

## Original Research Article

# COMPARATIVE STUDY OF CONVENTIONAL SMEAR CYTOLOGY VERSUS LIQUID-BASED CYTOLOGY IN DETECTION OF CERVICAL EPITHELIAL ABNORMALITIES

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Received : 09/03/2026  
Received in revised form : 20/04/2026  
Accepted : 08/05/2026

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DOI: 10.70034/ijmedph.2026.2.335

Source of Support: Nil,

Conflict of Interest: None declared

**Int J Med Pub Health**

2026; 16 (2); 2002-2008

## ABSTRACT

**Background:** Cervical cancer is one of the most preventable malignancies among women when detected at the precancerous stage through effective screening. Conventional smear cytology has been widely used for cervical screening; however, it may be limited by poor fixation, obscuring blood or inflammation, uneven cell distribution, and many times unsatisfactory smears. Liquid-based cytology has been introduced to improve specimen adequacy, cellular preservation, and background clarity, thereby enhancing cytological interpretation beside this we can also use HPV detection from remaining sample if needed. The aim is to compare conventional smear cytology and liquid-based cytology in the detection of cervical epithelial abnormalities among women attending a tertiary care hospital.

**Materials and Methods:** This hospital-based comparative observational study was conducted in the Department of Pathology at a tertiary care hospital and included 72 patients attending the gynecology outpatient department. Cervical samples were collected from each patient for both conventional smear cytology and liquid-based cytology. Smears were stained by the Papanicolaou method and reported according to The Bethesda System. The parameters studied included specimen adequacy, cellularity, background clarity, cellular preservation, obscuring blood or inflammation, infective and reactive changes, and epithelial cell abnormalities. Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 27.0. Categorical variables were expressed as frequencies and percentages, and appropriate statistical tests were applied. A p-value of less than 0.05 was considered statistically significant.

**Results:** The majority of patients belonged to the 31–40 years' age group 24 cases (33.33%), followed by 41–50 years 21 cases (29.17%). Vaginal discharge was the most common clinical presentation 28 cases (38.89%). Liquid-based cytology showed better specimen adequacy, with 70 satisfactory smears (97.22%), compared to 64 satisfactory smears (88.89%) by conventional smear cytology. A clear background was seen in 90.28% of liquid-based cytology smears compared to 66.67% of conventional smears. Good cellular preservation was higher in liquid-based cytology 94.44% than conventional smear cytology 83.33%. Obscuring blood or inflammation was lower in liquid-based cytology 9.72% than conventional smear cytology 33.33%. Epithelial abnormalities were detected in 15 cases (20.83%) by liquid-based cytology and 9 cases (12.50%) by conventional smear cytology.

**Conclusion:** Liquid-based cytology showed superior smear adequacy, cleaner background, better cellular preservation, and higher detection of cervical epithelial abnormalities compared to conventional smear cytology. Therefore, liquid-based cytology is a more effective method for cervical cytological evaluation in tertiary care settings.

**Keywords:** Cervical cytology; Conventional Pap smear; Liquid-based cytology; Cervical epithelial abnormalities; Bethesda system.

