Spinal cord glioma

- Clinical characteristics and prognostic outcomes of spinal cord gliomas with intracranial metastasis: An integrated analysis based on individual cases
- Synchronous Occurrence of T-cell Lymphoblastic Lymphoma and High-Grade Glioma in a Pediatric Patient: A Case Report
- Exploring genetic causal relationships between spinal cord injury and glioma: a Mendelian randomization study
- Intramedullary schwannoma mimicking ependymoma: illustrative case
- Persistent symmetrical white matter hyperintensities: a case report
- Intramedullary Glioblastoma as One of Multiple Radiation-Induced Neoplasms
- Chitosan nanocarriers: A promising approach for glioblastoma therapy
- A white matter-centered approach to investigate recurrence pathways in high-grade gliomas: a single-center retrospective study

see also Spinal cord astrocytoma.

The level of discordant diagnoses in children and adolescents with institutional diagnosis of high-grade glioma (HGG) of the spinal cord was 44% in a experience. However, there was no significant difference in outcome between patients with confirmed and discordant diagnosis. This group of tumor deserves a specific attention in future trials [1)].

High-grade spinal cord gliomas are rare and carry a poor prognosis.

Classification

Classification of Spinal Cord Gliomas Based on Cell Type

Spinal cord Astrocytomas: These are the most common type of spinal cord gliomas and arise from astrocytes, which are star-shaped glial cells. Astrocytomas can range from low-grade (less aggressive) to high-grade (more aggressive) tumors.

Pilocytic Astrocytoma (WHO Grade I): These are slow-growing, well-circumscribed tumors usually seen in children and young adults. They are generally associated with a favorable prognosis after surgical resection. Diffuse Astrocytoma (WHO Grade II): These are infiltrative tumors that grow slowly but have the potential to progress to higher grades. They are more common in adults. Anaplastic Astrocytoma (WHO Grade III): These are more aggressive and less differentiated tumors with a higher likelihood of recurrence and progression compared to low-grade astrocytomas.

Spinal cord Glioblastoma (WHO Grade IV): The most aggressive form of astrocytoma, glioblastomas are highly malignant tumors that grow rapidly and are associated with a poor prognosis.

Spinal cord ependymomas: These tumors arise from ependymal cells, which line the central canal of the spinal cord. Ependymomas are the most common intramedullary spinal cord tumor in adults.

Spinal cord Subependymoma (WHO Grade I): These are slow-growing, benign tumors that are often asymptomatic and may be discovered incidentally.

Myxopapillary Ependymoma (WHO Grade I): These are usually found in the filum terminale region of the spinal cord and have a relatively good prognosis after surgical resection.

Ependymoma (WHO Grade II): The most common type of ependymoma, these are moderately differentiated tumors that can be surgically removed with a good prognosis in most cases.

Anaplastic Ependymoma (WHO Grade III): These are more aggressive and have a higher risk of recurrence and progression compared to WHO Grade II ependymomas. Oligodendrogliomas: These tumors originate from oligodendrocytes, which are glial cells responsible for producing the myelin sheath around nerve fibers. Oligodendrogliomas are very rare in the spinal cord but can occur.

Oligodendroglioma (WHO Grade II): These are slow-growing tumors that may have a favorable prognosis if resected completely. Anaplastic Oligodendroglioma (WHO Grade III): These are more aggressive tumors with a higher tendency to recur and progress. Based on WHO Grading System The WHO grading system for gliomas classifies tumors based on histopathological characteristics such as cellularity, mitotic activity, nuclear atypia, endothelial proliferation, and necrosis:

Grade I (Low-Grade): Includes tumors like pilocytic astrocytomas and myxopapillary ependymomas. These are generally well-circumscribed and have a good prognosis after surgical resection.

Grade II (Low-Grade): Includes diffuse astrocytomas and ependymomas. These tumors have low proliferative potential but are infiltrative, which can make complete surgical resection challenging.

Grade III (High-Grade): Includes anaplastic astrocytomas, anaplastic ependymomas, and anaplastic oligodendrogliomas. These tumors are more aggressive, with higher rates of recurrence and progression.

Grade IV (High-Grade): Includes glioblastomas, which are highly aggressive tumors with poor prognosis.

Spinal cord gliomas are classified primarily based on the type of glial cell they originate from (astrocytomas, ependymomas, and oligodendrogliomas) and their histological grade according to the WHO grading system (Grade I to IV). The prognosis and treatment approach for spinal cord gliomas depend significantly on these classifications, with lower-grade tumors generally having a better outcome compared to higher-grade, more aggressive tumors.

