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### RESEARCH ARTICLE

#### APPROACHES IN EMERGING CANCER VACCINES FOR NEXT GENERATION TUMOURS

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#### Abstract

The spread of knowledge, increasing understanding of how to communicate risk of cancer to the public, and greater public awareness of cancer, make the coming years ones in which we will see many new attempts at widespread cancer prevention programs. Immune therapeutics takes on added emphasis given some of the recent breakthroughs in vaccine development and targeted delivery. Substantial hurdles that remain to develop effectively therapeutic vaccines is with cytokines, and progress will come only with an increased understanding activity in animal models and in patients. The rapid elucidation of tumour antigens targets and increased manipulation of antibodies will become increasingly important in the treatment of cancer.

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#### Introduction:-

Dendritic cells (DC's) are powerful antigen-presenting cells (APC's), the body's function is to absorb, digest, and present antigens in other immune system cells [1]. A key step in the production of an adaptive immune response is the introduction of antigens to white blood cells; it activates 'naive' or 'inert' T cells whose T cell receptor is specific for the particular antigen being presented by the APC [2]. The cytotoxic T lymphocyte (Killer T cell) adaptive immune response is the principle way in which tumors can be destroyed by the body [3]. Therefore, targeting tumour antigens to dendritic cells, either ex vivo or in vivo, offers an opportunity to circumvent these defects in the presentation of antigens and takes advantage of the many special features of dendritic cells as a potent cell presenting antigen [4]. That is, they often grow unabated when they are merely disaggregated and reinjected, and do not cause a defensive immune response [5]. As a possible therapeutic vaccine against lethal diseases, modified white blood cell injections may be used. This vaccine would, if effective, revolutionize the future of cancer care [6]. The dendritic cell cancer vaccine utilizes the dendritic cell's strong antigen-presenting ability and uses it to establish therapeutic immunity toward antigens associated with cancer [7].

#### Vaccine Approach

Mild therapeutic effects of vaccines are currently available, scientists are now searching for new ways to improve this treatment effect. In this review, we here with discussed about some of the principles and methods that are being used to bring a cancer curative vaccine closer to fruition [8].

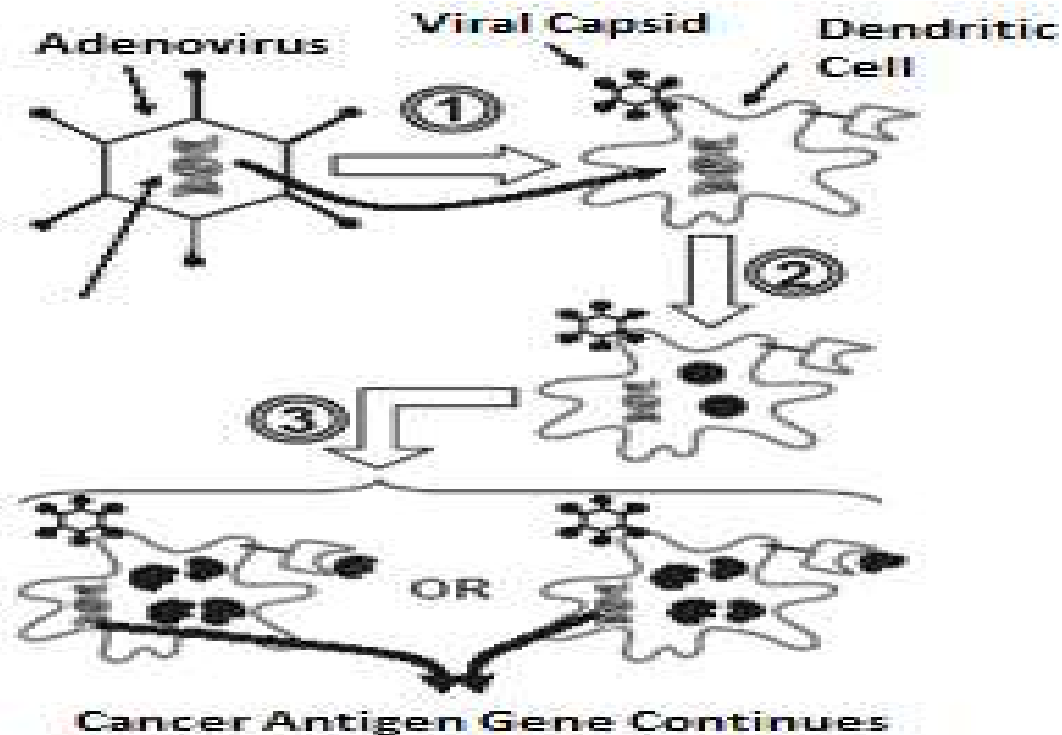
#### Gene Transduction

In addition to methods that apply the antigen to the DC directly, it is also possible to transfer the gene encoding the tumor-specific antigen into the DC [Figure 1]. Such an approach can be beneficial because it provides [9]:

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1. A continuous production of antigenic fragments
2. An intracellular source of antigen, easily accessible to the MHC I pathway

