

A Descriptive Study on Cervical Cancer Screening Methods

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Abstract

Cervical cancer continues to pose a major public health challenge, particularly in low- and middle-income countries where access to preventive services is often limited. This review presents an overview of the disease, covering its global burden, underlying causes, available screening approaches, treatment options, and preventive measures. Persistent infection with high-risk types of human papillomavirus (HPV) is widely recognized as the main cause of cervical cancer, with certain strains contributing more significantly to disease progression. Screening plays a crucial role in early detection and includes methods such as Pap smear testing, HPV DNA testing, and visual inspection techniques. Early diagnosis through these methods has been shown to significantly reduce morbidity and mortality. Treatment strategies depend on the stage of the disease and may involve surgery, radiotherapy, chemotherapy, or a combination of these approaches. In recent years, newer modalities such as targeted therapy and immunotherapy have gained attention for their potential to improve outcomes. Preventive strategies, particularly HPV vaccination, have brought notable progress in reducing the incidence of cervical cancer. However, disparities in vaccine coverage, limited healthcare infrastructure, and low awareness levels continue to hinder effective control of the disease in many regions. Strengthening screening programs, improving access to vaccination, and promoting public education are essential steps toward reducing the overall burden of cervical cancer.

Keywords: Cervical cancer, epidemiology, HPV, HPV vaccination, cervical cancer screening

INTRODUCTION

Cervical cancer is the second most prevalent malignant tumor in women worldwide and poses a major threat to their health. Persistent infection with high-risk human papillomavirus (HPV) is the primary cause of cervical cancer. In May 2018, the World Health Organization (WHO) launched a plea to eliminate cervical cancer globally. Over 70 countries and academic societies responded enthusiastically [1].

Most cervical cancer cases can be avoided. The best ways to reduce the healthcare burden and mortality from cervical cancer are primary prevention and screening. The HPV vaccine has been available to prevent cervical cancer since 2006 [2].

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EPIDEMIOLOGY

Persistent HPV infection is responsible for over 99% of all cervical cancer cases [3]. Annually, more than 500,000 new cervical cancer diagnoses and approximately 250,000 cervical cancer-related fatalities occur worldwide. Eighty percent of these cases are found in developing nations [4]. According to estimates provided by the WHO and the International Agency for Research on Cancer (IARC), there were 529,000 new cases of cervical

cancer worldwide in 2008. In developing nations, the number of new cervical cancer cases reached 452,000, making it the second most prevalent malignancy among women [5].

Types of Cervical Cancer

There are two main types of cervical cancer:

- *Squamous cell carcinoma*: Squamous cells are flat, skin-like cells that cover the outer surface of the cervix, known as the ectocervix.
- *Adenocarcinoma*: Adenocarcinoma is a type of cancer that originates in gland cells responsible for mucus production. The cervix contains glandular cells distributed throughout the canal, extending from the cervix to the uterus (endocervix) [6].

Etiology

Infection with human papillomavirus (HPV) is linked to nearly all cases of cervical cancer. HPV is typically spread through sexual contact or sexual intercourse [7].

Nonetheless, various additional risk factors (including reproductive, sexual, and behavioral factors) are associated with cervical cancer. These factors include engaging in sexual intercourse at a young age (under 16 years), having multiple sexual partners, smoking, high parity, and low socioeconomic status [8, 9].

REVIEW OF LITERATURE

Cervical cancer has been widely studied over the past few decades, particularly in relation to its preventable nature and the role of organized screening programs in its prevention. Early research established a strong association between persistent infection with high-risk human papillomavirus (HPV) and the development of cervical malignancies. Subsequent molecular studies have further clarified the oncogenic role of specific HPV strains, leading to a shift in both screening and prevention strategies.

Several population-based studies have demonstrated that well-structured screening programs significantly reduce the incidence and mortality of cervical cancer. Countries that have implemented routine cytological screening, especially Pap smear testing, have observed a marked decline in the disease burden over time. However, limitations such as variability in sensitivity and the need for repeated testing have led to the exploration of more reliable methods.

