RESEARCH ARTICLE

A comprehensive assessment of cervical cancer risk factors, screening modalities, and cytological outcomes

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Abstract

Objective: To assess risk factors, awareness, screening practices and cytological outcomes related to cervical cancer.

Method: The descriptive, cross-sectional study was conducted from January to December 2020 at tertiary care hospitals in Lahore, Pakistan, after approval from the ethics review committee of the University of Health Sciences, Lahore, and comprised women aged 15-45 years presenting with or without cervicovaginal infections at least 48 hours after the end of menstruation. Sociodemographic characteristics, clinical risk factors, and awareness level regarding cervical cancer and screening were noted. Data was analysed using SPSS 24.

Results: Among the 90 female subjects with 28.6 ± 7.4 years early childbirth 69(76.7%), multiparity 57(63.3%) and recurrent cervicovaginal infections 79(87.8%) were the most common factors. No subject was familiar with the human papillomavirus, and none had ever undergone a Papanicolaou test. Cytological analysis showed inflammation in 65(72.2%) cases, and atypical findings in 23(25.6%). Additional findings included infections, such as Escherichia coli 17(18.9%) and methicillin-resistant Staphylococcus aureus 10(11.1%), with 29(32.2%) participants testing positive for Trichomonas vaginalis.

Conclusion: The level of awareness regarding cervical cancer and screening practices was alarmingly low, underscoring the need for structured cervical cancer screening and education programmes in Pakistan.

Key Words: Uterine cervical neoplasms, Papanicolaou test, Liquid-based cytology, Human papillomavirus, Health knowledge, Attitudes, Practice.

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Introduction

Cervical cancer, the second most common cancer among women globally, is primarily caused by chronic infection with high-risk human papillomavirus (HPV) types.[1] In 2018, the disease accounted for approximately 570,000 new cases and 311,000 deaths worldwide. The burden of cervical cancer is disproportionately higher in developing regions, particularly in Sub-Saharan Africa and Southeast Asia.[2] High-risk HPV strains, such as HPV16 and HPV18, are closely associated with the disease, with infection rates peaking during adolescence and premenopausal years.[3]

Several factors contribute to the risk of cervical cancer, including early initiation of sexual activity (before age 16), multiple sexual partners, smoking, high parity, and low socioeconomic status (SES).[4] Women living with human immunodeficiency virus (HIV) face an elevated risk of persistent HPV infections, abnormal Papanicolaou (Pap) smears and cervical cancer, often presenting at a younger age compared to HIV-negative women. Furthermore, prolonged use of oral contraceptives (for five or more years) has been shown to double the risk of cervical cancer, particularly in HPV-positive individuals. Research indicates that long-term oral contraceptive use is an independent risk factor for both squamous cell carcinoma (SCC) and adenocarcinoma of the cervix.[5]

Screening is crucial in preventing and controlling cervical cancer.[6] Standard screening methods include the conventional Pap smear, liquid-based cytology (LBC), visual inspection with acetic acid (VIA), visual inspection with Lugol's iodine (VILI), and HPV deoxyribonucleic acid (DNA) testing. While Pap smears have significantly reduced cervical cancer incidence in developed countries, their accuracy depends on factors such as technician expertise and specimen quality. LBC offers improved sensitivity and is widely used in high-resource settings. Molecular approaches, such as HPV DNA testing through polymerase chain reaction (PCR) and next-generation sequencing, have enhanced screening accuracy, particularly for HPV16 and HPV18, the most common oncogenic types.[7]

Screening programmes in developed countries began in the 1990s and have evolved to include HPV DNA testing, LBC, and VIA/VILI. A global public health initiative aims at increasing screening coverage to >80% by 2030. These efforts, including rural outreach programmes, have

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already reached millions of women. Advances in artificial intelligence (AI) also hold promise for improving diagnostic accuracy and efficiency in screening programmes.[8] Health economics plays a pivotal role in determining the cost-effectiveness of screening strategies. Collaborative efforts involving governments, healthcare professionals and communities are essential to implementing sustainable prevention programmes and reducing the global burden of cervical cancer.[9]

Unfortunately, the progress seen in developed countries has not been mirrored in many developing regions. South-Central Asia, particularly India and Pakistan, bears a significant cervical cancer burden, with an age-standardised incidence rate of 24.6%. Studies indicate a high prevalence of HPV infections in Pakistan, especially in precancerous and malignant cervical lesions, often linked to early marriage and high parity.[10] Awareness about cervical cancer in Pakistan remains alarmingly low. In rural areas, 70.1% of women were found unaware of the disease, while only 36% of urban women had heard of cervical cancer.[11] The absence of a nationwide screening programme and limited public awareness results in most cases being detected at advanced stages. Opportunistic screenings and physician-driven education efforts provide some relief, but they remain insufficient to address the disease's widespread burden.[12]

The current study was planned to evaluate the awareness of cervical cancer symptoms, risk factors, screening and prevention among women of reproductive age.

