



Research Article

## Evaluation of Sensitivity and Specificity of Screening Test Papanicolaou, Visual Inspection with Acetic Acid, Visual Inspection with Lugol's Iodine in Cervical Cancer

Dr Shalini Kataria<sup>1</sup>, Dr Vikas Makkar<sup>2\*</sup>, Dr Kumkum Avasthi<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Obstetrics and Gynaecology, RIMT Medical College and Hospital, Mandi Govindgarh, Punjab

<sup>2</sup>Professor and Head, Department of Nephrology, Dayanand Medical College & Hospital, Ludhiana, India

<sup>3</sup>Director Obstetrics and Gynaecology, Satguru Partap Singh Hospital, Ludhiana, India

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### ABSTRACT

#### Corresponding Author:

**Dr Shalini Kataria**

Assistant Professor, Department of Obstetrics and Gynaecology, RIMT Medical College and Hospital, Mandi Govindgarh, Punjab.

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**Introduction:** Delayed diagnosis of cervical cancer leads to increased lesions and mortality. Early and accurate diagnosis using highly sensitive methods is essential to manage lesions before becoming cancerous. The present study aimed to assess the sensitivity and specificity of tests like Papanicolaou (Pap) smear test, Visual Inspection with Acetic Acid (VIA), and Visual Inspection with Lugol's Iodine (VILI) in cervical cancer screening.

**Methods:** A cross-sectional study was conducted from June 2013 to May 2014. The patients aged above 18 years, symptomatic women undergoing routine checkup were included in study. Their health complaints and baseline characteristics were recorded. Sensitivity and specificity of screening tests including Pap smear, VIA, and VILI were performed, followed by colposcopy examination and biopsy when indicated.

**Results:** The patients with mean age 45.15 (N=500) years were included. The majority of patients (74%) had age of menarche between 13-14 years and first intercourse between 21-25 years (65.2%). Most of the patients (86.6%) were multiparous and vaginal discharge (5.6%) was the common complaint. Sensitivity and specificity were highest for VIA (100% and 0%), followed by VILI (85.7% and 70%) and Pap smear (85.7% and 80%). Out of 7 patients positive on cervical biopsy, 18.7% patients showed cervical intraepithelial neoplasia (CIN) of grade 1 whereas the colposcopy was positive in 7 (1.4%) patients.

**Conclusion:** In this study VIA and VILI were less specific in comparison to Pap smear but they were more sensitive in detecting preinvasive lesions.

**Keywords:** Cervical cancer, human papilloma virus, cervical intraepithelial neoplasia, sensitivity.

### INTRODUCTION

Cervical cancer is the fourth most prevalent cancer in women globally with around 660000 new cases and around 350000 deaths in 2022.<sup>[1]</sup> In India it ranks second most prevalent cancer in women with 123907 cases diagnosed yearly and 77348 deaths reported due to the disease.<sup>[2]</sup> Usually, it is diagnosed in the age of 35 and 44, with the average age being 50, while it rarely develops in women younger than 20.<sup>[3]</sup> The known risk factors are low socio-economic status, smoking, young age at the first coitus, multiple sexual partners, multiple sexual partners of spouse, marrying before age 18 years and multiple childbirths.<sup>[4]</sup> Nearly in all the cases common cause is Human papillomavirus (HPV) infection.<sup>[5]</sup> It is considered to be preventable disease as it is preceded by a long pre-invasive phase known as cervical intraepithelial neoplasia (CIN) that can be detected by screening and treated effectively by simple treatment.<sup>[6,7]</sup> Early detection of disease is important meanwhile late diagnosis reduces the chance of survival. Diagnosis can be done using a variety of screening tests, generally Papanicolaou smear test (Pap) which uses cell cytology is employed.<sup>[8]</sup> The Pap test detects precancerous CIN and the early stage of invasive cervical cancer.<sup>[9]</sup> It is known for its high specificity; however, it has moderate sensitivity, requires skilled personnel and involves delays in results and frequent follow-ups.<sup>[10]</sup> Alternative strategies like visual inspection of cervix after application of 3-5% acetic acid (VIA) and visual inspection after lugol's iodine (VILI) are also used.<sup>[11]</sup> They are

