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Review Article

Types and importance of human papilloma virus vaccine and methods in promoting it for cervical cancer prevention

Amaal Abdo Dahab[1]*, Saeed Mohammed Dream[2], Bandar Ibrahim Mokli[3], Ahmed Ibrahim Alkhawaji[4], Rami Ali Shebaily[5], Nawaf Khalid Andijani[6], Zakia Isam Ibrahim[7], Saud Abdullah Alhasoun[8], Raghad Ali Alsufyani[9], Tala Wajdi Jowharji[10], Baraa Abdulrhman Abdulrahim[11]

[1]Department of Obstetrics and Gynecology, East Jeddah Hospital, Jeddah, Saudi Arabia
[2]Tendaha Alzalal Primary Healthcare Center, Ministry of Health, Asir, Saudi Arabia
[3]Department of Emergency Medicine, Sabya General Hospital, Sabya, Saudi Arabia
[4]Alzabya Primary Healthcare Center, Ministry of Health, Jazan, Saudi Arabia
[5]Al-Qaariah Primary Healthcare Center, Jazan, Saudi Arabia
[6]King Abdulaziz Airport Health Monitoring Center, Ministry of Health, Jeddah, Saudi Arabia
[7]General Physician, Saf Medical Company, Riyadh, Saudi Arabia
[8]University Medical Center, Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia
[9]College of Medicine, Taif University, Taif, Saudi Arabia
[10]General Physician, King Abdulaziz Hospital, Jeddah, Saudi Arabia
[11]College of Medicine, Ibn Sina National College, Jeddah, Saudi Arabia

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***Correspondence:**
Dr. Amaal Abdo Dahab,
E-mail: dr_amal_d@hotmail.com

ABSTRACT

Cervical cancer continues to be a significant global challenge as it is the fourth major cause of mortality among women. Cervical cancer is primarily caused by repeated human papilloma virus (HPV) infections. Although the incidence and death of cervical cancer have declined in high-income nations, the disease still places a heavy burden on low- and middle-income countries. HPV-16 is responsible for 50% while HPV-18 is responsible for 10% of cervical cancer cases. The introduction of HPV vaccines is limited in developing areas with greater need, despite the fact that they offer a potential alternative for disease control. The purpose of this research is to review the available information about types and importance of HPV vaccine and methods in promoting it for cervical cancer prevention. Three HPV vaccines for prevention of cervical cancer are available including a quadrivalent vaccine that protects against 4 HPV types, and the second is a bivalent vaccine that protects against 2 high-risk oncogenic HPV types and third is a 9-valent vaccine. All three vaccines provide comparable coverage. Preventative vaccinations against the virus, given to women before HPV infection, have proven to be efficient and have the potential to reduce the incidence of cervical cancer. Thus, it is advised to immunize girls aged 9-14 years. The development of the HPV vaccine has made primary cervical cancer prevention possible. Health promotion and education can potentially contribute to increasing the awareness of community regarding cervical cancer prevention and can lead to better utilization of HPV vaccine.

Keywords: Cervical, Cancer, Prevention, HPV, Vaccination

INTRODUCTION

Cervical cancer is the fourth most commonly diagnosed malignancy worldwide and the fourth leading cause of death attributed to cancer in women, with an expected 570,000 cases and 311,000 deaths, as per year 2018 statistics. Almost 85% of cervical cancer deaths worldwide occur in developing or underdeveloped countries, and mortality is 18 times higher in low- and middle-income countries than in high-income or developed countries. In regions with a lower human development index, cervical cancer lags behind breast cancer in terms of incidence and mortality but is the most commonly diagnosed cancer in 28 countries and the leading cause of cancer death in 42 countries, most of which are located in Sub-Saharan Africa and Southeast Asia. Africa has the greatest regional incidence and fatality rates. In comparison, rates are 7-10 times lower in Western Asia, Australia, New Zealand, and North America.[1] In May 2018, the world health organization issued a global call of action to eradicate cervical cancer as a public health issue. The global objective of speeding the eradication of cervical cancer led to the formation of the cervical cancer modelling consortium. For the disease to be completely eradicated, double-lived HPV-based screening and female-only HPV vaccination with 80–100% coverage with a highly effective 9-valent vaccine is necessary.[2]

The papillomavirus family includes the double-stranded circular DNA virus known as the HPV. It enters the body through cutaneous or mucosal injuries and is spread through skin-to-skin or mucosa-to-mucosa contact. Even though HPV infection is the most prevalent sexually transmitted disease, the immune system normally heals it. Men and women both have a 50% chance of contracting the disease at least once in their lifetimes around the world.[3] Infection with the HPV, which may be detected in 99.7% of cases of squamous cell carcinoma and adenocarcinoma, is the prelude to the development of cervical cancer. The major method of preventing cancer is still early diagnosis of precancerous lesions through Papanicolaou tests. Surgery, radiation therapy, chemotherapy, or a combination of these treatments may be used to treat cervical cancer once it has been identified. The treatment option is determined by the disease stage, lymph node involvement, comorbidities of the patient, and recurrence risk factors.[4] Persistent HPV infections are the main cause of cervical cancer. The international agency for research on cancer has classified 12 of the 200 HPV varieties recognized as carcinogenic, with HPV-16 responsible for 50% and HPV-18 for 10% of cervical cancer cases. Compared to a person who is not infected, the chance of developing cancer is increased by a factor of 435 or 248 depending on which HPV strain an individual has.[5]

