Extracellular Vesicle–Based Therapy

Extracellular Vesicle–Based Therapy is a form of cell-free, nanocarrier-mediated treatment that exploits the natural intercellular communication functions of extracellular vesicles (EVs) to deliver therapeutic biomolecules—either native or engineered—to target tissues. The goal is to modify pathological processes or promote regeneration in a controlled and biocompatible manner.

Key Features

- **Source**: Derived from various cell types (e.g., stem cells, immune cells, tumor cells).
- **Cargo**: Contain proteins, lipids, mRNAs, miRNAs, and other bioactive molecules.
- **Delivery Types**:
  - `Native`: EVs naturally secreted by therapeutic cells (e.g., MSCs).
  - `Engineered`: EVs loaded with synthetic cargo (e.g., CRISPR/Cas9, siRNAs, drugs).
- **Targeting**: EVs can be modified to selectively target specific tissues (e.g., gliomas, spinal cord lesions).

Applications in Neurosurgery

- Targeted delivery of gene-editing tools to brain tumors.
- Reduction of neuroinflammation after TBI, SAH, or AVM surgery.
- Promotion of axonal regeneration and remyelination in spinal cord injuries.

Limitations and Challenges

- Low and inconsistent cargo loading efficiency.
- Heterogeneity in EV subtypes and isolation methods.
- Limited tissue specificity and risk of off-target effects.
- Technical barriers in large-scale production and clinical-grade purification.

See Also

- extracellular_vesicle
- gene_therapy
- neuroregeneration
- glioblastoma_treatment