with the cervix. Care was taken to minimize patient discomfort and distress. With a gentle rotational movement, cervical cells were scraped from the cervical surface. The collected cells were then carefully transferred onto glass slides. The process aimed to secure an adequate representation of cervical cells for subsequent analysis. The glass slides, now bearing the collected cervical cells, were promptly fixed in alcohol to preserve the cellular morphology. Fixation was essential to prevent cellular degradation and maintain the integrity of the collected specimens. Following fixation, the glass slides were securely packaged and labelled with unique identification information, ensuring traceability. These slides were then transported to the laboratory, where they underwent staining and interpretation. The Pap smear results were classified by trained cytotechnologists or pathologists according to the standardized Bethesda system for cervical cytology. This classification system categorizes findings into various groups, such as "Negative for Intraepithelial Lesion or Malignancy," "Atypical Squamous Cells of Undetermined Significance," and more. In the cytological analysis, cytology results were considered positive if they exhibited any of the following abnormalities: Atypical Squamous Cells of Undetermined Significance (ASCUS), Atypical Squamous Cells, Cannot Exclude High-Grade Squamous Intraepithelial Lesion (ASC-H), Low-Grade Squamous Intraepithelial Lesion (LSIL), High-Grade Squamous Intraepithelial Lesion (HSIL), or cells with a suspicion of malignancy. Conversely, negative smears included those with inflammatory reports, indicating the absence of the aforementioned cytological abnormalities. The precise categorization allowed for a detailed assessment of the cytological findings and served as a foundation for subsequent comparisons with colposcopy and cervical biopsy/histopathology results.

Colposcopy

Colposcopy, performed by a skilled gynecologist, was an integral component of the study's screening protocol and offered a detailed visual examination of the cervix. A high-quality colposcope (Optopol CS-1 Colposcope), was employed for the examination. The colposcope provided enhanced magnification and illumination to enable a meticulous inspection of the cervix. Study participants who exhibited abnormal Pap smear results or visible cervical abnormalities during clinical examination were referred for colposcopy. This approach aimed to ensure that colposcopy was targeted, optimizing resource utilization and minimizing discomfort for participants without apparent abnormalities. During the colposcopy procedure, the gynecologist conducted a systematic visual examination of the cervix under magnification. This involved carefully assessing the cervical surface for any observable abnormalities, such as lesions, discolorations, or irregularities. When abnormal areas were identified during colposcopy, the gynecologist performed directed biopsies of the affected sites. These biopsies were guided by the colposcope, ensuring precision and accuracy. The relevant findings were meticulously documented, including the number and location of biopsied areas.

Cervical Biopsy and Histopathology

Cervical biopsies were an essential step to validate the findings from Pap smear cytology and colposcopy. Participants who exhibited suspicious or abnormal findings during colposcopy underwent cervical biopsy. One or more biopsies were taken from the identified abnormal areas using specialized biopsy instruments, such as forceps.

These biopsies were performed with a focus on precision and minimal discomfort to the participants. Immediately following the biopsy, the excised tissue specimens were placed in containers filled with formalin, a tissue-preserving solution. This step was crucial to maintain the structural integrity of the tissue and prevent decay. The formalin-fixed biopsy specimens were promptly transported to the pathology department within the healthcare facility. There, they underwent detailed histopathological examination.

The histopathological assessment was carried out by a certified pathologist experienced in gynecological pathology. Standardized criteria were employed for evaluating the tissue specimens. The pathologist examined the tissue sections under a microscope, assessing for cellular abnormalities, lesions, and the presence of malignancy. The histopathological findings were documented in detailed reports, including the classification of abnormalities, if present, and the severity of any identified lesions. These reports provided the basis for the reference standard against which the results of Pap smear cytology and colposcopy were compared in the study's analysis.

Data Analysis

Data collected from Pap smear cytology, colposcopy, and cervical biopsy/histopathology were compiled and analyzed using SPSS version 20.0 statistical software. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to assess the diagnostic accuracy of Pap smear cytology and colposcopy in comparison with cervical biopsy/histopathology as the reference standard. All

tests were two-tailed, and p-values less than 0.05 were considered statistically significant.