Subjects and Methods

The descriptive, cross-sectional study was conducted from January to December 2020 at tertiary care hospitals in Lahore, Pakistan, after approval from the ethics review committee of the University of Health Sciences (UHS), Lahore (No: UHS/REG-19/ERC/3454). Written informed consent was obtained from all the participants before enrolment. The participants were recruited using a convenience sampling technique from the gynaecology units and sexually transmitted infection (STI) clinics of Services Hospital and Jinnah Hospital, Lahore, and from the Punjab Acquired Immunodeficiency Syndrome (AIDS) Control Programme.

Women aged 15-45 years presenting with or without cervicovaginal infections at least 48 hours after the end of menstruation were eligible for inclusion. HIV-positive participants receiving antiretroviral therapy for <2 years were also included. Pregnant women and those with intrauterine contraceptive devices, recent sexual intercourse (<48 hours), active malignancy or tuberculosis were excluded. Women with hepatitis B or C were not excluded, and the hepatitis status was recorded as part of clinical data.

The sample size was calculated using the standard formula $n = Z^2p(1-p)/d^2$, assuming a prevalence of 40%, as described by Li S et al. in epidemiological studies.[13]

Data were collected using a structured pro forma through interviewer-administered, face-to-face interviews rather than self-completed questionnaires. Given the low literacy level in a subset of participants, trained female data collectors conducted interviews in Urdu, and, where required, in the local language. Each question was read aloud and, when necessary, explained in simple terms, and responses were recorded by the interviewer after confirming the participant's understanding. Data included risk factors, clinical history, awareness and participation in screening. Where applicable, relevant clinical and laboratory data were cross-checked from available records and test reports.

Data was analysed using SPSS 24. Descriptive statistics were used, with results presented as frequencies and percentages. No inferential statistical tests were applied.

Results

Among the 90 female subjects with a mean age of 28.6 ± 7.4 years, 20 (22.2%) were from Jinnah Hospital and 70 (77.8%) from Services Hospital. All the 90(100%) participants were Muslim. Regarding marital status, 76(84.4%) were married, 2(2.2%) were widowed, and 12(13.3%) were divorced. SES showed that 56 (62.2%) subjects belonged to low-income households and 34 (37.8%) to middle-income households. Educational attainment was generally low, with 29 (32.2%) participants being illiterate, 50 (55.6%) having completed primary education, and 11 (12.2%) having completed middle-level education.

With respect to risk factors, a history of induced abortion was reported by 22(24.4%) subjects, 6(6.7%) participants were smokers, surgical history was positive in 46(51.1%) cases, and 69(76.7%) had experienced childbirth before the age of 17. Exposure to diethylstilbestrol (DES) was noted in 39(43.3%) subjects, a history of intravenous (IV) drug use in 15(16.7%) and a history of STIs in 24(37.8%). Recurrent cervicovaginal infections were highly prevalent, 79(87.8%). Multiparity was common, with 57(63.3%) women having three or more children. Use of oral contraceptives was high 66(73.3%), whereas 12(13.3%) used intrauterine devices (IUDs). Immunosuppression 53(58.9%) referred to documented HIV positivity or clinically recorded chronic conditions. Hepatitis B and C positivity were observed in 10(11.1%) and 17(18.9%) participants, respectively (Table 1).

Table-1: Risk profile and clinical background of the subjects (n=90).