Over the last few decades decline by a third and 50% respectively has been observed in the incidence and mortality of cervical cancer. It has been demonstrated that the cervical screening program is linked to an increase in the number of women receiving treatment for cervical cancer.[6] About 80% of women will acquire HPV at some point in their lifetime, the majority by the age of 45 years. HPV infection is sexually transmitted. Because HPV infection is asymptomatic, it may take 10 to 15 years for changes in the cervix to appear. HPV infection is frequently contracted during adolescence and early adulthood. Cervical cancer rates have reduced by 1% to 1.9% annually since the introduction of HPV vaccinations, indicating that prevention is a key component of managing cervical cancer as a whole.[7] The purpose of this research is to review the available information about types and importance of HPV vaccine and methods in promoting it for cervical cancer prevention.

LITERATURE SEARCH

This study is based on a comprehensive literature search conducted on September 16, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about types and importance of HPV vaccine and methods in promoting it for cervical cancer prevention. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The role of papilloma viruses in the oncogenesis of cervical cancer was discussed by Prof. Dr. Harald zur Hausen in year 1983-1984. He also discovered HPV16 and HPV18 in cervical malignancies in the same year. Since 2006, there has been an availability of HPV vaccine. Currently, three vaccines are available to protect against HPV 16 and 18, which are believed to be responsible for at least 70% of cervical malignancies. According to the World Health Organization, all three vaccines offer comparable protection against cervical cancer. The most effective timing for HPV vaccinations is before HPV exposure. The World Health Organization therefore recommends vaccinating girls between the ages of 9 years and 14 years, when most have not yet started sexual behaviour. Due to the vaccine's ability to protect against male genital cancer, certain nations have begun immunizing boys. Cervical cancer screening is not replaced by HPV vaccination. It may still be necessary to build or strengthen screening programs in nations where the HPV vaccine has been introduced.[8]

Types of HPV vaccine

There are two HPV vaccines available: One is a quadrivalent vaccine available under brand name Gardasil

that shields against HPV types 6 and 11, which are primarily responsible for genital warts and other benign lesions in addition to protection against cervical cancer, and the other is a bivalent vaccine available as cervarix that prevents two oncogenic HPV types 16 and 18, which are in charge of 70% of cervical cancer. The HPV antigens in both vaccines are L1 proteins, which are distinct from each HPV type and are manufactured utilizing recombinant technologies, including in vitro yeast or insect cell expression systems to provide conformationally intact non-infectious virus-like proteins. Adjuvants are another component of the vaccinations that help to strengthen the humoral immune response. Adjuvant system 04 is the adjuvant system for bivalent HPV vaccine, and contains both an aluminium salt and mono-phosphoryl lipid A. The adjuvant for quadrivalent HPV vaccine is a patented aluminium hydroxy phosphate sulphate system.[9,10] Another third type of the vaccine is the 9-valent HPV vaccine covers 5 additional cancer-causing variants which are 31/33/45/52/58 along with the 6 HPV types that are 6/11/16/18. According to epidemiological research, the 9 valent HPV vaccination may be able to prevent up to 90% of genital warts, 85%-95% of vulvar, vaginal, and anal cancers caused by HPV, and 70-85% of high-grade cervical dysplasia precancers.[11] Safety profile of HPV vaccination confirms the positive risk-benefit relationship between immunization and the HPV vaccine, although it is appropriate to continue safety assessment using high-quality research as HPV vaccine use spreads to increasingly varied populations, including males.[12]

Importance of HPV vaccine

The ambitious aim of prevention with vaccination is to significantly lower the occurrence of HPV-related disease. In nations with high vaccination coverage, the introduction of HPV vaccinations has produced significant reductions in HPV rates. Ten years after the first HPV vaccines were developed, they demonstrated a very alluring way to perhaps remove HPV-related lesions. They have an excellent safety profile and are known for their strong efficacy. In nations with high vaccination rates, herd protection ensures a decrease in HPV-related lesions, even in those who are unvaccinated.[13] Particularly in low-income countries where the screening methods are inadequate or insufficient HPV vaccination administered to women prior to the infection has shown to be cost-effective and can significantly reduce the incidence of cervical cancer.[14]