In recent years, HPV DNA testing has emerged as a more sensitive screening tool than conventional cytology. Studies have indicated that HPV-based screening allows for the earlier identification of high-risk individuals, even before cytological abnormalities become evident. This has prompted many health systems to adopt HPV testing, either as a primary screening method or in combination with cytology (co-testing). Visual inspection methods, particularly in low-resource settings, have also shown practical value because of their cost-effectiveness and immediate results, despite their lower specificity.

Research has also highlighted disparities in screening uptake, influenced by factors such as socioeconomic status, education, cultural beliefs, and the accessibility of healthcare services. Lack of awareness and limited infrastructure remain key barriers to developing regions. Additionally, studies on HPV vaccination programs have shown promising reductions in the prevalence of high-risk HPV infections and precancerous lesions, particularly among younger populations.

Overall, the literature underscores the importance of integrating vaccination with effective screening strategies and improving public awareness and healthcare accessibility to achieve meaningful reductions in the burden of cervical cancer.

Clinical Manifestation

- Bleeding may happen following intercourse, douching, or a pelvic examination.

- Enigmatic, persistent pelvic and/or back pain.
- Blood spots or light bleeding may occur during the menstrual cycle.
- Discomfort may be experienced during sexual intercourse.
- There may be an increase in vaginal discharge.
- Menstrual bleeding that lasts longer and is heavier than usual.
- Blood loss can occur after menopause [10].

Cervical Cancer Screening

1. *HPV test*: This test examines cells for the presence of high-risk types of human papillomavirus (HPV) that can lead to cervical cancer [11].
2. *Pap smear (cervical cytology)*: This test gathers cervical cells for examination to identify changes induced by HPV that could potentially develop into cervical cancer if not treated.
3. *Co-testing*: The HPV/Pap co-test combines an HPV test with a Pap test to simultaneously assess high-risk HPV and alterations in cervical cells [12].

Prevention

HPV Vaccination

It is administered from 9 to 45 years of age. Most individuals over the age of 26 years will not gain any benefits from receiving the HPV vaccination. Children under the age of 15 years are required to receive two doses of the HPV vaccine [13].

- Avoid smoking and limit the use of oral contraceptives over an extended period.
- Additionally, it can be prevented by steering clear of risk factors and undergoing regular Pap tests, commonly referred to as Pap smears.
- Avoid having multiple sexual partners during sexual activity.
- Modify your lifestyle or dietary habits.
- Other risk factors include early marriage, childbearing, and smoking [14].

Treatment

The treatment of cervical cancer depends on several factors, including the stage of cancer and the size and location of the tumor.

Precancerous Lesions Cervical Intraepithelial Neoplasia (CIN)

- *Cryotherapy*: Freezing abnormal cells.
- *Laser therapy*: Burning abnormal cells.
- *Loop electrosurgical excision procedure (LEEP)*: Removing abnormal tissue using electrical current.
- *Cold knife conization*: Surgical removal of a cone-shaped tissue [15].

Stage I: Early-Stage Cervical Cancer

- Conization (for microinvasive cancers in women wanting to preserve fertility).
- Simple or radical hysterectomy (removal of the uterus; radical hysterectomy includes removal of part of the vagina and lymph nodes).
- Radiation therapy (sometimes used after surgery if risk factors are present).
- Chemoradiation (chemotherapy + radiation) if surgery is not an option.

Stage (II–III): Locally Advanced Cervical Cancer

- Concurrent chemoradiation (standard).
- External beam radiation therapy (EBRT).
- Brachytherapy (internal radiation).
- Cisplatin-based chemotherapy.

Stage IV: Metastatic Cervical Cancer

- Chemotherapy (often a combination like cisplatin + paclitaxel).
- *Targeted therapy*: Bevacizumab (Avastin) inhibits blood vessel growth to tumors.
- *Immunotherapy*: Pembrolizumab (Keytruda) for tumors that express PD-L1.
- *Palliative care* focuses on symptom control and improving the quality of life [16, 17].

DISCUSSION AND CONCLUSION

Cervical cancer remains a major global health challenge, particularly in low- and middle-income countries (LMICs), where it is one of the leading causes of cancer-related deaths among women. Despite being largely preventable, disparities in access to healthcare services, especially screening and vaccination, continue to drive high incidence and mortality rates. The burden of disease is disproportionately concentrated in regions where health infrastructure is limited, awareness is low, and sociocultural barriers hinder timely medical interventions.

