Therapeutic Cancer Vaccines: An Emerging Treatment Option

Susan E. King, MS, RN, OCN®

Therapeutic cancer vaccines treat disease by stimulating the body's immune system. They are a form of active immunotherapy with the goal of producing an immune response that involves the cellular and humoral components of the immune system. These two components appear to be complementary and work together to induce tumor regression and long-lasting immunity to the disease being treated. This article reviews the history of cancer vaccine development, autologous and allogeneic vaccines, vaccine targets, carrier proteins, adjuvants, and clinical trial data of studies evaluating cancer vaccines. Knowledge of this emerging cancer treatment option will enable oncology nurses to be informed about cancer vaccines and accurately provide information about them to patients.

Key Words: cancer vaccines

A vaccine is a foreign substance injected to stimulate the immune system to launch an immune response against the specific target or targets contained in the vaccine. A prophylactic vaccine is intended to prevent disease by protecting an individual from developing the disease. Therapeutic vaccines are designed to treat people affected by a disease with the goal of stimulating or boosting the body's immune defenses to fight the disease (Davis, 2002). Prophylactic and therapeutic vaccines can produce immune responses that last a lifetime (e.g., polio vaccines), or boosters may be required to maintain immunity (e.g., tetanus booster every 10 years).

Prophylactic cancer vaccines are not yet possible because of the variation among different cancers even within the same type of cancer. However, hepatitis B virus (HBV), Epstein-Barr virus (EBV), and human papillomavirus (HPV) play a role in the development of certain cancers such as hepatocellular carcinoma, lymphoma, and cervical cancer, respectively (Disis, Morse, & Weber, 2002). The closest science has come to a prophylactic cancer vaccine is the hepatitis B vaccine (National Cancer Institute [NCI], 2003a). By preventing HBV infections with the hepatitis B vaccine, the incidence of cirrhosis and primary hepatocellular carcinoma has been greatly reduced in Malaysia, Singapore, and Taiwan, where these diseases occurred in high numbers (Chang et al., 1997; Pajeau & Bennett, 1996).

HPV, with more than 100 known strains, has been linked to nearly every case of cervical cancer. Prophylactic vaccines that prevent HPV are being studied (NCI, 2003a). HPV vaccines may reduce the incidence of cervical cancer dramatically (American Cancer Society [ACS], 2003). As an example, the HPV quadrivalent vaccine contains the proteins from four HPV strains: HPV 16 and 18, which are linked to two-thirds of the worldwide cases of cervical cancer, and HPV 6 and 11, the strains most commonly associated with genital warts, which also are linked to cervical cancer (Bass, 2002; NCI, 2003a). Currently, more than 28 vaccines are being studied with the goal of eliminating HPV infections and reducing the morbidity and mortality associated with HPV-related cervical cancers (Likes & Itano, 2003).

In the future, prophylactic cancer vaccines may prevent cancer in populations at risk. However, identifying appropriate populations for these vaccines will be an issue (Poole, Bommiasamy, Bocchetta, & Kast, 2003). Some people with genetic abnormalities never develop cancer, so determining who should be immunized with a prophylactic vaccine is difficult. However, as more is known about why some people develop cancer, researchers may be able to determine who might benefit from a prophylactic cancer vaccine.

Therapeutic Cancer Vaccines

The concept of therapeutic vaccines as a way to treat and possibly cure cancer dates back at least 100 years (Duke University Medical Center Genitourinary Cancer Immunotherapy Program, 2001; Jaffee, 2000). They are a form of active immunotherapy, inducing the host to make an immune response against its own tumor cells (Press, Leonard, Coiffier, Levy, & Timmerman, 2001). These vaccines target tumor-associated antigens (TAAs), which are simply molecules on the surface of the tumor cell (AVI BioPharma, 2003). The overall goal of a therapeutic cancer vaccine is to produce a potent immune response that involves the cellular and humoral arms of the immune system resulting in a T-cell and antibody response (Cell Genesys, 2003). The two arms of the immune system appear to be

Submitted September 2003. Accepted for publication December 19, 2003. The author is an employee at Genitope Corporation, one of the pharmaceutical companies mentioned in this article. (Mention of specific products and opinions related to those products do not indicate or imply endorsement by the Clinical Journal of Oncology Nursing *or the Oncology Nursing Society.)*

Digital Object Identifier: 10.1188/04.CJON.271-278