simpler, cost-effective and provide immediate results. Despite these benefits, they have variable accuracy, risk of overtreatment, and are less suitable for older women, they lack consistent training standards.<sup>[10]</sup> The well efficient screening by cytology reduces the occurrence of morbidity and mortality in developed countries.<sup>[12]</sup> The present study aimed to assess the sensitivity and specificity of tests like Pap smear, VIA and VILI as screening test in cervical cancer. Comparing above methods is crucial as each method differs in diagnostic accuracy, cost, and feasibility. Assessing their sensitivity and specificity helps determine which test offers the best balance between detecting cervical cancer early and minimizing false results, particularly in resource-limited settings. This study evaluates all three screening modalities which adds valuable data from a potentially under-represented setting, enhancing global estimates on test performance and help in development of cervical cancer prevention strategies in similar healthcare environments.

## MATERIALS AND METHODS

### Study design

The cross-sectional study was conducted at *<the study site has been removed for peer review process>* from June 2013 to May 2014. The protocol for study was approved by Institutional Ethics Committee. Written informed consent was obtained from all the patients about whole treatment process and follow ups.

### Inclusion criteria and exclusion criteria

The patients aged above 18 years, sexually active, symptomatic women undergoing routine checkup were included in study. Patients with active vaginal bleeding, with frank growth, pregnant women, postpartum patients, who were never been sexually active, patients who have undergone prior treatment for CIN or cancer cervix and post hysterectomy patients were excluded from the study.

### Data collection

A detailed history regarding chief complaints, present illness, menstrual cycle, obstetric history, coital history and contraception was taken. General physical examination, systemic examination - chest, cardiovascular and abdomen was done. Patients were put in dorsal position after passing urine and speculum examination was done. Findings were noted. The history and examination findings were recorded on pre-designed proforma.

### Screening tests and examination

Examinations like Pap smear, VIA test, VILI and colposcopy were performed. For Pap smear, sample collection was done using an Ayre's spatula and an endocervical brush, cytology was evaluated by Bethesda system 2001.<sup>[13]</sup> In VIA test naked eye examination of cervix swabbed with 3-5% dilute acetic acid for 1-2 minutes with a good source of light was performed. The VIA test interpretation of results was done as negative and positive based on presence or absence of acetowhite areas.<sup>[14]</sup> In VILI test cervix was visualized after application of Lugol's iodine with a swabstick. Interpretation of VILI test was done as test negative when squamous epithelium turns brown or test positive when iodine non uptake, yellow in colour.<sup>[15]</sup>

### Sample calculation

From previous studies it is known that ROC of PAP smear is 0.89.<sup>[16]</sup> Assuming VIA to be more sensitive, area under the curve was assumed to be 0.92.<sup>[17]</sup> Correlation between method and outcome was assumed to be 0.8. Keeping alpha at 0.5 and beta at 0.2 total sample size came out to be 508.

### Statistical analysis

Data was analyzed using SPSS 15.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed by mean (SD), ordinal variables as median and minimum-maximum, and frequent variables represented as rates. Frequencies were calculated as mean (SD) Sensitivity, specificity, positive and negative predictive value was calculated as per standard formulae using VassarStats software.

## RESULT

A total of 500 patients were enrolled in the study. The mean (SD) age of patients was 45.15 (9.62) years. Most of the patients were in the age group of 41-50 years (35.6%). The majority of patients (70.2%) were graduate and many of them (63.2%) were Sikh. The common complaint presented (5.6%) was discharge per vaginum. Other complaints presented were menorrhagia (4%), irregular menstrual bleeding (4%), abdominal pain (4%), urinary symptoms (3%) and dyspareunia (1%) (**Table 1**).