A central factor in the development of cervical cancer is persistent infection with high-risk strains of human papillomavirus (HPV). HPV is a common sexually transmitted infection, and while most infections resolve spontaneously, certain high-risk types (notably HPV-16 and HPV-18) can lead to precancerous lesions and eventually invasive cancer if left untreated. This well-established causal link provides a unique opportunity for both primary and secondary prevention strategies to be implemented.

Early detection through routine screening plays a critical role in reducing the incidence and mortality of cervical cancer. Pap smear has been a cornerstone of screening programs for decades. Pap smears enable timely intervention and treatment by identifying abnormal cellular changes in the cervix before they progress to cancer. Recently, HPV testing has emerged as a highly sensitive method for detecting high-risk HPV infections. Many healthcare systems now recommend a combination of Pap smear and HPV testing (co-testing) or even primary HPV testing as a more effective screening approach for cervical cancer. However, in LMICs, access to these services is often limited because of cost, lack of trained personnel, and inadequate laboratory infrastructure.

In addition to screening, vaccination against HPV is one of the most effective tools for preventing cervical cancer. Vaccines, such as the HPV vaccine, target the most common high-risk HPV types responsible for the majority of cervical cancer cases. When administered before exposure to the virus, ideally in early adolescence, the vaccine can provide long-lasting protection. Countries that have implemented widespread vaccination programs have already observed significant declines in HPV infection rates and in the incidence of precancerous cervical lesions. Nevertheless, vaccine coverage remains uneven globally, with LMICs facing challenges related to cost, supply, distribution, and vaccine hesitancy issues.

Healthcare disparities are major barriers to cervical cancer control. Women in underserved communities often lack access to regular screening and vaccination services, leading to late-stage diagnoses and poorer outcomes. Geographic barriers, poverty, and weak healthcare systems further exacerbate this problem. Additionally, sociocultural factors, such as the stigma associated with gynecological examinations, gender inequality, and limited health literacy, can discourage women from seeking preventive care. Misconceptions about HPV and vaccines also contribute to low uptake rates in some populations.

Addressing these challenges requires a multifaceted approach. Strengthening healthcare systems is essential to ensure that screening and vaccination services are accessible, affordable, and culturally appropriate. Community-based interventions, including awareness campaigns and education programs, can help dispel myths and encourage proactive health-seeking behaviors. Training healthcare providers and integrating cervical cancer prevention into primary healthcare services can improve coverage and outcomes.

Technological innovations offer promising solutions in resource-limited settings. For example, low-cost screening methods, such as visual inspection with acetic acid (VIA), can be used as an alternative where Pap smears are not feasible. Self-sampling for HPV testing is another emerging strategy that may increase participation by offering a more private and convenient option for women. Digital health tools and mobile clinics can further expand their reach in remote areas.

Global collaboration is crucial for advancing cervical cancer prevention and control. Initiatives led by organizations such as the World Health Organization aim to eliminate cervical cancer as a public health problem through coordinated efforts in vaccination, screening, and treatment. The WHO's global strategy includes ambitious targets: vaccinating 90% of girls by age 15, screening 70% of women by age 35 and again by age 45 and ensuring that 90% of women with cervical disease receive appropriate treatment. Achieving these targets will require sustained political commitment, international funding, and cross-sector partnerships.

Research continues to play a vital role in improving the prevention and treatment strategies. Advances in molecular diagnostics, vaccine development, and targeted therapies have enhanced the effectiveness of interventions. Implementation research is also critical for identifying context-specific solutions that can overcome barriers in different settings.

In conclusion, although cervical cancer remains a significant public health concern, it is one of the most preventable and treatable forms of cancer when appropriate measures are implemented. Expanding access to screening and vaccination, addressing healthcare disparities, and fostering global cooperation are essential steps toward reducing the disease burden. With sustained efforts and innovation, the vision of eliminating cervical cancer as a public health threat is both achievable and within reach in the near future.

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