Cancer Vaccine for Glioblastoma

A **cancer vaccine for glioblastoma** is an immunotherapy designed to stimulate the immune system to recognize and attack glioblastoma (GBM) tumor cells by targeting **tumor-specific or tumor-associated antigens**.

Rationale

Glioblastoma is a highly aggressive brain tumor with poor prognosis. Traditional therapies offer limited survival benefit. Cancer vaccines aim to:

- **Induce T cell–mediated immune responses**
- Promote **immune memory** against tumor recurrence
- Target **specific tumor antigens** or **neoantigens**
- Overcome glioma-associated immune suppression

Types of Glioblastoma Vaccines

Type	Description	Example(s)
Peptide Vaccines	Short tumor antigen fragments induce antigen-specific T cells	Rindopepimut (EGFRvIII)
Dendritic Cell Vaccines	Patient DCs loaded with tumor lysate or peptides ex vivo	DCVax-L
mRNA Vaccines	Encode neoantigens in mRNA to trigger T cell activation	NOA-16 Trial
Neoantigen Vaccines	Personalized to each patient's unique tumor mutations	Moderna/BioNTech platforms
Tumor Lysate Vaccines	Use whole tumor cell lysate to broaden antigen exposure	HSPPC-96 (heat-shock protein)

Target Antigens in GBM

- **EGFRvIII** – mutant receptor in 25–30% of GBM
- **IDH1 R132H** – mutation in lower-grade gliomas
- **WT1**, **SOX2**, **Survivin** – tumor-associated antigens
- **Personalized neoantigens** – identified through sequencing

Key Clinical Trials

Trial Name	Type	Target/Strategy	Phase	Outcome/Status
NOA-16	mRNA vaccine	Personalized IDH1 neoantigens	Phase I	Safe, immunogenic (93% T cell response)
AMPLIFY-NEOVAC	Combo therapy	IDH1 vaccine + anti–PD-L1	Phase I	Ongoing

Trial Name	Type	Target/Strategy	Phase	Outcome/Status
DCVax-L	DC-based vaccine	Tumor lysate-loaded DCs	Phase III	Improved survival in long-term subgroup
Rindopepimut	Peptide vaccine	EGFRvIII	Phase III	No OS benefit → development discontinued

⚠ Challenges

- **Antigen heterogeneity** → not all tumor cells express the same target
- **Immune suppression** → GBM microenvironment inhibits T cells
- **HLA restriction** → some vaccines only work for patients with certain HLA types
- **Time and cost** of personalized vaccine design

Future Directions

- **mRNA platforms** for rapid personalization and multi-antigen delivery
- **AI-based neoantigen prediction**
- **Combination therapies** with:
  1. Checkpoint inhibitors (e.g., anti–PD-1)
  2. Oncolytic viruses
  3. Radiotherapy
- **Local delivery** methods (e.g., intratumoral injection, hydrogel implants)

Summary

Cancer vaccines for glioblastoma represent a promising class of immunotherapy with a growing body of early clinical evidence. Personalized mRNA vaccines and dendritic cell–based strategies are showing **immunogenicity and feasibility**, especially in combination with other treatments. Overcoming immune suppression and tailoring vaccines to tumor evolution are key to their future success.

Related Pages

- Glioblastoma
- Glioblastoma Immunotherapy
- NOA-16 Trial
- AMPLIFY-NEOVAC Trial
- Dendritic Cell Vaccines
- Personalized mRNA Neoantigen Vaccine
- Checkpoint Inhibitors