Results

In our study of 143 women undergoing cervical cancer screening at a North Indian tertiary care hospital, we observed diverse demographic and clinical characteristics among the participants. The age distribution varied, with the majority falling within the 26-35 years age group, comprising 35.7% of the cohort, while the <26 years group accounted for 29.4%. Various presenting complaints were documented, notably, hypertrophied cervix (19.6%) and intermenstrual spotting/bleeding (16.1%). Concerning parity, a substantial number were nulliparous (29.4%), while 37.8% had fewer than three children. The age of marriage showed significant variation, with 48.3% marrying between 18-25 years. Additionally, oral contraceptives (19.6%) and other contraceptive methods (29.4%) were employed, while 51% reported no contraceptive use.

A small proportion (12.6%) had a family history of cervical cancer, and socioeconomic status revealed a balanced distribution among low-income (33.6%), middle-income (49.7%), and high-income (16.8%) groups. Moreover, personal hygiene practices were generally good (55.9%), though 15.4% reported smoking or tobacco chewing. Menstrual cycle regularity indicated that 80.4% experienced regular cycles (Table 1).

Table 1: Characteristics of Study Participants (N=143)

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
<26 years	42	29.4
26-35 years	51	35.7
36-45 years	30	21.0
>45 years	20	14.0
Presenting Complaints		
Hypertrophied cervix	28	19.6
Cervical ectropion	25	17.5
Abnormal vaginal discharge	16	11.2
Post-coital bleeding	9	6.3
Intermenstrual spotting/bleeding	23	16.1
Cervix that bleeds on touch	16	11.2
Abnormal uterine bleeding	26	18.2
Parity		
Nulliparous	42	29.4
1-3	54	37.8
3 to 4	29	20.3
>4	18	12.6
Age of Marriage (years)		
<18 years	18	12.6
18-25 years	69	48.3
26-35 years	35	24.5
>35 years	21	14.7
Contraceptive Use		
Oral contraceptives	28	19.6
Other methods	42	29.4
No	73	51
Family History of Cervical Cancer		
Yes	18	12.6
No	125	87.4
Socioeconomic status		
Low income	48	33.6
Middle income	71	49.7
High income	24	16.8
Personal Hygiene and Addictions		
Good personal hygiene	80	55.9
Smoking/Tobacco chewing	22	15.4
Menstrual Cycle Regularity		
Regular	115	80.4
Irregular	28	19.6

In the analysis of Pap smear results from the study, we observed a range of cytological findings among the participants. A majority of the cases were categorized as "Negative for Intraepithelial Lesion or Malignancy," representing 58.0% of the total, underscoring the importance of routine screening for early detection and prevention. We also identified cases with various degrees of atypia and potential risk. Specifically, 15.4% showed "Atypical Squamous Cells of Undetermined Significance (ASCUS)," while 5.6% fell into the "Atypical Squamous Cells, Cannot Exclude High-Grade Squamous Intraepithelial Lesion (ASC-H)" category, indicating the need for further evaluation. Additionally, "Low-Grade Squamous Intraepithelial Lesion (LSIL)" was found in 7.7% of cases, and "High-Grade Squamous Intraepithelial Lesion (HSIL)" in 3.5%, highlighting the presence of pre-cancerous changes. A smaller subset exhibited more severe abnormalities, with "Squamous Cell Carcinoma" at 2.1%, "Atypical Glandular Cells (AGC)" at 4.2%, "Endocervical Adenocarcinoma in situ (AIS)" at 0.7%, and "Adenocarcinoma" at 2.8% (Table 2).