## INTRODUCTION

Cervical cancer remains an important public health problem and continues to contribute substantially to cancer-related morbidity and mortality among women worldwide. Although it is largely preventable, it still occurs commonly in settings where organized screening, timely diagnosis, vaccination, and treatment services are not uniformly available. Persistent infection with high-risk human papillomavirus is the central etiological factor in cervical carcinogenesis, but progression from infection to epithelial abnormality and invasive malignancy is usually gradual. This long pre-invasive phase provides an important opportunity for detection of cervical epithelial abnormalities before the development of invasive disease. Therefore, cervical cytology continues to play a valuable role in screening, especially in institutions where cytology-based services are established and where women present with gynecological complaints requiring cervical evaluation.<sup>[1]</sup> The prevention of cervical cancer depends on a coordinated approach involving primary prevention through vaccination, secondary prevention through screening, and appropriate treatment of detected precancerous lesions. The global strategy for cervical cancer elimination emphasizes that screening should not be viewed merely as a laboratory test but as a complete clinical pathway that includes sample collection, accurate interpretation, reporting, follow-up, and treatment when required. In tertiary care hospitals, cytology remains particularly relevant because these centers receive both symptomatic and asymptomatic women, including patients with vaginal discharge, abnormal uterine bleeding, postcoital bleeding, unhealthy cervix, and those attending routine screening. Early identification of epithelial abnormalities in such women helps guide colposcopy, biopsy, clinical management, and follow-up.<sup>[2]</sup> Conventional smear cytology, commonly known as the Pap smear, has been one of the most widely used methods for cervical cancer screening for many decades. It is simple, inexpensive, and can be performed in a wide range of healthcare settings. In this method, exfoliated cells collected from the transformation zone are directly spread on a glass slide, fixed, stained, and examined microscopically. The transformation zone is the most important site for sampling because most squamous intraepithelial lesions arise in this region. Conventional cytology allows identification of inflammatory changes, infective organisms, reactive cellular changes, atypical squamous cells, squamous intraepithelial lesions, glandular abnormalities, and features suggestive of malignancy. However, the quality of the smear is highly dependent on proper sampling, even spreading, immediate fixation, and adequate staining.<sup>[3]</sup> Despite its usefulness, conventional smear cytology has certain limitations. Uneven distribution of cells, air-drying artifact, thick smears, overlapping

cells, excessive mucus, blood, inflammatory exudate, and poor fixation may reduce interpretability. These factors can lead to unsatisfactory smears or difficulty in identifying abnormal epithelial cells. In addition, only a portion of the collected material is transferred to the slide, while residual diagnostic cells may remain on the collection device and be discarded. These limitations are particularly important in busy tertiary care settings, where patients may present with cervicitis, discharge, bleeding, or an inflamed cervix, all of which can obscure cellular details. Therefore, methods that improve sample adequacy, cellular preservation, and background clarity are valuable for cervical cytology reporting.<sup>[4]</sup> Liquid-based cytology was introduced as an alternative technique to overcome some limitations of conventional smear preparation. In this method, cervical cells collected using a brush or spatula are rinsed into a vial containing preservative fluid rather than being directly smeared onto a slide. The sample is then processed to produce a thin, uniform layer of cells on the slide. This technique improves cell distribution and reduces obscuring material such as blood, mucus, and inflammatory debris. It also provides better preservation of cellular morphology, which may help in the recognition of subtle nuclear and cytoplasmic abnormalities. Another practical advantage is that residual material in the vial may be used for ancillary testing, including human papillomavirus testing, where such facilities are available.<sup>[5]</sup> The comparison between conventional smear cytology and liquid-based cytology is clinically relevant because both techniques are used for the same purpose but differ in sample processing, smear quality, adequacy, cost, and laboratory requirements. Conventional smear cytology remains useful in resource-limited settings due to its affordability and minimal technical requirements. Liquid-based cytology, on the other hand, requires additional processing systems and consumables but may improve laboratory efficiency and diagnostic clarity. In cervical cytology, the reliability of reporting depends not only on the presence of abnormal cells but also on proper visualization of cellular morphology. Therefore, evaluating both methods in the same patient population allows a meaningful comparison of their diagnostic utility in detecting cervical epithelial abnormalities.<sup>[6]</sup>

## MATERIALS AND METHODS

This was a hospital-based comparative observational study conducted in the Department of Pathology at a tertiary care hospital. The study was designed to compare the diagnostic utility of conventional smear cytology and liquid-based cytology in the detection of cervical epithelial abnormalities among women undergoing cervical cancer screening. A total of 72 patients attending the gynecology outpatient department were included in the study. Women presenting with complaints such as vaginal discharge,

abnormal uterine bleeding, postcoital bleeding, intermenstrual bleeding, pelvic pain, or those attending routine cervical screening were considered for inclusion. All patients were evaluated clinically before sample collection.