Out of all the patients included in the study, 20 (4%), 11 (2.2%) and 13 (2.6%) were positive for VIA, VILI and Pap smear respectively. The patients who had positive results in any of the screening tests were subjected to colposcopy and/or biopsy (**Table 2**).

The patients positive for Pap smear were subjected to colposcopy and cervical biopsy but only 8 patients were followed up and 5 lost to follow up. The sensitivity of the Pap smear was evaluated and found to be 85.7% and specificity was 80%. Out of the patients positive for VIA, only 16 underwent cervical biopsy and 4 were lost to follow-up. The sensitivity of VIA was found to be 100% while the specificity was 60%. The patients found to be VILI positive were 11 and out of them 9 patients followed up and underwent cervical biopsy. The sensitivity of VILI was evaluated and came out to be 85.7% and specificity was 70%. (**Table 3**). While correlating VIA with Pap smear, the 11 (55%) VIA positive patients out of 20

were negative for intraepithelial lesion or malignancy (Neg). Whereas, 4 Pap smear positive patients were VIA negative (atypical squamous cells of undetermined significance ASCUS (n=1), atypical glandular cells of undetermined significance AG-NOS (n=1)). The VIA-negative result strongly indicates a normal Pap smear category. Only 3 (15%) VIA positive patients out of 20 were atypical squamous cells (ASC-H) - cannot exclude high-grade squamous intraepithelial lesion.

The correlation of VILI and Pap smear results indicates that 3 (27.2%) out of 11 VILI positive patients were neg. While, 5 VILI negative patients (ASCUS (n=1), ASC-H (n=1) AG-NOS (n=3)) had positive findings on Pap smear (**Table 4**).

Histopathologic examination of colposcopy-directed cervical biopsy was used as the reference standard for diagnosing CIN. The patients positive on cervical biopsy were 7 out of 17 wherein, 3 (18.7%) were CIN 1, 1 (6.2%) was CIN 2, 2 (12.5%) were CIN 3 and only 1 (6.2%) had squamous cell carcinoma (**Table 5**).

The colposcopy was positive in 7 (41.2%) patients which revealed CIN 1 in 2 patients and normal in others. The patients who were positive for VIA, VILI and Pap smear and followed up for cervical biopsy, 6 out of them had abnormal cervical biopsy. Only 1 patient out of these 7 was VIA positive wherein biopsy came out to be CIN 1.

#### **Table 1. Demographic characteristics**

Parameters	Number of responses (N = 500)
<b>Age [Years]</b>	
<20	2 (0.4)
21-30	38 (7.6)
31-40	126 (25.2)
41-50	178 (35.6)
51-60	133 (26.6)
>60	23 (4.6)
<b>Education</b>	
Illiterate	9 (1.8)
Primary (1-5)	17 (3.4)
Middle	10 (2)
Matric (6-10)	104 (20.8)
Secondary (11-12)	2 (0.4)
Graduate	351 (70.2)
Postgraduate	7 (1.4)
<b>Religion</b>	
Hindu	181 (36.2)
Sikh	316 (63.2)
Christian	1 (0.2)
Muslim	2 (0.4)
<b>Age at menarche [Years]</b>	
<11	2 (0.4)
11-12	96 (19.2)
13-14	370 (74)
15-16	31 (6.2)
>17	1 (0.2)
<b>Age at 1st Intercourse [Years]</b>	
<20	139 (27.8)
21-25	326 (65.2)
26-30	33 (6.6)
>30	2 (0.4)
<b>Parity</b>	
Nulliparous	14 (2.8)
Primiparous	53 (10.6)
Multiparous	433 (86.6)
<b>Contraceptive</b>	
Barrier	90 (18)
Coitus interrupts	16 (3.2)
Cu T	41 (8.2)
OCP	4 (0.8)
Tubal ligation	73 (14.6)
None	276 (55.2)
<b>Husbands occupation</b>	
Agriculture	29 (5.8)
Business	323 (64.6)
Service	144 (28.8)
Deceased	4 (0.8)