Characteristics	Frequency	Percentages
History of Induced Abortion	Yes	22 (24.4%)
	No	68 (75.6%)
Smoking Status	Yes	6 (6.7%)
	No	84 (93.3%)
Surgical History	Yes	46 (51.1%)
	No	44 (48.9%)
Childbirth before age 17	Yes	69 (76.7%)
	No	21 (23.3%)
Exposure to diethylstilbestrol (DES)	Yes	39 (43.3%)
	No	51 (56.7%)
Intravenous drug use	Yes	15 (16.7%)
	No	75 (83.3%)
History of STI	Yes	34 (37.8%)
	No	56 (62.2%)
Recurrent Cervicovaginal Infections	Yes	79 (87.8%)
	No	11 (12.2%)
Multiple Sexual Partners	Yes	8 (8.9%)
	No	82 (91.1%)
Multiparity	0	5 (5.6%)
	1	6 (6.7%)
	2	22 (24.4%)
	3	57 (63.3%)
Obesity	Yes	33 (36.7%)
	No	57 (63.3%)
Immunosuppression	Yes	53 (58.9%)
	No	37 (41.1%)
Haemophilia	Yes	0 (0%)
	No	90 (100%)
General health status	Good	56 (62.2%)
	Bad	34 (37.8%)
Current cervicovaginal infection	Yes	61 (67.8%)
	No	29 (32.2%)
Oral Contraceptives	Yes	66 (73.3%)
	No	24 (26.7%)
Intrauterine Devices	Yes	12 (13.3%)
	No	78 (86.7%)
Bilateral Tubal Ligation	Negative	63 (70%)
	Positive	27 (30%)
History of Blood Transfusion	Yes	9 (10%)
	No	81 (90%)
Screening for Hepatitis B	Yes	10 (11.1%)
	No	80 (88.8%)
Screening for Hepatitis C	Yes	17 (18.8%)
	No	73 (81.1%)

STI: Sexually transmitted infection.
Recurrent cervicovaginal infection was defined as ≥3 clinically documented episodes in the preceding year.

None of the patients reported being familiar with cervical cancer or HPV. Additionally, 4 (4.4%) reported being aware of a vaccine to prevent cervical cancer. This awareness was non-specific and not linked to knowledge of HPV or cervical cancer. Knowledge of Pap tests was limited (6, 6.7%). Regarding receipt of information about

Table-2: Cervical cancer screening for awareness, testing, and acceptability..

Variable	Category	n (%)
Familiar with Cervical Cancer	Yes	0 (0%)
	No	90 (100%)
Familiar with Human Papillomavirus	Yes	0 (0%)
	No	90 (100%)
Aware of vaccine to prevent cervical cancer	Yes	4 (4.4%)
	No	86 (95.6%)
Familiar with Pap Test	Yes	6 (6.7%)
	No	84 (93.3%)
Received Information about Cervical Cancer Screening in the Last 12 Months	Yes	0 (0%)
	No	90 (100%)
Acceptability of Cervical Cancer Screening	Yes	90 (100%)
	No	0 (0%)
Ever undergone Pap test	Yes	0 (0%)
	No	90 (100%)
Ever Undergone Cervical Examination	Yes	0 (0%)
	No	90 (100%)
Knowledge of diagnostic test for cervical cancer	Aware	0 (0%)
	Not aware	90 (100%)

Pap: Papanicolaou. Awareness of a "vaccine" was non-specific and not linked to knowledge of cervical cancer or human papillomavirus; respondents had heard of a vaccine by name only

Table-3: Cytological and microbiological findings.

Variable	Category	n (%)
Type of Inflammation in Pap Smear	Acute	25 (27.8%)
	Chronic	26 (28.9%)
	Mixed	39 (43.3%)
Inflammation Grade	Marked	14 (15.6%)
	Mild	56 (62.2%)
	Moderate	20 (22.2%)
Atypia in Inflammation	Yes	23 (25.6%)
	No	67 (74.4%)
Other Findings in Inflammation	Normal	67 (74.4%)
	Fungi	20 (22.2%)
	Koilocyte	2 (2.2%)
	Fungi and Koilocyte	1 (1.1%)
Additional Cytological Findings in Pap Smear	Positive	3 (3.3%)
	Negative	87 (96.7%)
Culture Test Results	E. coli	17 (18.9%)
	Gram-Positive Cocci	2 (2.2%)
	Gram-Positive Rods	2 (2.2%)
	Gram-Negative Rods	6 (6.7%)
	Klebsiella	2 (2.2%)
	MRSA	10 (11.1%)
	Normal Flora	43 (47.8%)
	Staphylococcus aureus	8 (8.9%)
Trichomonas vaginalis	Negative	61 (67.8%)
	Positive	29 (32.2%)

Pap: Papanicolaou, MRSA: Methicillin-resistant staphylococcus aureus; E: Escherichia. No test of statistical significance was applied.

cervical cancer screening in the preceding 12 months, none of the patients reported receiving it. Despite the lack of awareness, all 90(100%) patients expressed acceptability towards cervical cancer screening. However, none of the patients had undergone a Pap test or cervical examination, and none was familiar with the type of examination used to confirm cervical cancer (Table 2).