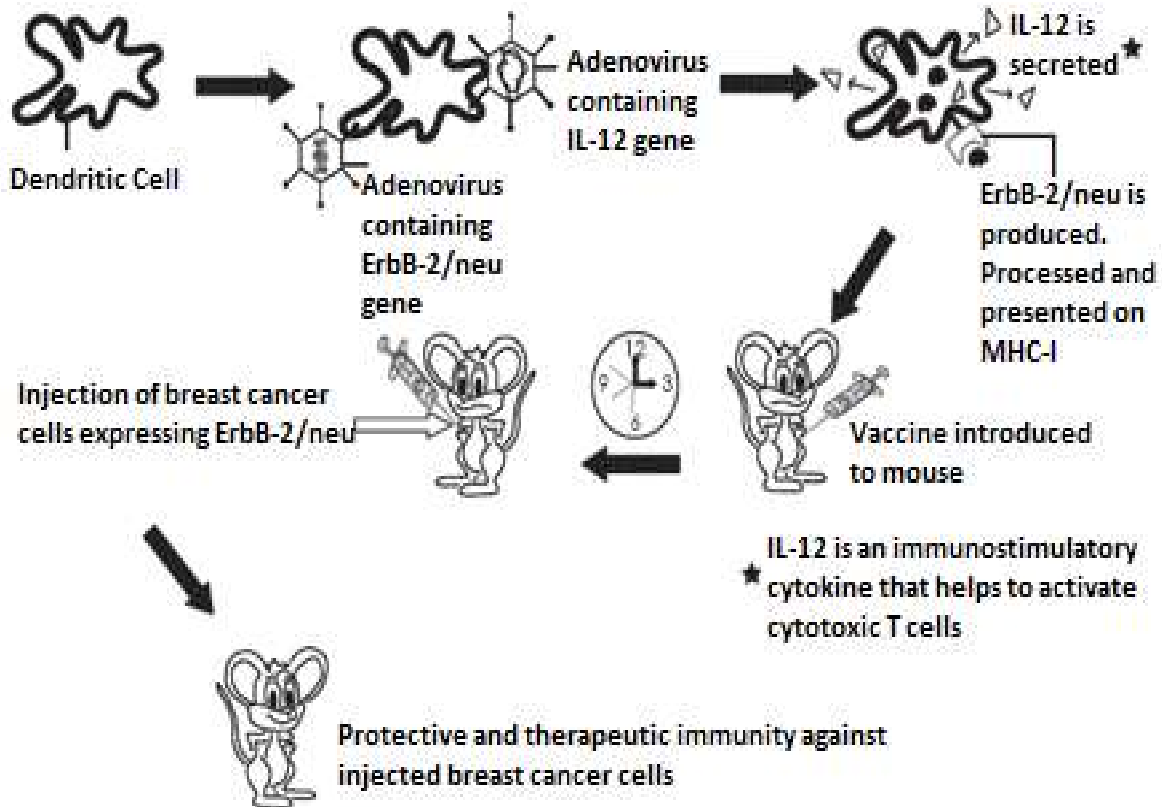


**Figure 1:-** Using viral gene transduction to introduce antigen genes into a dendritic cell.

Continuous production of antigen allows for prolonged availability for loading into the MHC I pathway [10]. Compared with peptide-pulsing techniques that provide short-term exposure, antigen gene transduction provides long-term exposure. Given that MHC I/antigen complexes are unstable and degrade relatively rapidly with time, it is believed helpful to have constant antigen present for continuous loading onto MHC I. By providing an intracellular antigenic source, gene transduction improves the access of antigen fragments to the MHC I pathway [11]. Exogenous antigen sources, as in peptide pulsing, are normally presented on the MHC II pathway and require cross-presentation by the dendritic cell. However, if the antigen is produced within the cell, it will be naturally loaded onto MHC I without the need for the less-efficient cross-presentation process [12].

To achieve gene transduction, viruses are normally used, one of the most effective techniques for dendritic cell gene transduction makes use of genetically modified adenoviruses. The adenoviral vector boasts high transfection rates and allows for several vectors to be introduced into the same DC population [13]. In addition, this technique can also be used to transduce genes encoding immunostimulatory cytokines that stimulate the killer T lymphocyte response (cytotoxic T lymphocyte response) [14].

Gene technology can be united with dendritic cell cancer vaccine research, the results has been promising. Dendritic cell vaccine effectiveness could be increased by a combination of both antigen and immunostimulatory cytokine gene transduction [15]. The cytokine IL-12 was chosen for the experiment because of its ability to activate immune cells and strengthen the killer T cell response in Mycobacterium tuberculosis. Using adenoviral vectors, we can simultaneously introduce a breast cancer antigen (ErbB-2/neu) and an IL-12 gene into dendritic cells ex vivo before administering the vaccine [Figure 2]. The result was a significant strengthening of the protective and therapeutic immunity of mice against injected breast cancer cells [16].



**Figure 2:-** Successful transduction of breast cancer antigen, ErbB-2/neu, and IL-12 genes into dendritic cells before administering the DCs as a vaccine to induce protective and therapeutic immunity against injected breast cancer cells.

Likewise, new natural and synthetic molecules capable of restoring and/or enhancing DC activities, often impaired in patients, have recently been identified and can be tested for their possible role in strategies of immunotherapy of cancer [17]. In addition to this, a considerable interest has focused on the use of patients dendritic cells loaded with cancer antigens as a potentially more effective strategy of therapeutic vaccination in cancer individuals [18]. Of particular note, DCs are important targets of cancer, and attention should be paid to the choice of DCs used in clinical studies. Different types of DCs may exhibit not only a different potential in inducing antiviral immunity but also a different degree of susceptibility to cancer and capability to transfer the virus to the target cell [19]. Thus, both preclinical and clinical studies are needed in order to evaluate the effectiveness of DC-based vaccines in the immunotherapy of cancer [20].

### Conclusion:-

We conclude this by stressing that while the potential future validation of DC-based cancer immunotherapy vaccines would definitely not solve the drastic needs of individuals with cancer in developing countries, the advancement of research in this field would help us recognize novel and realistic strategies for in vivo targeting of the related cancer antigens to the right DC. All this will lead to the definition of new cost-effective immunotherapy for various types of cancer.

### Conflict Of Interests:

The authors declare that there is no conflict of interests exist among them regarding the publication of this paper.

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