<b>Chief complaints</b>	
Discharge per vaginum	28 (5.6)
Menorrhagia	20 (4)
Oligomenorrhea	4 (0.8)
Irregular menstrual bleeding	20 (4)
Post coital bleeding	4 (0.8)
Post-menopausal bleeding	4 (0.8)
Dysmenorrhoea	2 (0.4)
Dyspareunia	5 (1)
Pain abdomen	20 (4)
Urinary symptoms	15 (3)
Infertility	4 (0.8)
Routine check up	374 (74.8)
Data shown as n (%). N = 500, unless otherwise specified. Cu T, copper T; OCP, oral contraceptive pills.	

**Table 2. Findings of the three screening tests**

	<b>Screening test (N = 500)</b>
<b>VIA</b>	
Positive	20 (4)
Negative	480 (96)
<b>VILI</b>	
Positive	11 (2.2)
Negative	489 (97.8)
<b>PAP smear</b>	
Positive	13 (2.6)
Negative	487 (97.4)
Data shown as n (%). N = 500, unless otherwise specified. PAP, papanicolaou; VIA, visual inspection with acetic acid; VILI, visual inspection with lugol's iodine.	

**Table 3. Sensitivity analysis of VIA, VILI and Pap smear**

<b>Sensitivity parameter (%)</b>	<b>VIA</b>	<b>VILI</b>	<b>Pap smear</b>
Sensitivity	100	85.7	85.7
Specificity	60	70	80
PPV	63.6	66.6	75
NPV	100	87.5	88
NPV, negative predictive value; Pap, papanicolaou; PPV, positive predictive value; VIA, visual inspection with acetic acid; VILI, visual inspection with lugol's iodine.			

**Table 4. Correlation of Pap smear cytology with VIA and VILI outcomes.**

<b>PAP vs. VIA</b>	
<b>Neg</b> VIA Positive (n = 20) VIA Negative (n = 480)	11 (55) 476 (99.1)
<b>ASCUS</b> VIA Positive (n = 20) VIA Negative (n = 480)	1 (5) 2 (0.41)
<b>LSIL</b> VIA Positive (n = 20) VIA Negative (n = 480)	1 (5) 0
<b>HSIL</b> VIA Positive (n = 20) VIA Negative (n = 480)	2 (10) 0
<b>ASC-H</b> VIA Positive (n = 20) VIA Negative (n = 480)	3 (15) 0
<b>AG-NOS</b> VIA Positive (n = 20) VIA Negative (n = 480)	2 (10) 2 (0.41)
<b>PAP vs. VILI</b>	
<b>Neg</b> VILI Positive (n = 11) VILI Negative (n = 489)	3 (27.2) 484 (98.9)
<b>ASCUS</b> VILI Positive (n = 11) VILI Negative (n = 489)	2 (18.1) 1 (0.2)
<b>LSIL</b> VILI Positive (n = 11) VILI Negative (n = 489)	1 (9.09) 0
<b>HSIL</b> VILI Positive (n = 11) VILI Negative (n = 489)	2 (18.1) 0
<b>ASC-H</b> VILI Positive (n = 11) VILI Negative (n = 489)	2 (18.1) 1 (0.2)
<b>AG-NOS</b> VILI Positive (n = 11) VILI Negative (n = 489)	1 (9.09) 3 (0.6)

Data shown as n (%), unless otherwise specified.  
 AG-NOS, atypical glandular cells of undetermined significance; ASC-H, atypical squamous cells - cannot exclude high-grade squamous intraepithelial lesion; ASCUS, atypical squamous cells of undetermined significance; HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion; Neg, negative for intraepithelial lesion or malignancy; PAP, papanicolaou; VIA, visual inspection with acetic acid.