Findings of a cohort study on 867 689 participants showed that at baseline, 36.3% of participants were immunized at age 16 or younger, and during follow-up, 19.3% and 2.3% of participants were immunized at ages 17-19 and 20–30, respectively. In comparison to uninfected women, the incident rate ratio for cervical cancer were 0.14 (95% confidence interval (CI)=0.04 to 0.53) and 0.32 (95% CI=0.08 to 1.28), respectively, for women who received vaccinations between the ages of 16 and under and 17 and 19. When compared to uninfected women, the incidence rate was greater in women aged 20 to 30 at the time of vaccination (incident rate ratio=1.19, 95% CI=0.80 to 1.79) but somewhat decreased with increasing buffer time (incident rate ratio=0.85, 95% CI=0.55 to 1.32, with 4-year buffer time). Girls who receive the HPV vaccine before age 20 have a high population-level effectiveness against cervical cancer.[15] Results of another cohort study showed that in total, 391 participants (5.0%) had received greater than one dose of the vaccine, and 893 (11.5%) had abnormal cytology. Abnormal cytology was likely to occur or reported among women who received at least one dose of the vaccine. Similar outcomes were seen in women who only received one dose of the bivalent and quadrivalent vaccines while using the buffer periods excluding cytological outcomes within 1 month, 6 months and 1 year of the first dose. The risk of developing cervical abnormalities was cut in half by immunization against the HPV.[16]

The effectiveness of the HPV vaccine is almost near to 100% when administered in a three-dose regimen for defence against recurrent infection and precancerous lesions linked with the HPV vaccine among HPV-negative young under 25 years old women.[17] Shiko concluded in his study that in comparison to women aged 20-29 years old who received at least one dose of HPV vaccine, high-grade cervical lesions were significantly less common than those women who did not receive vaccination.[18] Lei concluded in his findings that a significantly lower risk of invasive cervical cancer among Swedish girls and women aged 10 to 30 years at population level was associated with quadrivalent HPV vaccination.[19] Results of a comparative modelling analysis projected that cervical cancer will be eliminated in the majority of low- and lower-middle-income nations within the next century if 90% of girls receive the HPV vaccine. However, countries with a higher cervical cancer incidence which is greater than 25 cases per 100,000 woman-years may not achieve eradication at four or fewer cases per 100,000 woman-years with vaccine alone, although being predicted to experience the largest absolute reductions.[2] Black stated that the development of the HPV vaccine has made primary cervical cancer prevention possible and has already had a significant influence on lowering incidence in high-income nations.[20]

Promotion of vaccination

A vaccine to prevent HPV infections in both males and females has been available since 2006; nevertheless, administration of this vaccine has only been about half as often as other vaccinations, and vaccine reluctance may play a role. In particular, unaccompanied minors seeking care in public health department clinics rely heavily on the factual and non-judgmental immunization education provided by public health nurses to their clients.[21] Cervical cancer is currently a major threat to women all over the world. Public health behaviours may be influenced by social media health campaigns. Compared

to women who were exposed to non-threat communications, those exposed to threat messages exhibited a stronger intention to get vaccinated against HPV. Women who were exposed to advertisements that combined efficacy and threat tended to have the highest intention of getting an HPV vaccination, despite the low number of likes.[22]

Tiro described in his study that only the HPV vaccine was covered in the educational materials that were effective for Hispanic people but not for black people. Future studies should examine potential mediators of the impacts of interventions for various racial and ethnic groups, such as informational needs or vaccination schemes, experiences, beliefs, and norms.[23] Health professionals employ immunization summaries, vaccine information statements, and provider training to encourage HPV vaccination. Although there is need for provider training for more uniform recommendations as well as education of parents to demystify the advantages and hazards of HPV vaccination.[24] When offering health education programs for college students, healthcare providers need to emphasize the knowledge and information regarding HPV vaccination, with an emphasis on students in lower grades and from non-healthcare fields. In the interim, social media can be used to disseminate relevant information to better reach college students and raise their awareness of the HPV vaccine, taking into account the verified effectiveness of social media in increasing HPV vaccination awareness and the fact that social media is preferred by current college students.[25] A comprehensive strategy that incorporates staff and provider education, patient reminder/recall, and patient education can increase the uptake of the HPV vaccine. Changes made at the system level to improve reminders and recall messages may have a significant effect on the uptake of HPV vaccines.[26] Health promotion and education activities also population-based surveys are need of time to increase the awareness of the communities regarding the utilization of HPV vaccine and prevention of cervical cancer also advocacy at government level is required to generate strict compliance strategies and implementation of HPV vaccination in both developed and developing countries hence, targeting the global population additionally further research can be beneficial in this regard.

CONCLUSION

HPV vaccination and screening are the only effective ways for reducing and preventing burden of cervical cancer globally. Counselling by healthcare providers can enhance the utilization of HPV vaccination and increase awareness among population although specific HPV vaccination and cervical cancer training of healthcare providers is also needed to achieve optimal outcomes.

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