#### **Inclusion Criteria**

Women of reproductive, perimenopausal, or postmenopausal age groups who were advised cervical cytological examination were included in the study. Patients who provided consent for participation and in whom both conventional smear cytology and liquid-based cytology samples could be obtained were enrolled.

#### **Exclusion Criteria**

Women with a previously diagnosed malignancy of the cervix, history of total hysterectomy, ongoing menstruation at the time of sample collection, active heavy vaginal bleeding, or those who had received radiotherapy or chemotherapy for cervical lesions were excluded from the study. Unsatisfactory samples due to inadequate cellularity or improper fixation were also excluded from final analysis.

**Methodology:** The study included 72 patients. From each patient, cervical samples were collected for both conventional smear cytology and liquid-based cytology, allowing paired comparison of the two cytological techniques in the same study population.

**Sample Collection Procedure:** Cervical samples were collected under aseptic precautions after proper positioning of the patient in lithotomy position. A sterile Cusco's speculum was introduced without lubricant to visualize the cervix clearly. Any excess mucus or discharge was gently removed before sample collection. The transformation zone and ectocervical area were sampled carefully using a cervical sampling device such as Ayre's spatula and/or cytobrush.

**Conventional Smear Cytology:** For conventional smear cytology, the collected cervical material was immediately spread evenly on a clean glass slide. The smear was promptly fixed in 95% ethyl alcohol to prevent air-drying artifacts. The slides were subsequently stained by the Papanicolaou staining method. The stained smears were examined microscopically for adequacy, cellularity, inflammatory background, epithelial cell abnormalities, and other cytomorphological features.

**Liquid-Based Cytology:** For liquid-based cytology, the cervical sample obtained using a cytobrush was rinsed directly into a vial containing preservative fluid. The sample was processed according to the standard liquid-based cytology protocol. A representative thin-layer preparation was made and stained using the Papanicolaou method. The prepared slides were assessed for cellular preservation, background clarity, obscuring factors, adequacy, and epithelial abnormalities.

**Cytological Evaluation:** Both conventional smear cytology and liquid-based cytology slides were evaluated independently. The cytological findings were reported using The Bethesda System for reporting cervical cytology. The parameters assessed

included specimen adequacy, presence of inflammatory changes, bacterial vaginosis, candidiasis, Trichomonas infection, reactive cellular changes, atypical squamous cells of undetermined significance, low-grade squamous intraepithelial lesion, high-grade squamous intraepithelial lesion, atypical glandular cells, and malignancy wherever applicable.

The main parameters studied were sample adequacy, cellularity, fixation quality, background cleanliness, presence of obscuring blood or inflammatory exudate, preservation of cellular morphology, detection of infectious organisms, and identification of cervical epithelial abnormalities. The diagnostic performance of conventional smear cytology and liquid-based cytology was compared based on the detection rate of epithelial abnormalities and the proportion of satisfactory and unsatisfactory smears.

#### **Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize demographic variables and cytological findings. Categorical variables were expressed as frequencies and percentages. The comparison between conventional smear cytology and liquid-based cytology was performed using appropriate statistical tests such as the chi-square test or Fisher's exact test, wherever applicable. A p-value of less than 0.05 was considered statistically significant.

## **RESULTS**

[Table 1] shows the age-wise distribution of patients included in the study. The maximum number of patients belonged to the 31–40 years age group, comprising 24 patients (33.33%), followed by the 41–50 years age group with 21 patients (29.17%). There were 12 patients (16.67%) in the 21–30 years age group, while 10 patients (13.89%) were in the 51–60 years age group. The least number of patients, 5 cases (6.94%), were above 60 years of age. Thus, most patients in the study were between 31 to 50 years, representing the common age group attending cervical screening and gynecological evaluation.

