

Cervical Cancer Unveiled: Insights into HPV, Risks, and Therapeutic Frontiers

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Abstract

Predictions indicate that the number of instances of cervical cancer will increase significantly by 2040, making it a major worldwide health concern at this moment. Reducing the incidence of cervical cancer and improving patient outcomes require an understanding of its complex dynamics, including its causes, risk factors, preventive measures, and available treatments. This study aims to clarify the incidence, etiology, function of Human Papillomavirus (HPV) subtypes, transmission dynamics, and related risk factors, using data from academic databases. The prognosis of cervical cancer is greatly influenced by early detection and timely treatment. An interdisciplinary strategy that includes diagnosis, treatment adherence, and comprehensive patient care is essential to the management of invasive cervical cancer. In order to reduce the burden of cervical cancer, this study emphasizes the critical need for comprehensive methods incorporating prevention, screening, and treatment modalities. Several scholarly articles from reputable scientific databases are referred to in this article.

Keywords: *Cervical cancer, Human Papillomavirus, Cervical cancer screening, Precancerous lesions, Risk factors*

INTRODUCTION

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By 2040, projections indicate that there will be 28.4 million instances of cancer worldwide. Cancer treatment plans are customized for each patient, taking into account the type and stage of the cancer. Surgery, radiation therapy, and medication are often used in combination [1-4]. Nonetheless, there are a ton of stories of cancer therapy organ toxicities [5, 6]. As a result, some patients turn to using natural plant products. Plant-based products have promising anti-cancer properties [7-9]. Plant products' chemical components allow them to show anti-cancer properties [10-15]. Early diagnosis is one of the catalysts to cancer survival including cervical cancer [17-19]. The mortality rates from female breast and cervical cancers remain comparatively higher, notwithstanding some medical advances in cancer treatment. Therefore, it is imperative to comprehend the complex dynamics of cervical cancer, including its causes, preventive measures, and treatment options, in order to reduce its incidence and improve patient outcomes. This paper examines the incidence of cervical cancer, clarifies its etiology, investigates the function of Human Papillomavirus (HPV) subtypes and their transmission, and analyzes a number of risk factors related to the illness. Comprehending these aspects becomes essential for formulating efficacious management and preventive methods. This article draws on a number of academic papers from reliable scientific databases.

Cervical cancer prevalence

The fourth most common cancer in women worldwide is cervical cancer. In 2020, there were 604 000 new cases of cervical cancer and 342 000 fatalities from the disease; almost 90% of these deaths were in underdeveloped nations [1]. The high prevalence of HIV, insufficient vaccine, screening, and treatment programs, as well as poverty, are blamed for contributing to the high cervical cancer prevalence in developing nations. Women are more likely to contract HIV, and there is a wealth of data indicating that HIV infection raises the chance of developing cervical cancer [20-26].

Causes of cervical cancer and risk factors

Papillomavirus is its major cause. Cervical cancer risk has also been linked to other variables, such as immunosuppression, smoking, poor sexual health, and screening non-attendance [27].

Papillomavirus in humans (HPV)

A prevalent sexually transmitted infection that can damage the skin, genitalia, and throat is HPV. High-risk infections have the potential to develop into cancer. Recurring cervical HPV infection is the primary cause of the majority of cervical malignancies [27].

HPV Subtypes

Reproductive tract infections are caused by HPVs, a kind of Papillomaviridae virus, which are tiny, double-stranded DNA viruses [28]. Eight proteins, split into early and late regions, and a circular genome are characteristics of them. The 'early' section contains six proteins (E1–E7) that control immune response and HPV genome replication. The "late" portion of the virus is made up of the L1 and L2 capsid proteins, which have been linked to its spread [29]. More than 200 subtypes are classified as high-risk or low-risk based on their oncogenicity [29]. Low-risk HPVs like HPV6,11,42,43, and 44 generate benign epithelial lesions including verrucae, warts, and papillomas; however, high-risk HPVs like HPV16, 18 are accountable for half of high-grade cervical pre-malignancies [28].

HPV Transfer

The most typical method of HPV transmission is sexual contact with an infected individual [30]. Additionally, there is the less frequent non-sexual method of HPV transmission through bodily contact [31]. The sexually transmitted nature of cervical cancer is associated with certain risk factors, such as having several sexual partners [32].

Other Cervical Cancer Risk Factors

Consuming tobacco

Even though there is proof linking HPV infection to cervical cancer, there may be additional risk factors to consider. Despite similar risk factors for adenocarcinoma and cervical squamous cell carcinomas, smoking is a substantial risk factor for squamous cell carcinomas [33]. According to a research by Roura et al. [34] with 308,036 women, tobacco use raises the risk of cervical cancer. The results of the study showed that the risk of cervical cancer was elevated by smoking status, duration, and intensity.

Pill for Oral Contraception

Because of its great efficacy, the oral contraceptive pill is the most widely used method of contraception when combined with barrier protection. However, the oral contraceptive pill use raises the incidence of cervical cancer [35]. Some systematic reviews and meta-analyses concluded that there was no evidence connecting oral contraceptive pill use to a higher chance of cancer while other studies concluded that hormonal contraceptives might affect the HPV-dependent pathway of

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carcinogenesis [36, 37]. A meta-analysis and comprehensive review revealed a strong correlation between oral contraceptive pill use and cervical cancer, especially adenocarcinomas [35]. It's possible that those taking oral contraceptive pill are less likely to employ concurrent barrier protection, making them more vulnerable to contracting HPV. Barrier measures, including using condoms, have been shown in several long-term trials to have a remarkable protection against HPV and the cervical cancer.

