

Central Nervous System Tumors - Brain Tumors

Clinical Background

Central nervous system (CNS) tumors cause either focal or generalized neurologic symptoms.

Epidemiology

- Incidence – 20,500 new cases of primary brain tumors are diagnosed yearly in the U.S. (American Cancer Society, 2007)
 - Half are histologically benign
- Sex – M<F (minimal)
 - Higher meningioma incidence in females

Risk Factors

- High-dose ionizing radiation (gliomas)
- Familial
 - Neurofibromatosis 1 (NF-1) (neurofibroma, glioma, sarcoma)
 - Neurofibromatosis 2 (NF-2a) (schwannoma, glioma, meningioma)
 - Tuberous sclerosis (astrocytoma)
 - Von Hippel-Lindau (hemangioblastoma)
 - Li Fraumeni (glioma)
 - Retinoblastoma
 - Multiple endocrine neoplasia 1 (pituitary adenoma, schwannoma, glioma)
- Virus infection
 - HIV infection is associated with an increased risk of CNS lymphoma

Pathophysiology

- Histologically classified as glioma or non-glioma
 - Gliomas (about 50% of primary brain tumors)
 - Astrocytomas (includes glioblastoma multiforme [GBM])
 - GBM – 50% of gliomas
 - Oligodendrogliomas
 - Mixed gliomas
 - Ependymomas
 - Non-gliomas
 - Meningiomas – usually benign
 - Pituitary adenomas – often benign
 - Primary CNS lymphoma
 - Medulloblastoma – childhood cerebellar tumor
 - Brain metastases – lung, breast and melanoma are most common
- Malignant gliomas are the most common type of primary brain tumor
- Separation of astrocytomas from oligodendrogliomas has prognostic and therapeutic importance

Clinical Presentation

- Headache, nausea, vomiting, hemiparesis, aphasia, memory loss, language deficit, visual deficit
- Seizures – more common with gliomas

Diagnosis

- Indications for testing

- New onset headaches associated with focal neurologic deficits in patient without headaches
- Change in character of headaches in patient with previous headaches
- New onset seizures
- Laboratory testing
 - Very few abnormalities except for increased erythrocyte sedimentation rate (ESR)
- Imaging studies
 - CT, MRI
 - MRI is more sensitive than CT for diagnosis
 - PET is used in assessing diagnosis, grading gliomas and differentiating between tumor recurrence and radiation necrosis

Prognosis

- Markers
 - Combined loss of short arm of chromosome 1 (1p) and long arm of chromosomes 19 (19q) is a prognostic marker of oligodendrogliomas
 - Patients with 1p and 19q deletions have a better prognosis than those without the deletions
 - Loss of 1p may identify treatment-sensitive malignant gliomas, in particular subtypes of anaplastic oligodendroglioma

Differential Diagnosis

- Meningitis, encephalitis
- Seizure disorders
- Migraine headache
- Stroke

Lab Tests

Indications for Laboratory Testing

Tests generally appear in the order most useful for common clinical situations. For test-specific information, refer to the test number in the ARUP Laboratory Test Directory on the ARUP Web site at www.aruplab.com.

Test Name and Number	Recommended Use	Limitations	Follow Up
1p/19q, d(1;19) Deletion by FISH 0049360 Method: Fluorescence in situ Hybridization	Diagnosis of and prognosis for oligodendrogliomas Fix in formalin for optimal results	Absence of combined loss of the short arm of chromosome 1 (1p) and long arm of chromosomes 19 (19q) does not exclude diagnosis of oligodendroglioma	
Sedimentation Rate, Westergren (ESR) 0040325 Method: Westergren	Increased ESR may indicate abnormalities	Time-sensitive test	

Immunohistochemistry Stain Offering arup005 Method: Immunohistochemistry	For fixed tissue samples, consultative services as well as immunohistochemical staining for CD117 (c-kit) are available		
---	---	--	--

Cited References

Detailed Guide: Brain/CNS Tumors in Adults. American Cancer Society. [Accessed: 20 Apr 2009]

General References

Buckner JC, Brown PD, O'Neill BP, Meyer FB, Wetmore CJ, Uhm JH. Central nervous system tumors. Mayo Clin Proc. 2007; 82 (10) 1271-1286.

Chandana SR, Movva S, Arora M, Singh T. Primary brain tumors in adults. Am Fam Physician. 2008; 77 (10) 1423-1430.

Chen W, Silverman DH. Advances in evaluation of primary brain tumors. Semin Nucl Med. 2008; 38 (4) 240-250.

Duffner PK. Diagnosis of brain tumors in children. Expert Rev Neurother. 2007; 7 (7) 875-885.

Takei H, Bhattacharjee MB, Rivera A, Dancer Y, Powell SZ. New immunohistochemical markers in the evaluation of central nervous system tumors: a review of 7 selected adult and pediatric brain tumors. Arch Pathol Lab Med. 2007; 131 (2) 234-241.

van den Bent MJ, Kros JM. Predictive and prognostic markers in neuro-oncology. J Neuropathol Exp Neurol. 2007; 66 (12) 1074-1081.

References from the ARUP Institute for Clinical and Experimental Pathology®

Layfield LJ, Willmore C, Tripp S, Jones C, Jensen RL. Epidermal growth factor receptor gene amplification and protein expression in glioblastoma multiforme: prognostic significance and relationship to other prognostic factors. Appl Immunohistochem Mol Morphol. 2006; 14 (1) 91-96.

Tripp SR, Willmore-Payne C, Layfield LJ. Relationship between EGFR overexpression and gene amplification status in central nervous system gliomas. Anal Quant Cytol Histol. 2005; 27 (2) 71-78.

Reviewed by

Chin, Steven S., MD, PhD. Medical Director, Neuropathology at ARUP Laboratories; Associate Professor, Director of Neuropathology, University of Utah

Layfield, Lester, MD. Fine-Needle Aspiration Services and Molecular Diagnostics at ARUP Laboratories; Professor and Division Head, Anatomic Pathology, University of Utah

Related Content

- Jewish Genetic Disease
- Meningitis, Acute
- Rabies Virus
- Seizure Disorders - Epilepsy
- Taenia Solium - Cysticercosis

Tumor Markers

Comprehensive Review: January 2009

Last Update: March 2009