[Table 2] presents the clinical presentation of the study population. The most common presenting complaint was vaginal discharge, observed in 28 patients (38.89%). This was followed by abnormal uterine bleeding, which was seen in 16 patients (22.22%). Postcoital bleeding was reported in 8 patients (11.11%), while intermenstrual bleeding and routine screening accounted for 7 patients each (9.72%). Pelvic pain was the least common complaint, present in 6 patients (8.33%).

[Table 3] compares specimen adequacy between conventional smear cytology and liquid-based cytology. In conventional smear cytology, 64 out of 72 smears (88.89%) were satisfactory for evaluation, while 8 smears (11.11%) were unsatisfactory. In comparison, liquid-based cytology showed 70

satisfactory smears (97.22%) and only 2 unsatisfactory smears (2.78%). Liquid-based cytology therefore demonstrated a higher adequacy rate and a lower unsatisfactory rate than conventional smear cytology. The difference in specimen adequacy between the two methods showed a p-value of 0.070, which was not statistically significant.

**[Table 4] demonstrates the comparison of smear quality parameters between the two methods.** Adequate cellularity was observed in 62 conventional smears (86.11%) and 69 liquid-based cytology smears (95.83%), with a p-value of 0.070, showing no statistically significant difference. A clear background was seen in 48 conventional smears (66.67%), whereas it was present in 65 liquid-based cytology smears (90.28%). This difference was statistically significant, with a p-value of 0.000, indicating that liquid-based cytology produced smears with a significantly cleaner background. Good cellular preservation was noted in 60 conventional smears (83.33%) compared to 68 liquid-based cytology smears (94.44%), and this difference was statistically significant with a p-value of 0.039. Obscuring blood or inflammation was present in 24 conventional smears (33.33%), while it was seen in only 7 liquid-based cytology smears (9.72%), with a statistically significant p-value of 0.000.

**[Table 5] shows the detection of infective and reactive changes by conventional smear cytology and liquid-based cytology.** Inflammatory smears were identified in 34 cases (47.22%) by conventional smear cytology and 32 cases (44.44%) by liquid-based cytology, with a p-value of 0.774, showing no significant difference. Bacterial vaginosis was

detected in 10 cases (13.89%) by conventional smear cytology and 12 cases (16.67%) by liquid-based cytology, with a p-value of 0.625. Candidiasis was observed in 7 cases (9.72%) by conventional smear cytology and 8 cases (11.11%) by liquid-based cytology, with a p-value of 1.000. Trichomonas vaginalis was detected in 3 cases (4.17%) by conventional smear cytology and 4 cases (5.56%) by liquid-based cytology, also with a p-value of 1.000. Reactive cellular changes were reported in 18 cases (25.00%) by conventional smear cytology and 20 cases (27.78%) by liquid-based cytology, with a p-value of 0.754.

**[Table 6] compares cervical epithelial abnormalities detected by conventional smear cytology and liquid-based cytology.** Negative for intraepithelial lesion or malignancy was reported in 55 cases (76.39%) by both conventional smear cytology and liquid-based cytology. ASC-US was detected in 4 cases (5.56%) by conventional smear cytology and 5 cases (6.94%) by liquid-based cytology. LSIL was identified in 3 cases (4.17%) by conventional smear cytology and 5 cases (6.94%) by liquid-based cytology. HSIL was detected in 2 cases (2.78%) by conventional smear cytology, compared to 3 cases (4.17%) by liquid-based cytology. Atypical glandular cells were not detected by conventional smear cytology, whereas liquid-based cytology detected 1 case (1.39%). Similarly, squamous cell carcinoma was not detected by conventional smear cytology but was detected in 1 case (1.39%) by liquid-based cytology. Unsatisfactory smears were higher in conventional smear cytology, with 8 cases (11.11%), compared to only 2 cases (2.78%) in liquid-based cytology.