Treatment

A number of treatment modalities exist for spinal cord gliomas, but no consensus exists regarding their management.

Despite their increasing clinical incidence, intramedullary spinal cord gliomas remain without an effective treatment strategy. Given their diffusely invasive nature, surgical resection is perilous, and both chemotherapeutic and radiation options demonstrate poor response.

Over the past decade, researchers have found that neural stem cells (NSCs) migrate toward inflammatory sites, including tumors. This insight has inspired research into genetic engineering of human NSCs to express enzymes such as cytosine deaminase (CD) and thymidine kinase (TK). These

enzymes enable these cells to convert the nontoxic prodrugs 5-fluorocytosine (5FC) and ganciclovir (GCV) into oncolytic 5-fluorouracil and GCV-triphosphate, respectively.

Both of these agents inhibit tumor growth by impeding DNA elongation, thus triggering apoptosis. Ropper et al3 hypothesized that these dual gene-engineered human NSCs could be used to effectively treat intramedullary spinal cord gliomas by using their glioma trackability to deliver targeted chemotherapeutic agents.

Cordectomy represents a possible option for treating these lesions; however, few cases have been reported in adults, and none have been reported in the pediatric population. The authors describe the use of cordectomy for the treatment of a high-grade spinal glioma in a 9-year-old boy who remains cancer free 14 years following his initial presentation [2)].

Prognosis

Zhao et al. performed gene set enrichment analysis (GSEA) and unsupervised clustering analysis to investigate the roles of EMT (epithelial-mesenchymal transition) in glioma. DEG (differently expressed gene) screening and correlation analysis were conducted to filter the candidate genes which were closely associated with EMT process in SCG. Enrichment analysis and GSVA (Gene Set Variation Analysis) were conducted to investigate the potential mechanism of RDH10 for SCG. Trans-well and healing assay were performed to explore the role of RDH10 in the invasion of SCG. Western blotting was performed to evaluate the levels of markers in PI3K-AKT and EMT pathway. In vivo tests were conducted to verify the role of RDH10 in EMT process. Results: Bioinformatic analysis demonstrated the EMT pathway was associated with dismal prognosis of glioma. Further analysis demonstrated that RDH10 showed the strongest correlation with the EMT process. Retinol Dehydrogenase 10 expression was significantly increased in SCG tissues, correlating with advanced tumor grade and unfavorable prognosis. Functional analysis indicated that decreasing RDH10 levels impeded the invasive and migratory abilities of SCG cells, whereas increasing RDH10 levels augmented them. Enrichment analysis and western blot revealed that RDH10 regulated EMT process of SCG by PI3K-AKT pathway. They observed that the enhanced invasion ability and increased EMT-related protein induced by RDH10 overexpression can be suppressed by PI3K-AKT pathway inhibitor (LY294002). The research found that RDH10 was an effective biomarker associated with tumor grade and prognosis of SCG. RDH10 could regulate EMT process of SCG through PI3K-AKT pathway [3)].

Case series

Twenty-five patients with spinal cord glioma of grade IV who underwent surgery in a single institute were selected. All grade IV spinal cord glioma histologically confirmed as glioblastoma or “diffuse midline glioma with H3 K27M-mutant” by the 2016 WHO classification of the central nervous system were included. Basic demographics, treatment modalities, and pathological tumor molecular profiles were investigated for prognosis.

RESULTS: Mean age was 39.1 yr; male to female ratio was 18 : 7. Tumor was located in thoracic cord (53.3%), cervical cord (40%), and lumbar area (6.7%). Median overall survival was 37.1 mo; median disease-free survival was 18.5 mo. Treatment modality showed no statistical difference. Only K27M profile showed significant prognostic value, 20 patients (80%) showed K27M mutation positive, K27M mutation patients showed longer overall survival (40.07 mo) than K27M negative patients (11.63 mo, $P < .0001$), and disease-free survival (20.85 vs 8.72 mo, $P = .0241$).

CONCLUSION: This study is the first and largest report of the prognosis of primary spinal cord grade IV glioma using the new WHO classification. This study reported survival analysis and prognostic factors, and revealed that H3.3 K27M mutation is not a major poor prognostic factor. Further studies to explore K27M mutations needed for risk stratification and therapy optimization [4].

1)
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