Primary pediatric central nervous system tumor treatment

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Primary pediatric central nervous system tumor treatment requires a multidisciplinary approach involving pediatric oncologists, neurosurgeons, radiation oncologists, and other specialists. The specific treatment plan depends on several factors, including the type of tumor, its location, the age and overall health of the child, and whether the tumor is benign or malignant. Here is an overview of the primary treatment modalities for pediatric CNS tumors:

Surgery: Surgical removal of the tumor is often the initial step in treating pediatric CNS tumors, when feasible. The goal is to remove as much of the tumor as possible without causing significant neurological damage. In some cases, complete resection may be curative for benign tumors. For malignant tumors, surgery may be followed by other treatments.

Radiation Therapy: Radiation therapy uses high-energy X-rays or other forms of radiation to target and kill cancer cells. It is typically used for malignant or aggressive tumors that cannot be completely removed surgically. Radiation therapy is carefully planned to minimize damage to healthy brain tissue. In young children, radiation may be deferred or avoided if possible due to potential long-term side effects on brain development.

Chemotherapy: Chemotherapy involves the use of drugs to kill or slow the growth of cancer cells. It can be used before or after surgery and may also be combined with radiation therapy. Chemotherapy is often used for malignant CNS tumors and can be administered orally or through intravenous (IV) infusions.

Targeted Therapies: Some pediatric CNS tumors have specific genetic mutations or alterations that can be targeted with specific drugs. Targeted therapies are designed to disrupt the signaling

pathways that drive tumor growth while sparing normal cells.

Stem Cell Transplantation: In certain cases, especially for tumors that do not respond well to standard treatments, high-dose chemotherapy may be followed by autologous stem cell transplantation. Stem cells are collected from the patient, frozen, and then reinfused after the high-dose chemotherapy to replenish the bone marrow.

Supportive Care: Managing symptoms and side effects of treatment is crucial in pediatric CNS tumor care. Supportive care includes pain management, nutrition support, physical therapy, and psychological support for the child and their family.

Clinical Trials: Many pediatric CNS tumor patients are enrolled in clinical trials to access experimental treatments or therapies that are not yet widely available. Participation in clinical trials can offer access to cutting-edge therapies and contribute to research.

Long-Term Follow-Up: Pediatric CNS tumor survivors require long-term follow-up care to monitor for tumor recurrence, late effects of treatment, and ongoing neurodevelopmental support.

The choice of treatment for a specific pediatric CNS tumor will depend on factors such as the tumor type (e.g., glioma treatment, medulloblastoma treatment, ependymoma treatment), its grade (benign or malignant), its location, and the age and overall health of the child. Treatment plans are individualized to provide the best possible outcome while minimizing the impact on the child's quality of life. Parents and caregivers need to work closely with a pediatric oncology team to determine the most appropriate treatment approach for their child's specific case.

It has been well documented that outcomes of pediatric neurosurgery rely on the extent of tumor resection. Therefore, techniques that improve surgical results have significant clinical implications. Intraoperative ultrasound (IOUS) offers real-time surgical guidance and a more accurate means for detecting residual tumor that is inconspicuous to the naked eye.

Given the heterogeneity of immune infiltration within pedNST, the findings suggest personalized immunogenomic profiling is needed to guide the selection of immunotherapeutic strategies [1].

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Nabbi A, Beck P, Delaidelli A, Oldridge DA, Sudhaman S, Zhu K, Yang SYC, Mulder DT, Bruce JP, Paulson JN, Raman P, Zhu Y, Resnick AC, Sorensen PH, Sill M, Brabetz S, Lambo S, Malkin D, Johann PD, Kool M, Jones DTW, Pfister SM, Jäger N, Pugh TJ. Transcriptional immunogenomic analysis reveals distinct immunological clusters in paediatric nervous system tumours. Genome Med. 2023 Sep 7;15(1):67. doi: 10.1186/s13073-023-01219-x. PMID: 37679810.