**Table 1: Age-wise Distribution of Patients**

Age Group	No. of Patients	Percentage
21–30 years	12	16.67%
31–40 years	24	33.33%
41–50 years	21	29.17%
51–60 years	10	13.89%
>60 years	5	6.94%
Total	72	100.00%

**Table 2: Clinical Presentation of Patients**

Clinical Presentation	No. of Patients	Percentage
Vaginal discharge	28	38.89%
Abnormal uterine bleeding	16	22.22%
Postcoital bleeding	8	11.11%
Intermenstrual bleeding	7	9.72%
Pelvic pain	6	8.33%
Routine screening	7	9.72%
Total	72	100.00%

**Table 3: Comparison of Specimen Adequacy in Conventional Smear Cytology and Liquid-Based Cytology**

Specimen Adequacy	Conventional Smear Cytology	Liquid-Based Cytology	p-value
Satisfactory	64 (88.89%)	70 (97.22%)	0.070
Unsatisfactory	8 (11.11%)	2 (2.78%)	
Total	72 (100.00%)	72 (100.00%)	

**Table 4: Comparison of Smear Quality Parameters**

Parameter	Conventional Smear Cytology	Liquid-Based Cytology	p-value
Adequate cellularity	62 (86.11%)	69 (95.83%)	0.070
Clear background	48 (66.67%)	65 (90.28%)	0.000

Good cellular preservation	60 (83.33%)	68 (94.44%)	0.039
Obscuring blood/inflammation present	24 (33.33%)	7 (9.72%)	0.000

**Table 5: Detection of Infective and Reactive Changes**

Cytological Finding	Conventional Smear Cytology	Liquid-Based Cytology	p-value
Inflammatory smear	34 (47.22%)	32 (44.44%)	0.774
Bacterial vaginosis	10 (13.89%)	12 (16.67%)	0.625
Candidiasis	7 (9.72%)	8 (11.11%)	1.000
Trichomonas vaginalis	3 (4.17%)	4 (5.56%)	1.000
Reactive cellular changes	18 (25.00%)	20 (27.78%)	0.754

**Table 6: Comparison of Cervical Epithelial Abnormalities Detected by Both Methods**

Cytological Diagnosis	Conventional Smear Cytology	Liquid-Based Cytology
NILM	55 (76.39%)	55 (76.39%)
ASC-US	4 (5.56%)	5 (6.94%)
LSIL	3 (4.17%)	5 (6.94%)
HSIL	2 (2.78%)	3 (4.17%)
AGC	0 (0.00%)	1 (1.39%)
Squamous cell carcinoma	0 (0.00%)	1 (1.39%)
Unsatisfactory	8 (11.11%)	2 (2.78%)
Total	72 (100.00%)	72 (100.00%)

## DISCUSSION

In the present study, the maximum number of patients belonged to the 31–40 years age group, 24 cases (33.33%), followed by the 41–50 years age group, 21 cases (29.17%), indicating that most women undergoing cervical cytology were in the reproductive and perimenopausal age groups. This pattern was comparable with Agarwal et al. (2019), who also reported that the most common age group in their comparative study of liquid-based cytology and conventional cytology was 31–40 years (35.00%), followed by 20–30 years (32.50%). Thus, both studies show that cervical screening attendance and epithelial abnormalities are commonly encountered in sexually active reproductive-age women.<sup>[7]</sup>

In this study, the most common clinical presentation was vaginal discharge, seen in 28 patients (38.89%), followed by abnormal uterine bleeding in 16 patients (22.22%), postcoital bleeding in 8 patients (11.11%), intermenstrual bleeding in 7 patients (9.72%), routine screening in 7 patients (9.72%), and pelvic pain in 6 patients (8.33%). Similar symptom-based attendance was noted by Varma et al. (2025), although their most common indication was routine checkup 95 cases (48.50%), followed by discharge per vaginum 36 cases (18.40%) and menstrual irregularities 26 cases (13.30%). Compared with their study, the present study had a higher proportion of symptomatic women, especially those with vaginal discharge.<sup>[8]</sup>

