

## Az immunválasz jellegzetességei és az immunterápia lehetőségei glioblastomában

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### Összefoglalás

A glioblastoma a leggyakoribb malignus primer glioma a központi idegrendszerben. Az átlagos túlélés 14 hónap a jelenlegi standard kezelési eljárások mellett (kiterjedt műtéti eltávolítás, sugárterápia és temozolomid kemoterápia). A tumorra nagyfokú szöveti és molekuláris heterogenitás jellemző. Az ennek háttérében álló ok-okozati összefüggések feltárása az elmúlt évtizedben jelentős előrehaladást hozott a glioblastoma jobb megértése és kezelési lehetőségei terén. Ahhoz, hogy még hatékonyabb kezelési eljárások lépjenek életbe, sokkal jobban kell ismerni a glioblastomára jellemző immunológiai sajátosságokat, melyek döntő mértékben befolyásolják a tumor kezelésre adott válaszát, valamint a prognózist. A jelen irodalmi áttekintésben bemutatjuk a glioblastoma kutatás fontosabb molekuláris, szövettani és immunológiai eredményeit. Szót ejtünk a tumorra jellemző molekuláris mintázatokról és a terápiás szempontból legfontosabb mutációkról. Ismertetjük a tumor specifikus immun-infiltrációt, ennek mechanizmusát és szerepét a prognózisban, valamint az ebben résztvevő immunsejtek és a glioblastoma kapcsolatát. Szintén ismertetjük a glioblastoma immunrendszert megkerülő képességének eddig feltárt részleteit, amelyekkel a T- és B limfocitákat, a makrofágokat, dendritikus sejteket és a természetes ölüsejteket is befolyásolva növeli a daganat saját túlélési esélyeit. Végezetül rövid bepillantást adunk azokba a jelenleg is folyamatban lévő terápiás tanulmányokba, amelyek eddigi eredményei ígéretesek. Célunk, hogy a glioblastoma és az immunrendszer kapcsolatáról rendelkezésre álló friss információkat a jelenlegi és a jövőbeni terápiás megközelítések jobb megértése érdekében mutassuk be.

**Kulcsszavak:** Glioblastoma, heterogenitás, immunválasz, terápia

## **Features of immune response and the possibilities of immune therapy in regulation of glioblastoma**

### **Summary**

Glioblastoma is the most frequent malignant glioma of the central nervous system. The standard of care includes extensive surgical resection, radiotherapy and temozolomide chemotherapy, which results in a median survival time of 14 months. The tumor is characterized by extreme histological and molecular heterogeneity, explorations of which led to a better understanding of disease pathogenesis and identified new treatment targets during the last few years. In order to further improve the effectiveness of therapy, we need to better reveal immunological properties of glioblastoma, which profoundly influence both the outcome and prognosis. This literature survey features molecular, histological and immunological results of glioblastoma research. Key molecular patterns and mutations in the tumor are summarized. We present characteristics of immune infiltration and response, and highlight mechanisms of immune evasion that affect effectiveness of T and B cells, macrophages, dendritic cells, and natural killer cells, and lead to the survival of glioblastoma. Finally, we provide some insight into the most promising experimental and clinical therapeutic approaches. With this review, we intend to provide new information concerning the complex interactions between glioblastoma and the immune system, which may facilitate a better understanding and development of new treatment strategies.

**Keywords:** glioblastoma, heterogeneity, immune response, therapy

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