**Table 5. Correlation of histopathology to VIA, VILI and Pap smear**

	VIA + (n = 16)	VIA - (n = 1)	VIL + (n = 9)	VILI - (n = 8)	Pap + (n = 8)	Pap - (n = 9)
Normal	1 (6.25)	1 (100)	1 (11.1)	1 (12.5)	0	2 (22.2)
Chronic active cervicitis	2 (12.5)	0	1 (11.1)	1 (12.5)	0	2 (22.2)
Focal erosive cervicitis	1 (6.2)	0	0	1 (12.5)	0	1 (11.1)
Atrophic cervicitis	1 (6.2)	0	0	1 (12.5)	0	1 (11.1)
CIN 1	3 (18.7)	0	2 (22.2)	1 (12.5)	2 (25)	1 (11.1)
CIN 2	1 (6.2)	0	1 (11.1)	0	1 (12.5)	0
CIN 3	2 (12.5)	0	2 (22.2)	0	2 (25)	0
SCC	1 (6.2)	0	1 (11.1)	0	1 (12.5)	0

+, positive; -, negative; CIN, cervical intraepithelial neoplasia; Pap, papanicolaou; VIA, visual inspection with acetic acid; VILI, visual inspection with lugol's iodine.

## DISCUSSION

Cervical cancer is a major health problem faced by the Indian women.<sup>[18]</sup> Usually, it is preceded by premalignant lesions, which later develop to invasive cancer. When identified and treated early, they have high rate of reversal with simple surgical procedure. Once reached advanced stage cancers survival rate decreases.<sup>[19]</sup> In the present study we attempted to evaluate techniques Pap smear, VIA, VILA in a tertiary care hospital in northern India for early detection.

In this study 500 females were enrolled with mean age of 45.15 years and 35.6% of the patients were in the age group of 41-50 years. Another study also reported mean age of patient as 44.09 years and were in range of 35-57 years.<sup>[20]</sup> Age of menarche was reported between 13-14 years in 74% of patients this was similar to a study where they have seen this age at menarche as higher risk of cervical cancer.<sup>[21]</sup> The first intercourse between 21-25 years was seen in 65.2% patient, these results are consistent with other studies which reported early age at first intercourse is at major risk.<sup>[22,23]</sup> Most of the patients (86.6%) were multiparous, this was similar to other study where they reported patients with 84.0% multiparity.<sup>[24]</sup> Majority of patient (74.8%) tested positive for cervical cancer at routine checkup, while only 5.6% had complaint of discharge per vaginum, other studies also reported vaginal discharge as common complaint.<sup>[15]</sup>

The Pap smear was positive in 13 (2.6%) patients including atypical glandular cells not otherwise specified (AG-NOS) in 4 and atypical squamous cells of undetermined significance (ASCUS) in 3 patient and Atypical squamous cells-cannot exclude high grade lesion (ASC-H) in 3 patients. The similar results were seen in other studies.<sup>[15]</sup> The sensitivity of the Pap smear was evaluated and found to be 85.7% and specificity was 80% in another studies variation in sensitivity and specificity of test was seen.<sup>[25]</sup>

The sensitivity of VIA was found to be 100% while the specificity was 60% while another study reported it 88.8% and 43.8% respectively.<sup>[26]</sup> The sensitivity of VILI was evaluated as 85.7% and specificity was 70%. In another study the sensitivity of VILI was 78.6% and specificity was 85.1% respectively.<sup>[27]</sup>

The PPV and NPV of all the three tests were calculated. VIA had NPV of 100% thereby implying that it can be used as a test for screening in low resource countries.<sup>[28]</sup> Pap smear had highest PPV of 75% in the present study amongst all three tests emphasizing highest specificity of this test. Consequently in another study the PPV of Pap was extremely low at 31.11%.<sup>[29]</sup>

Out of 7 patients positive on cervical biopsy, 3 (18.7%) patients were CIN 1, 1 (6.2%) was CIN 2, 2 (12.5%) were CIN 3, these results were consistent with study of Ghosh et al.<sup>[15]</sup>

### Strength and Limitations of the study

VIA and VILI offer affordable, simple, point-of-care cervical screening achievable by non-specialist health workers, with immediate results enabling a 'screen-and-treat' approach. Their sensitivity in low-resource contexts is comparable to Pap smear, enhancing real-world effectiveness.