The predominance of vaginal discharge in the present study was also supported by Sherwani et al. (2007), who reported discharge per vaginum as the most common presenting complaint in 68 cases (42.50%). In the present study, vaginal discharge was present in 38.89%, which is close to their observation. Sherwani et al. also found that liquid-based cytology detected cytological abnormalities in 42 cases (26.20%), compared with 24 cases (15.00%) by conventional Pap smear, showing better diagnostic yield with liquid-based preparation. This is similar to the

present study, where liquid-based cytology detected epithelial abnormalities in 15 cases (20.83%), compared with 9 cases (12.50%) by conventional smear cytology.<sup>[9]</sup>

In the present study, specimen adequacy was better with liquid-based cytology, where 70 smears (97.22%) were satisfactory and only 2 smears (2.78%) were unsatisfactory. In comparison, conventional smear cytology showed 64 satisfactory smears (88.89%) and 8 unsatisfactory smears (11.11%). Although the p-value was 0.070, showing no statistically significant difference, the trend favored liquid-based cytology. Similar findings were reported by Pankaj et al. (2018), who observed a significantly higher unsatisfactory rate with conventional Pap smear 7.10% compared with liquid-based cytology 1.61%. Their study also concluded that LBC was superior mainly in reducing unsatisfactory smears, while epithelial abnormality detection was comparable between the two methods.<sup>[10]</sup>

Smear quality was clearly better with liquid-based cytology in the present study. Adequate cellularity was observed in 95.83% of LBC smears compared with 86.11% of conventional smears. A clear background was seen in 90.28% of LBC smears compared with 66.67% of conventional smears, and this difference was statistically significant with  $p = 0.000$ . Good cellular preservation was also higher in LBC 94.44% compared with conventional smear cytology 83.33%, with  $p = 0.039$ . Sharma et al. (2016) similarly reported that SurePath liquid-based cytology had slightly better satisfactory smears 93.00% compared with conventional smears 92.00%, along with better morphology and shorter screening time. These findings support the present observation that LBC improves smear quality and interpretability.<sup>[11]</sup>

In the present study, obscuring blood or inflammation was present in 24 conventional smears (33.33%), whereas it was seen in only 7 liquid-based cytology smears (9.72%), with a statistically significant  $p =$

0.000. This reduction in obscuring material is important because blood, mucus, and inflammation can mask diagnostic cells in conventional smears. Gupta et al. (2016) also reported that the unsatisfactory rate was much lower in LBC samples 1.20% compared with conventional Pap smears 10.50%, and noted that low cellularity with excess blood was an important cause of unsatisfactory conventional smears. The present study therefore agrees with Gupta et al. that liquid-based cytology improves slide quality by reducing obscuring factors.<sup>[12]</sup>

Detection of infective and reactive changes was broadly comparable between both techniques in the present study. Inflammatory smears were detected in 47.22% by conventional smear cytology and 44.44% by LBC. Bacterial vaginosis was detected in 13.89% and 16.67%, candidiasis in 9.72% and 11.11%, *Trichomonas vaginalis* in 4.17% and 5.56%, and reactive cellular changes in 25.00% and 27.78% by conventional smear and LBC, respectively. None of these differences were statistically significant. Atla et al. (2021) also found that infective findings such as *Candida* infection 9 cases (4.50%) and *Trichomonas vaginalis* 5 cases (2.50%) could be identified on LBC, while epithelial abnormalities such as ASC-US and HSIL/SCC were more frequently reported by LBC than conventional smears. This supports the view that LBC is comparable for infection detection and better for epithelial abnormality detection.<sup>[13]</sup>