Table 2: Cytology Results and Pap Smear Findings of Study Participants

Pap Smear Results	Frequency (n)	Percentage (%)
Negative for Intraepithelial Lesion or Malignancy	83	58.0
Atypical Squamous Cells of Undetermined Significance (ASCUS)	22	15.4
Atypical Squamous Cells, Cannot Exclude High-Grade Squamous Intraepithelial Lesion (ASC-H)	8	5.6
Low-Grade Squamous Intraepithelial Lesion (LSIL)	11	7.7
High-Grade Squamous Intraepithelial Lesion (HSIL)	5	3.5
Squamous Cell Carcinoma	3	2.1
Atypical Glandular Cells (AGC)	6	4.2
Endocervical Adenocarcinoma in situ (AIS)	1	0.7
Adenocarcinoma	4	2.8

The colposcopy findings in our study provided valuable insights into the cervical health of the participants. Among the cases, 43.4% exhibited "Normal" colposcopy findings, indicating the absence of significant visual abnormalities. However, 70.6% of the participants had "Abnormal Findings," necessitating further investigation and clinical attention. Within this category, 9.8% presented with "Inflammation/Squamous Metaplasia/ Erosion/ Hyperemia," suggesting non-neoplastic changes. Notably, 14.0% showed "Hazy/Fine Acetowhite Area/Punctation or Mosaicism (LSIL)," and 11.9% had "Dense Acetowhite Area/Punctation or Mosaicism (HSIL)," indicative of low and high-grade squamous intraepithelial lesions, respectively.

Furthermore, 13.3% exhibited "Aceto White Area/Punctate/Metaplasia/Mosaic Pattern," which signifies various cervical transformations. A smaller subset, accounting for 5.6%, presented with "Abnormal Vascularity/Polyp/Growth," suggesting the presence of growths or vascular irregularities. Finally, 2.1% of cases were classified as "Unsatisfactory/Malignancy (Intense Acetowhite Area, Coarse Irregular Punctation)," indicating severe abnormalities that warrant immediate attention (Table 3).

Table 3: Colposcopy Findings of Study Participants.

Colposcopy Findings	Frequency (n)	Percentage (%)
Normal	62	43.4
Abnormal Findings	101	70.6
Inflammation/Squamous Metaplasia/Erosion/Hyperemia	14	9.8
Hazy/Fine Acetowhite Area/Punctation or Mosaicism (LSIL)	20	14.0
Dense Acetowhite Area/Punctation or Mosaicism (HSIL)	17	11.9
Aceto White Area/Punctate/Metaplasia/Mosaic Pattern	19	13.3
Abnormal Vascularity/Polyp/Growth	8	5.6
Unsatisfactory/Malignancy (Intense Acetowhite Area, Coarse Irregular Punctation)	3	2.1

The histopathological examination of cervical tissue specimens provided crucial diagnostic information and insights into the cervical health of the participants. Among the cases, 48.3% showed "Negative for Intraepithelial Lesion or Malignancy," indicating the absence of significant cellular abnormalities or malignancy. However, a significant portion of the cases exhibited various degrees of cervical lesions. Notably, 16.8% of cases were diagnosed with "Low-Grade Squamous Intraepithelial Lesion (LSIL)," suggesting mild abnormalities in the cervical epithelium. Additionally, 13.3% of cases were categorized as "High-Grade Squamous Intraepithelial Lesion

(HSIL)," indicating more severe cellular changes, which might be precancerous. A further 9.1% were identified as having "Squamous Cell Carcinoma," a more advanced stage of cervical cancer. Furthermore, 8.4% of cases were diagnosed with "Adenocarcinoma," highlighting the presence of glandular cell malignancies. In some instances, specifically 4.2% of cases, "Endocervical Adenocarcinoma in situ (AIS)" was observed, indicating early-stage glandular cell carcinoma confined to the cervix (Table 4).

Table 4: Histopathological Results of Study Participants

Histopathological Findings	Frequency (n)	Percentage (%)
Negative for Intraepithelial Lesion or Malignancy	69	48.3
Low-Grade Squamous Intraepithelial Lesion (LSIL)	24	16.8
High-Grade Squamous Intraepithelial Lesion (HSIL)	19	13.3
Squamous Cell Carcinoma	13	9.1
Adenocarcinoma	12	8.4
Endocervical Adenocarcinoma in situ (AIS)	6	4.2

A comparative analysis of the diagnostic performance of Pap smear cytology and colposcopy against histopathological findings revealed distinct sensitivity and specificity patterns. For Pap smear cytology, among the cases with histopathological confirmation, 56.52% were correctly identified as positive, while 71.62% were accurately identified as negative.