The study was conducted in a single hospital; hence the results may not represent the whole community. Detection of true positive by each screening test was used for the calculation of sensitivity, specificity, positive and negative predictive value. Therefore, these values could be an approximate estimation.

### Future prospective

Tests that allow increased screening coverage with low cost and reducing the number of patients for follow up are likely to improve cervical cancer screening services in developing countries like India. Integration of VIA and VILI based screening programme at primary care level of health services will help to downstage cervical cancer.

### CONCLUSION

In this study VIA and VILI are less specific in comparison to Pap smear but they are more sensitive in detecting preinvasive lesions. Hence VIA and VILI can be used as screening tools for cervical cancer in low resource setting.

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### REFERENCE

1. Cervical cancer. Available from: <https://www.who.int/news-room/fact-sheets/detail/cervical-cancer>. Last accessed: 22.09.2025.
2. India Human Papilloma Virus and Related Cancers, Fact Sheet 2023. Available from: [https://hpvcentre.net/statistics/reports/IND\\_FS.pdf](https://hpvcentre.net/statistics/reports/IND_FS.pdf). Last accessed: 24.05.2025.
3. Key statistics for Cervical Cancer. Available from: <https://www.cancer.org/cancer/types/cervical-cancer/about/key-statistics>. Last accessed: 26.05.2025.
4. Kashyap N, Krishnan N, Kaur S, Ghai S. Risk factors of cervical cancer: A case-control study. *Asia Pac J Oncol Nurs*. 2019;6(3):308-14.
5. Okunade KS. Human papillomavirus and cervical cancer. *J Obstet Gynaecol*. 2020;40(5):602-8.
6. Faghih N, Arab M, Tehranian A, Ghavami B, Nouri B, Khosravi D. Effective high grade cervical intraepithelial neoplasia case finding in low resource settings. *Med J Islam Repub Iran*. 2022;36:33.
7. Bhattacharyya AK, Nath JD, Deka H. Comparative study between pap smear and visual inspection with acetic acid (VIA) in screening of CIN and early cervical cancer. *J Midlife Health*. 2015;6(2):53-8.
8. Mustafa WA, Ismail S, Mokhtar FS, Alquran H, Al-Issa Y. Cervical cancer detection techniques: A chronological review. *Diagnostics (Basel)*. 2023;13(10):1763.
9. Sachan PL, Singh M, Patel ML, Sachan R. A study on cervical cancer screening using pap smear test and clinical correlation. *Asia Pac J Oncol Nurs*. 2018;5(3):337-41.
10. Gupta R, Gupta S, Mehrotra R, Sodhani P. Cervical cancer screening in resource-constrained countries: Current status and future directions. *Asian Pac J Cancer Prev*. 2017;18(6):1461-7.
11. Qureshi S, Das V, Zahra F. Evaluation of visual inspection with acetic acid and Lugol's iodine as cervical cancer screening tools in a low-resource setting. *Trop Doct*. 2010;40(1):9-12.
12. Nivedhitha VS, Sankareswari R. Study of effectiveness of combined test Pap smear, visual inspection with acetic acid and Lugol's iodine for mass screening of premalignant and malignant lesions of cervix. *Int J Reprod Contracept Obstet Gynecol*. 2016;5(3):725-30.
13. Comprehensive cervical cancer control: A guide to essential practice. 2nd edition. Geneva: World Health Organization; 2014. Annex 5, The 2001 Bethesda System. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK269610/> Last accessed: 24.05.2025.
14. Atlas of visual inspection of the cervix with acetic acid for screening, triage, and assessment for treatment. Available from: <https://screening.iarc.fr/atlasviadetail>. Last accessed: 24.05.2025.

