Review

Immunotherapeutic strategies for glioma treatment

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ABSTRACT

Glioblastoma is the most common and malignant primary brain tumor. Despite intensive clinical investigation and several novel therapeutic approaches, the median survival continues to remain poor and it is usually in the range of fifteen months. Immunotherapy is a beacon of hope for cancer treatment and offers a different approach against glioma. Various approaches have been used, such as dendritic cell based vaccines, peptide vaccines, T-cell-based therapies and immune checkpoint blockade with promising results. This paper provided an overview of the results of the most exciting immune therapeutic strategies for the treatment of gliomas.

Key words: Glioma; immunotherapy; vaccines

INTRODUCTION

Glioblastoma (GBM) is by far the most common type of primary brain tumor in adults. This devastating disease is usually incurable and virtually all GBM patients succumb despite treatments that consist of surgery, radiotherapy and chemotherapy. The median survival time remains in the range of 15 months.[1,2] GBM is an heterogenous tumor and there is great variability regarding response to treatment and outcome. Verhaak *et al.*[3] developed a molecular classification of GBM into Classical, Mesenchymal, Proneural and Neural subtypes based on gene expression. Epidermal Growth Factor Receptor amplification and the absence of *p53* mutations characterize the Classical subtype, whereas the Mesenchymal subtype is characterized by deletions or mutation of the gene and the Proneural subtype is characterized by alterations of Platelet Derived Growth Factor A and point mutations in cytosolic isocitrate dehydrogenase. A clinical significance was also reported, concluding that therapeutic approaches need to be GBM subtype-specific.[3]

Immunotherapy is an attractive treatment option that involves the stimulation of patient's immune system against cancer cells with high specificity and minimal toxicity.[4] In the late 1800s, William B. Coley, a pioneer in immunotherapy, was the first who injected a mixture of live streptococcus bacilli and subsequently heat-killed streptococcus into sarcomas and induced regression of these tumors.[5] GBM cases of increased survival after bacterial infection have been documented, whereas patients with neutrophil to lymphocyte ratio in the blood that exceeded 4.7 differ significantly from those with neutrophil to lymphocyte ratio lower than 4.7 and were associated with worse survival.[6,7] Nevertheless, GBM can evade by several mechanisms immune surveillance, such

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