This corresponded to a sensitivity of 56.52% (95% CI: 44.04% to 68.42%) and a specificity of 71.62% (95% CI: 59.95% to 81.50%). The positive predictive value (PPV) for Pap smear cytology was 65%, indicating the likelihood of a true positive result. The negative predictive value (NPV) was relatively high at 63.86%, signifying the accuracy of negative predictions, and the overall accuracy was 64.34%. In contrast, colposcopy exhibited notably higher sensitivity and NPV. It identified 98.55% (95% CI: 92.19% to 99.96%) of cases with histopathological confirmation correctly, while achieving a specificity of 82.43% (95% CI: 71.83% to 90.30%).

The PPV for colposcopy was 83.95%, and the NPV was 98.39%, highlighting its effectiveness in both confirming positive cases and ruling out negative ones. The overall accuracy of colposcopy was 90.21%, indicating its superior performance in this comparative analysis. These findings emphasize the enhanced diagnostic capabilities of colposcopy, especially in detecting true positive cases, and its importance in the clinical assessment of cervical health (Table 5).

Table 5: Sensitivity and Specificity of Pap smear and Colposcopy with gold standard (Histopathological Findings of Biopsy)

Test	Histopathological Findings	
	Positive (n=69)	**Negative (n=74)**
Pap Smear		
Positive (n=60)	39	21
Negative (n=83)	30	53
Sensitivity analysis	Value	95% CI
Sensitivity	56.52%	44.04% to 68.42%
Specificity	71.62%	59.95% to 81.50%
Positive Predictive Value	0.65	55.04% to 73.81%
Negative Predictive Value	63.86%	56.57% to 70.56%
Accuracy	64.34%	55.90% to 72.16%
Test	**Histopathological Findings**	
	Positive (n=69)	**Negative (n=74)**
Colposcopy		
Positive (n=81)	68	13
Negative (n=62)	1	61
Sensitivity analysis	Value	95% CI
Sensitivity	98.55%	92.19% to 99.96%
Specificity	82.43%	71.83% to 90.30%
Positive Predictive Value	83.95%	76.14% to 89.56%
Negative Predictive Value	98.39%	89.68% to 99.77%
Accuracy	90.21%	84.12% to 94.54%

Discussion

The present study aimed to assess the diagnostic accuracy of Pap smear cytology and colposcopy as screening tools for cervical intraepithelial lesions and cervical cancer in the Indian context. The findings revealed several significant insights into the utility and effectiveness of these two methods, and their implications for cervical cancer screening programs.

In our study, the majority of participants were falling within the 26-35 years age group, comprising 35.7% of the cohort, while the <26 years group accounted for 29.4%. A similar pattern was observed in the studies by Vaidya et al., and Kushtagi et al., [11,12]. In our study, various presenting complaints were documented, notably, hypertrophied cervix (19.6%) and intermenstrual spotting/bleeding (16.1%), A similar pattern was observed in the study by Shalini et al., whereas in the study Garg et al., white discharge was the most common complaint (58.5%) [13,14].

The analysis of Pap smear results in our study revealed that a substantial proportion of women presented with abnormalities, with an overall positivity rate of 42.0% for any cervical lesion. The most common abnormalities were ASCUS (15.4%), LSIL (7.7%), and ASC-H (5.6%), of the positive cases. These results align with previous study by conducted by Sawant et al., and Joshi et al., [10,15]. In our study, notably, 14.0% showed "Hazy/Fine Acetowhite Area/Punctation or Mosaicism (LSIL). In study by Bhalero et al., aceto-whiteness (42.5%) was reported as the most common colposcopy finding [9].

In our study, the Pap smear cytology demonstrated a sensitivity of 56.52%, specificity of 71.62%, a positive predictive value of 65%, and a negative predictive value of 63.86%. These results indicate that while Pap smear cytology is a valuable initial screening tool, it may not be highly sensitive in detecting pre-cancerous and cancerous lesions. These findings align with previous studies by Poudel et al., (pap smear accuracy was found to be 55.5%) and Gupta et al., (pap smear accuracy was found to be 81.82%)and have also reported limitations in the sensitivity of Pap smear, especially in resource-constrained settings [16,17].When comparing these results to previous studies, we find variation in the performance of these tests. In contrast, Savitha et al., found a sensitivity of 50% but notably higher specificity at 90% in their study [18]. Similarly, Sayyah-Melli et al., observed a sensitivity of 77.4% and a specificity of 69.7% in their study [19]. For instance, Singhal et al., reported higher sensitivity (81.8%) and slightly lower specificity (78.2%) in their study [20]. These variations suggest that the diagnostic accuracy of cervical cancer screening tests can vary significantly across different studies and populations. Such differences may be attributed to variations in study design, sample characteristics, and the reference standards used for comparison. Understanding these variations is essential for optimizing screening strategies and improving the early detection of cervical lesions.