Regarding the type of inflammation observed in Pap smears, 25 (27.8%) exhibited acute inflammation, 26 (28.9%) had chronic inflammation, and 39 (43.3%) presented with mixed inflammation. The inflammation grade varied, with 14(15.6%) showing marked inflammation, 56(62.2%) exhibiting mild inflammation, and 20(22.2%) displaying moderate inflammation. Concerning atypia in the context of inflammation, 23 (25.6%) patients had atypical findings, while the majority, 67 (74.4%), had no atypia. Additional findings within the realm of inflammation included expected results in 67 (74.4%) patients, fungal presence in 20 (22.2%), koilocyte presence in 2 (2.2%), and both fungi and koilocytes in 1 (1.1%). In the broader context of cytological findings in Pap smears, 3 (3.3%) women had positive results, while 87 (96.7%) had negative results. Culture test results indicated varying bacterial presence, including escherichia (E.) coli 17(18.9%) patients, gram-positive cocci and gram-positive rods in 2(2.2%) patients each, gram-negative rods in 6(6.7%), Klebsiella in 2(2.2%), methicillin-resistant staphylococcus aureus (MRSA) in 10(11.1%), normal flora in 43(47.8%) of patients, and S. aureus in 8(8.9%). Overall, 61 (67.8%) patients tested negative for Trichomonas vaginalis, while 29 (32.2%) tested positive (Table 3).

Discussion

The current study highlighted significant socioeconomic and educational disparities among the participants, with a predominant representation of low-income and less-educated women. This aligns with global trends, where cervical cancer disproportionately affects socioeconomically disadvantaged populations, as these groups often have limited access to healthcare, screening, and preventive measures.[14] Most participants in the current study were housewives, reflecting limited exposure to health awareness campaigns typically accessible through workplaces or educational institutions.[15]

The current study revealed a high prevalence of risk factors for cervical cancer, including early childbirth (76.7%), multiparity (63.3%), recurrent cervicovaginal infections (87.8%), and oral contraceptive usage (73.3%). These findings are consistent with existing literature.[16-18]

Interestingly, while the prevalence of smoking (6.7%) was low in the current sample, immunosuppression was reported in 58.9% cases. Immunosuppressed individuals, particularly those with HIV or other chronic conditions, are known to have a higher risk of persistent HPV infections and subsequent progression to cervical cancer. Moreover, the findings related to induced abortion (24.4%) and STIs (37.8%) emphasised the need for comprehensive sexual and reproductive health education, as these factors exacerbate vulnerability to HPV infections.[19]

The high prevalence of cervicovaginal infections (67.8%) and positive results for Trichomonas vaginalis (32.2%) underscored the role of untreated infections as a cofactor in cervical cancer development, consistent with studies highlighting their role in enhancing HPV persistence and oncogenesis. [20, 21]

None of the participants reported familiarity with cervical cancer or HPV, and only 4.4% had at least heard of the HPV vaccine. This lack of awareness mirrored findings in other developing countries, including Pakistan, where low levels of knowledge among women and even healthcare workers have been reported.[22-24]

The detection of koilocytes, a hallmark of HPV infection, supports the need for molecular HPV testing alongside cytology for comprehensive screening. The low percentage of positive Pap smears (3.3%) may reflect the limitations of opportunistic screenings in detecting precancerous lesions in asymptomatic populations. Comparable studies from South Asia and other low-resource settings have similarly reported a high burden of cervicovaginal inflammation and mixed infections on cytology, supporting the need to integrate infection management with the screening pathway.[1,2] This aligns with research suggesting that systematic screening programmes are more effective in reducing cervical cancer incidence by identifying lesions at an earlier, more treatable stage.[25]

The current study has limitations owing to its cross-sectional design and a modest sample size. Besides, data collection was completed in 2020, before the national HPV vaccination rollout. Findings should therefore be interpreted as baseline evidence rather than as reflecting current population awareness or screening coverage.

Despite the limitations, the current findings underscore the urgent need for organised cervical cancer screening programmes in Pakistan, coupled with robust awareness campaigns targetting both women and healthcare providers. The integration of HPV testing with Pap smear cytology may enhance early detection. Addressing socio-

cultural barriers and strengthening healthcare infrastructure in low-income settings remain essential to improving accessibility and participation in preventive services.

Conclusion

There were identifiable gaps in awareness and screening practices before the implementation of national preventive strategies. The findings supported the need for structured, accessible cervical cancer screening and education programmes. Cytological findings revealed a significant burden of inflammation and infections, emphasising the importance of systematic screening approaches. Strengthening public health initiatives focused on education, cultural acceptability and healthcare access is essential for effective cervical cancer prevention.

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