Suppression of the immune system

Immunosuppressed people are known to have a higher chance of acquiring a variety of malignancies, including stomach, liver, and colorectal tumors [38]. Individuals who have received an organ transplant or immunodeficiency illnesses are among these high-risk patients, although they are not the only ones [38]. Due to the mechanism of oncogenesis, HPV infections put patients with cervixes on immunosuppressive treatment after organ transplantation at higher risk of developing cervical cancer [39]. According to a 2009 Dutch study, compared to the immunocompetent population, kidney transplant recipients had a three-fold greater risk of cervical cancer and a two-to six-fold increased risk of CIN. Recent research from China and Brazil also confirmed these results [40, 41]. Moreover, it is believed that women who are HIV-positive may also be vulnerable since they may not be able to successfully eradicate their infection [42]. Research suggests that compared to non-HIV individuals, those living with HIV are noticeably more likely to present with abnormal cervical cytology [38]. Moreover, a correlation has been noted between a declining CD4 count and an elevated vulnerability to invasive cervical malignancies [43]. As a result, compared to the general population, these high-risk patients should receive diligent screening, more frequent follow-ups, and a warning about potential immunosuppressive side effects.

Sexual Behavior Components

Due to a higher risk of contracting HPV, some characteristics of sexual behavior escalate risk of cervical cancer [77]. First off, having sex at a young age is identified to escalate the risk of emergence of cervical cancer in females younger than 16 years old. Rogua et al. [44] early sexual exposure found heightens cervical cancer risk by 2.4 times. Thus, the HPV vaccination prior to 16 years of age can offer sufficient limitation against cervical cancer progression. Contrary to this report, another study found no link between HPV infection and sexual activity [45].

Cervical cancer prevention

The prevention and control of HPV infection, cervical cancer, and other malignancies mostly depend on raising public awareness and facilitating access to services and information. Early identification and treatment can prevent cancer, and vaccination between the ages of 9 and 14 is

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effective [32]. All females between the ages of 9 and 14 should receive HPV vaccinations as a priority, before they start engaging in sexual activity. There are two possible dosages for the vaccination. Ideally, two or three doses should be given to those with weakened immune systems. In order to prevent men's HPV-related cancers and to further decrease the prevalence of HPV in the society, some governments have also decided to vaccinate boys. Other crucial measures to avoid contracting HPV are: using condoms; abstaining from smoking; and getting male circumcision on a voluntary basis.

Precancer screening and cervical cancer therapy

Beginning at age 30, women should have screenings for cervical cancer every five to ten years. Beginning at age 25, women who are HIV positive should undergo screening every three years. A minimum of two lifetime screenings with a high-performance HPV test by age 35 and again by age 45 are recommended by the worldwide strategy. Even if you have received an HPV vaccination, routine cervical cancer screening is crucial because precancers rarely show symptoms.

A medical professional may check for alterations in the cervix, such as precancers, which could progress to cervical cancer if treatment is not received following a positive HPV test result or other screening technique. Cervical cancer can be avoided with a straightforward precancer treatment process. Treatment can be provided on the same visit (see and treat approach) or following a second test (see, triage and treat approach)—the latter of which is particularly advised for women who are HIV positive [31]. Precancer treatments are brief, usually painless, and only rarely result in problems. Colposcopy, or visual inspection of the cervix, is a method of diagnosis and treatment that involves locating and evaluating the lesion accompanied by thermal ablation, which burns off cells using a hot probe; cryotherapy, which freezes tissue using a cold probe; LEETZ (long loop excision of the transformation zone), which entails using an electrically heated loop to remove the aberrant tissues from you; and/or a cone-shaped wedge of tissue is cut out with a knife during a cone biopsy [46].

Early cervical cancer identification, diagnosis, and therapy

Cervical cancer can be cured with early detection and treatment, which includes recognizing signs and consulting a doctor. Women who experiences any of the following symptoms, should consult a doctor: unusual bleeding during periods, post-menopausal, or post-coital activity; increased or foul-smelling vaginal release; signs like chronic back, leg, or pelvic ache; weight loss, exhaustion, and appetite loss; vaginal discomfort; or leg swelling [46]. Following crucial clinical assessments and diagnostic testing, patients are typically referred for treatment options, such as palliative care, which offers supportive care and pain management, as well as surgery, radiation, and chemotherapy. Management pathways are essential tools in invasive cancer care, ensuring patient

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referrals, diagnosis assistance, and treatment options are promptly provided. A multidisciplinary team that ensures diagnosis and staging (pathology, imaging, and histopathology) occur before treatment decisions are made; treatment decisions that follow national guidelines; and interventions that are backed by comprehensive physical, psychological, spiritual, and palliative care are characteristics of high-quality care [38].

Conclusion

Cervical cancer is a global health concern with many facets, including the complex dynamics of HPV subtypes and the wide range of risk factors that impact the disease's prevalence. In order to reduce the prevalence of this illness, strategies emphasizing HPV vaccination, early diagnosis through routine screening, and thorough therapy of precancerous lesions are essential. Although knowledge about the etiology and treatment of cervical cancer has advanced, universal access to preventive measures and comprehensive care is crucial if global efforts are to lower the incidence of cervical cancer and enhance patient outcomes.

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