In our study 56.6% of cases were reported positive on colposcopy, whereas Malur et al., reported positive colposcopy in 37.89% cases [21]. Colposcopy, on the other hand, exhibited a significantly higher sensitivity of 98.55%, a specificity of 82.43%, a positive predictive value of 83.95%, and a negative predictive value of 98.39%. This suggests that colposcopy is highly sensitive in identifying cervical intraepithelial lesions and cervical cancer, making it a robust tool for the early detection of cervical abnormalities. Our findings echo those of previous studies by Dorji et al., where Colposcopy accuracy was found to be 83.6%, and Olaniyan et al., where Colposcopy accuracy was found to be 89%; also advocated for the utility of colposcopy in a cervical cancer screening program [22,23]. Notably, colposcopy proved particularly valuable in detecting high-grade lesions (HSIL), which are of paramount clinical importance due to their potential to progress to invasive cancer. Early identification of HSIL through colposcopy enables timely intervention and improved patient outcomes. A comparative analysis with findings from previous studies highlights the substantial variation in the performance of colposcopy across different research endeavors. Chaudhary et al., found a sensitivity of 79.37% and specificity of 81.02% in their investigation [8]. For instance, Moreover, Oğlak et al., reported a sensitivity of 85.7% and specificity of 76.2% in their study [24]. Ramesh et al., reported a lower sensitivity of 83.33% but a markedly lower specificity of 46.42% in their study [25].These variations highlight the potential impact of differing study populations, methodologies, and the choice of reference standards. Understanding these differences is crucial for refining the utilization of colposcopy as an effective tool for the early detection of cervical lesions and enhancing the overall cervical cancer screening process. The accuracy of both Pap smear and colposcopy was measured, and colposcopy displayed a notably higher accuracy of 90.21%, emphasizing its potential as an effective cervical cancer screening method. These results indicate that colposcopy has the capacity to minimize false-negative diagnoses and enhance the overall reliability of the screening process.

It is important to note that the diagnostic efficacy of these screening methods might vary depending on factors such as the experience and training of the healthcare provider, the quality of equipment, and the clinical setting. As this study was conducted in a tertiary care center, the results may not fully represent the accuracy of these methods in primary healthcare or rural settings.

The results from our study emphasize the need for comprehensive cervical cancer screening programs in India, and the importance of considering colposcopy as a primary tool in cervical cancer detection. Nevertheless, given the resource limitations in some areas, the Pap smear still holds a role as an initial screening tool. Our findings highlight the potential for combining these methods for enhanced accuracy and ensuring that patients receive appropriate follow-up care, especially when an abnormality is detected.

Limitations

It is essential to acknowledge the limitations of our study. The sample size of 143 may not fully represent the entire population, and further research involving larger and more diverse cohorts is needed to generalize the results. Additionally, the study does not explore other potential screening methods such as HPV testing, which is gaining recognition as a highly sensitive and specific tool for cervical cancer screening. Future research should consider the integration of multiple screening methods and assess their feasibility and cost-effectiveness in low-resource settings.

Conclusion

In conclusion, our study underscores the value of colposcopy as an adjunct to traditional cervical cancer screening methods like Pap smear. A combination of both techniques could enhance early detection and intervention, thereby reducing the burden of cervical cancer in this region. As cervical cancer remains a significant public health issue in this region, the results of this study may contribute to the development of more effective cervical cancer screening programs and policies. The optimization of screening strategies, incorporating colposcopy, could be a vital step towards reducing the incidence of cervical cancer and improving the overall health outcomes of women in this region.

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