The Present Status of Therapeutic Cancer Vaccines**

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Cancer immunotherapy is currently recognized as the fourth most common therapy for cancer, after surgery, radiotherapy, and chemotherapy. Cancer vaccination is a therapeutic approach that involves attacking cancer cells by enhancing the immunity of cancer patients. The use of cancer immunotherapy to induce a therapeutic antitumor immune response in the patient has huge potential for complementing traditional cancer therapies.

Tumor antigens have been identified in a variety of carcinomas. Since the recognition of cancer-associated antigens by cytotoxic T cells (CTL) was first reported by Van der Bruggen *et al.* in 1991, numerous clinical trials have been conducted to demonstrate the efficacy of cancer vaccination. In 2010, the US Food and Drug Administration (FDA) approved the vaccine Sipuleucel-T (Provenge®) for the treatment of prostate cancer. Ipilimumab (Yervoy®) is an anti-CTLA-4 antibody preparation that targets cytotoxic T-lymphocyte antigen 4. In 2011, Ipilimumab was approved in both Europe and the USA for the treatment of malignant melanoma. As a result, cancer immunotherapy has attracted attention worldwide, including in Japan.

Peptide vaccination, which is one form of cancer immunotherapy, is a promising approach in which a clinical response is expected. Activated CTLs, which are antigen-specific, are generated using the human leukocyte antigen (HLA) -restrictive epitope peptide derived from a tumor antigen identified by exhaustive gene analysis. In Japan, peptide vaccination is a form of therapy that is currently the focus of intense research.

Cancer vaccination is a therapy that can offer prolonged overall survival whilst maintaining quality of life. However, the efficacy of cancer vaccination has not yet been proved, with the exception of for particular malignant tumors. If a biomarker for responders of cancer vaccination can be discovered, the efficacy of cancer vaccination should be established. We anticipate the results of an investigation by clinical trials using cancer vaccination.

Key words: cancer vaccine, peptide vaccination, cancer immunotherapy, clinical trial

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