In the present study, NILM was reported in 55 cases (76.39%) by both methods, but epithelial abnormalities were more frequently detected by liquid-based cytology. ASC-US was detected in 5 cases (6.94%) by LBC compared with 4 cases (5.56%) by conventional smear; LSIL in 5 cases (6.94%) compared with 3 cases (4.17%); and HSIL in 3 cases (4.17%) compared with 2 cases (2.78%). LBC also detected 1 case (1.39%) of AGC and 1 case (1.39%) of squamous cell carcinoma, which were not detected by conventional smear. Kituncharoen et al. (2015) similarly reported higher abnormal cytology detection with LBC 12.30% compared with conventional cytology 8.10%, with significantly higher detection of squamous cell abnormalities 11.50% vs. 7.70%. Their ASC-US and LSIL detection rates were also higher with LBC, supporting the present study findings.<sup>[14]</sup>

Overall, the present study demonstrated that liquid-based cytology performed better than conventional smear cytology in terms of adequacy, smear clarity, cellular preservation, reduced obscuring material, and detection of epithelial abnormalities. The unsatisfactory rate was lower with LBC 2.78% than conventional smear cytology 11.11%, and epithelial abnormalities were detected more often by LBC 20.83% than conventional smear cytology 12.50%. Beerman et al. (2009), in a large population-based study of 86,469 women, similarly reported a significantly lower unsatisfactory rate with LBC 0.13% compared with conventional cytology 0.89%, higher ASC-US or worse detection 2.97% vs. 1.64%,

and higher sensitivity for histologically proven lesions 96.20% vs. 92.00%. These findings strongly support the use of LBC as a superior method where resources permit.<sup>[15]</sup>

## CONCLUSION

Liquid-based cytology showed better performance than conventional smear cytology in terms of specimen adequacy, clear background, cellular preservation, and reduction of obscuring blood or inflammation. It also detected a higher number of cervical epithelial abnormalities compared to conventional smear cytology. Both methods were comparable in detecting infective and reactive changes. Thus, liquid-based cytology appears to be a more effective technique for cervical cytological evaluation, especially in tertiary care settings.

## REFERENCES

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74(3):229-263. doi:10.3322/caac.21834. Available from: <https://doi.org/10.3322/caac.21834>
2. World Health Organization. Global strategy to accelerate the elimination of cervical cancer as a public health problem. Geneva: World Health Organization; 2020. Available from: <https://www.who.int/publications/i/item/9789240014107>
3. World Health Organization. WHO guideline for screening and treatment of cervical pre-cancer lesions for cervical cancer prevention. 2nd ed. Geneva: World Health Organization; 2021. Available from: <https://www.who.int/publications/i/item/9789240030824>
4. Fontham ETH, Wolf AMD, Church TR, Etzioni R, Flowers CR, Herzig A, et al. Cervical cancer screening for individuals at average risk: 2020 guideline update from the American Cancer Society. *CA Cancer J Clin.* 2020;70(5):321-346. doi:10.3322/caac.21628. Available from: <https://doi.org/10.3322/caac.21628>
5. American College of Obstetricians and Gynecologists. Updated cervical cancer screening guidelines. Washington, DC: American College of Obstetricians and Gynecologists; 2021. Available from: <https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2021/04/updated-cervical-cancer-screening-guidelines>
6. Perkins RB, Guido RS, Castle PE, Chelmsow D, Einstein MH, Garcia F, et al. 2019 ASCCP risk-based management consensus guidelines for abnormal cervical cancer screening tests and cancer precursors. *J Low Genit Tract Dis.* 2020;24(2):102-131. doi:10.1097/LGT.0000000000000525. Available from: <https://doi.org/10.1097/LGT.0000000000000525>
7. Agarwal P, Gupta R, Kakkar M, Misra T, Agrawal D, Dahiya S. Comparison of liquid-based cytology and conventional Papanicolaou smear as a screening tool in high-risk females. *J South Asian Feder Obst Gynae.* 2019;11(3):156-160. doi:10.5005/jp-journals-10006-1673. Available from: <https://www.jsafog.com/doi/10.5005/jp-journals-10006-1673>
8. Varma AS, Balani RK, Reddy DN, Jadhao AN. Cervical cancer screening redefined: a comparative study of conventional Pap smear and liquid-based cytology. *Int J Acad Med Pharm.* 2025;7(3):179-184. doi:10.47009/jamp.2025.7.3.33. Available from: [https://www.academicmed.org/Uploads/Volume7Issue3/33.%205239.%20JAMP\\_Avinash\\_179-184.pdf](https://www.academicmed.org/Uploads/Volume7Issue3/33.%205239.%20JAMP_Avinash_179-184.pdf)
9. Sherwani RK, Khan T, Akhtar K, Zeba A, Siddiqui FA, Rahman K, et al. Conventional Pap smear and liquid based cytology for cervical cancer screening: a comparative study. *J*

