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Spinal Cord Gliomas, glioneuronal, and neuronal tumors in the 2021 WHO CNS Central Neural System Classification: A Pictorial and Pathological Review

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Summary

Intradural intramedullary primary spinal cord tumors are rare central nervous system (CNS) neoplasms, occurring approximately ten times less frequently than their intracranial counterparts. They include gliomas, glioneuronal, and neuronal tumors, each further characterized by distinct histological and molecular features. Radiological classification and diagnosis have become increasingly challenging following the introduction of new classifications and expanded molecular profiling in the 2021 WHO Classification of Tumors of the Central Nervous System. While multiple publications have addressed the updated WHO classification, existing radiologic literature has primarily focused on intracranial tumors, with limited emphasis on spinal cord tumors. Moreover, the application of the 2021 WHO classification to spinal cord tumors presents unique challenges, including limited molecular data, overlapping imaging features, and constraints related to tissue sampling.

This educational review aims to provide a comprehensive discussion of spinal cord gliomas, glioneuronal, and neuronal tumors within the 2021 WHO CNS framework, highlighting both the strengths and limitations of the classification when applied to spinal cord tumors, while emphasizing key imaging findings and radiologic–pathologic correlations.

Educational Objectives

- *Identify the major categories of spinal cord gliomas, glioneuronal, and neuronal tumors as defined in the 2021 WHO Classification of Central Nervous System Tumors.*
- *Recognize characteristic MRI imaging features of common and newly defined spinal cord tumor entities.*
- *Correlate radiologic findings with histopathological and molecular features relevant to the 2021 WHO classification.*
- *Explore imaging features that may aid in the differentiation of spinal cord gliomas, glioneuronal, and neuronal tumors from other intramedullary spinal cord lesions.*

Materials and Methods

This educational review is based on the 2021 World Health Organization (WHO) Classification of Tumors of the Central Nervous System and a focused review of the relevant literature. The exhibit is presented as a pictorial essay emphasizing imaging–pathology correlation. Content is organized by tumor category, including spinal cord gliomas, glioneuronal, and neuronal tumors, with further subdivision into adult and pediatric entities.

Results

The exhibit illustrates the imaging spectrum of spinal cord gliomas, glioneuronal, and neuronal tumors within the 2021 WHO classification framework. Characteristic MRI findings, including patterns of cord expansion, signal characteristics, and enhancement behavior, are correlated with histopathological and molecular features. Key imaging patterns and diagnostic pitfalls relevant to adult and pediatric intramedullary spinal cord tumors are highlighted.

Conclusion

Familiarity with the imaging spectrum of spinal cord gliomas, glioneuronal, and neuronal tumors within the 2021 WHO framework improves diagnostic accuracy. Radiologic–pathologic correlation plays a critical role in differentiating intramedullary spinal cord tumors and supporting informed clinical decision-making.

References

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Figures

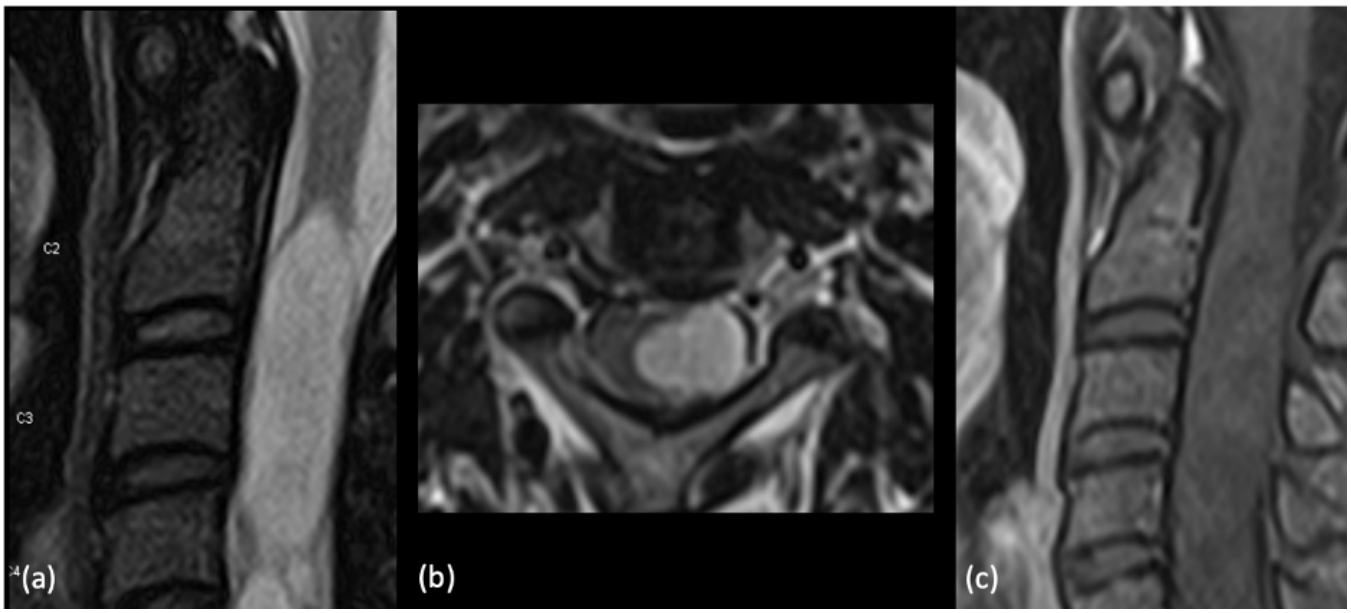

Figure 1. Spinal subependymoma.
(a) Sagittal T2-weighted MRI demonstrates an intramedullary lesion with surrounding hyperintense signal along both the anterior and posterior aspects of the spinal cord, producing the characteristic **"bamboo leaf sign"** due to steep, elongated cord expansion (arrow).
(b) Axial T2-weighted MRI shows an intramedullary tumor with an eccentric subpial growth pattern.
(c) Sagittal T1-weighted MRI demonstrates the lesion to be isointense to the spinal cord.