15. Ghosh P, Gandhi G, Kochhar PK, Zutshi V, Batra S. Visual inspection of cervix with Lugol's iodine for early detection of premalignant & malignant lesions of cervix. *Indian J Med Res.* 2012;136(2):265-71.
16. Shen-Gunther J, Wang CM, Poage GM, Lin CL, Perez L, Banks NA, et al. Molecular Pap smear: HPV genotype and DNA methylation of ADCY8, CDH8, and ZNF582 as an integrated biomarker for high-grade cervical cytology. *Clin Epigenetics.* 2016;8:96.
17. Kumari K, Kumar V, Lakhera KK, Lakhotia A, Jain N, Arya J, et al. Pap smear and colposcopic examination of the cervix in pelvic inflammatory disease and other gynaecological conditions: A prospective analytical study. *J Clin Diagn Res.* 2023;17(3).
18. Srivastava AN, Misra JS, Srivastava S, Das BC, Gupta S. Cervical cancer screening in rural India: Status & current concepts. *Indian J Med Res.* 2018;148(6):687-96.
19. Faghih N, Arab M, Tehranian A, Ghavami B, Nouri B, Khosravi D. Effective high grade cervical intraepithelial neoplasia case finding in low resource settings. *Med J Islam Repub Iran.* 2022;36:33.
20. Jeyakumar AM, Mohanapu S. A comparison of cervical cancer screening methods: Pap smear, liquid based cytology and VIA VILI. *Int J Reprod Contracept Obstet Gynecol.* 2019;8(5):1738-44.
21. Sharma P, Pattanshetty SM. A study on risk factors of cervical cancer among patients attending a tertiary care hospital: A case-control study. *Clinical Epidemiology and Global Health.* 2018;6(2):83-7.
22. Mekonnen AG, Mittiku YM. Early-onset of sexual activity as a potential risk of cervical cancer in Africa: A review of literature. *PLOS Glob Public Health.* 2023;3(3):e0000941.
23. Plummer M, Peto J, Franceschi S. International collaboration of epidemiological studies of cervical cancer. Time since first sexual intercourse and the risk of cervical cancer. *Int J Cancer.* 2012;130(11):2638-44.
24. Akhter H, Begum F. Risk factors of carcinoma cervix. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology.* 2023;12(5):1257-62.
25. Najib FS, Hashemi M, Shiravani Z, Poordast T, Sharifi S, Askary E. Diagnostic accuracy of cervical Pap smear and colposcopy in detecting premalignant and malignant lesions of cervix. *Indian J Surg Oncol.* 2020;11(3):453-8.
26. Huy NVQ, Tam LM, Tram NVQ, Thuan DC, Vinh TQ, Thanh CN, et al. The value of visual inspection with acetic acid and Pap smear in cervical cancer screening program in low resource settings - A population-based study. *Gynecol Oncol Rep.* 2018;24:18-20.
27. Thapa N, Maharjan M, Shrestha G, Maharjan N, Lindell D, Zuo N, et al. Accuracy of visual tests for primary cervical cancer screening in rural Nepal. *JNMA J Nepal Med Assoc.* 2018;56(214):917.
28. Mustafa MS, Jindal AK, Singh P. Visual inspection using acetic acid for cervical cancer in low resource settings. *Med J Armed Forces India.* 2010;66(4):382-4.
29. Mahezabeen, Thobbi VA. Screening of premalignant and malignant lesions of cervix by visual inspection with (acetic acid or Lugol's iodine) and PAP smear. *Int J Reprod Contracept ObstetGynecol [Internet].* 2024;13(9):2392-7. Available from: <https://www.ijrcog.org/index.php/ijrcog/article/view/14405>. Last accessed: 27.05.2025.