- Cytol. 2007;24(4):167-172. doi:10.4103/0970-9371.41888. Available from: [https://journals.lww.com/jocy/fulltext/2007/24040/conventional\\_pap\\_smear\\_and\\_liquid\\_based\\_cytology.1.aspx](https://journals.lww.com/jocy/fulltext/2007/24040/conventional_pap_smear_and_liquid_based_cytology.1.aspx)
10. Pankaj S, Nazneen S, Kumari S, Kumari A, Kumari A, Kumari J, et al. Comparison of conventional Pap smear and liquid-based cytology: a study of cervical cancer screening at a tertiary care center in Bihar. *Indian J Cancer*. 2018;55(1):80-83. Available from: <https://pubmed.ncbi.nlm.nih.gov/30147099/>
  11. Sharma J, Toi PC, Siddaraju N, Sundareshan M, Habeebullah S. A comparative analysis of conventional and SurePath liquid-based cervicovaginal cytology: a study of 140 cases. *J Cytol*. 2016;33(2):80-84. doi:10.4103/0970-9371.182525. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4881410/>
  12. Gupta N, Bhar VS, Rajwanshi A, Suri V. Unsatisfactory rate in liquid-based cervical samples as compared to conventional smears: a study from tertiary care hospital. *CytoJournal*. 2016;13:14. doi:10.4103/1742-6413.183831. Available from: <https://cytojournal.com/unsatisfactory-rate-in-liquid-based-cervical-samples-as-compared-to-conventional-smears-a-study-from-tertiary-care-hospital/>
  13. Atla B, Prasad U, Botta VSK, Namballa U, Pujari L, Lalam N. Comparative study of conventional Pap smear and liquid based cytology as a screening method for cervical cancer. *Int J Res Med Sci*. 2021;9(8):2439-2444. doi:10.18203/2320-6012.ijrms20213096. Available from: <https://www.msjonline.org/index.php/ijrms/article/view/9905>
  14. Kituncharoen S, Tantbirojn P, Niruthisard S. Comparison of unsatisfactory rates and detection of abnormal cervical cytology between conventional Papanicolaou smear and liquid-based cytology. *Asian Pac J Cancer Prev*. 2015;16(18):8491-8494. doi:10.7314/APJCP.2015.16.18.8491. Available from: [https://journal.waocp.org/article\\_31767\\_1054c0724d73a3a17f672ad9b4b64904.pdf](https://journal.waocp.org/article_31767_1054c0724d73a3a17f672ad9b4b64904.pdf)
  15. Beerman H, van Dorst EBL, Kuenen-Boumeester V, Hogendoorn PCW. Superior performance of liquid-based versus conventional cytology in a population-based cervical cancer screening program. *Gynecol Oncol*. 2009;112(3):572-576. doi:10.1016/j.ygyno.2008.12.012. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0090825808010603>