Temporal lobe tumor surgery

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Temporal lobe tumor surgery involves the removal or treatment of abnormal tissue located within the temporal lobe of the brain.

Here is a general overview of the surgical procedure for a temporal lobe tumor:

1. Preoperative Evaluation:

see Preoperative planning in neurosurgery.

Imaging Studies: Diagnostic tools such as MRI (Magnetic Resonance Imaging) and CT (Computed Tomography) scans are used to locate and characterize the tumor.

Neurological Evaluation: Assessing the patient's neurological function to determine the potential impact of the tumor on specific brain functions.

2. Surgical Approaches:

Temporal Craniotomy: The most common surgical approach involves a craniotomy, where a portion of the skull is temporarily removed to access the brain.

Temporal Lobectomy: In some cases, a portion or the entire temporal lobe may need to be removed, depending on the size and location of the tumor.

3. Intraoperative Monitoring:

Brain Mapping: Intraoperative mapping may be performed to identify critical areas of the brain responsible for language, motor function, or sensory processing.

Neurophysiological Monitoring: Monitoring techniques, such as EEG (Electroencephalogram), may be used to assess brain activity during surgery.

4. Tumor Resection:

Microsurgical Techniques: The surgeon may use microscopic guidance to visualize and carefully remove the tumor while minimizing damage to surrounding healthy tissue.

Ultrasonic Aspiration: An ultrasonic aspirator may be used to break down and remove the tumor tissue. Intraoperative Imaging: Intraoperative MRI or other imaging techniques may be utilized to ensure complete tumor removal.

5. Biopsy (if necessary): In some cases, if complete removal is not feasible, a biopsy may be performed to obtain a tissue sample for pathological analysis.

6. Closure: After tumor resection or biopsy, the bone flap is replaced, and the surgical site is closed with sutures or other closure methods.

7. Postoperative Care: Monitoring: The patient is closely monitored in the postoperative period for neurological function, signs of complications, and overall recovery. Rehabilitation: Depending on the extent of surgery and the impact on brain function, rehabilitation may be necessary for optimal recovery.

8. Pathological Analysis: The removed tumor tissue is sent for pathological analysis to determine the tumor type, grade, and other relevant characteristics. 9. Follow-up: Regular follow-up appointments and imaging studies are conducted to monitor for any signs of tumor recurrence. The specific details of the surgery will depend on the nature of the tumor, its location within the temporal lobe, and the overall health of the patient. The surgical approach and techniques used aim to balance tumor removal with the preservation of essential brain functions.

Surgical access to the temporal lobe is complex with many eloquent white fiber tracts, requiring careful preoperative surgical planning. Many microsurgical approaches to the temporal lobes are described, each with their own disadvantages. The adoption of the endoscope in neurosurgery has increased the options available when treating these difficult access tumors.

Ma et al. from the Department of Neurosurgery, John Radcliffe Hospital, Oxford University Hospitals NHS Foundation Trust, United Kingdom, present the experience with a novel, minimally invasive, endoscopic approach to resect temporal lobe tumors.

All patients undergoing endoscopic temporal lobe tumor resection between December 1, 2011 and December 1, 2017, with a single surgeon, were included. Tumors were resected through a minicraniotomy using a high-definition rigid endoscope with a 0- and 30-degree viewing angle. Bimanual resection was performed using standard microsurgical technique.

There were 45 patients (22 men and 23 women) with a mean age of 53 years. There were 23 (51%) glioblastoma multiforme, 11 (24%) metastases, 7 (16%) astrocytoma, 3 (7%) anaplastic astrocytoma, and 1 (2%) World Health Organization grade I glioneuronal tumor. In 82.2% of cases (37/45), >95% resection was achieved and 42.2% (19/45) of patients achieving gross total resection.

The endoscope has a role in temporal lobe intraparenchymal tumor surgery, especially in 3 illustrative scenarios: 1) medial temporal, parahippocampal-gyrus low-grade nonenhancing gliomas, 2) subcortical high-grade glioma and metastases medial to the sagittal stratum, and 3) recurrent gliomas with cystic resection cavity. The endoscope offers a safe and useful adjunct to the surgeons' armamentarium in brain tumor surgery. A minimally invasive approach also reduces surgical morbidity and length of stay [1)].

Temporal lobe tumors causing chronic intractable epilepsy demonstrated excellent results in seizure improvement after surgery [2].

There has been considerable controversy regarding most appropriate management, with some advocating lesionectomy only, and other arguing for more extensive resection.

A study specifically addressing this issue, it was found that patients treated with lesionectomy alone had lower seizure-free outcomes than those with more extensive electrophysiologically guided resection.

In another study, however, postoperative seizure control was achieved in 94% of patients after complete lesionectomy regardless of the extent of seizure focus resection.

Thus, this issue remains to be resolved, and the only agreement at this time appears to be that gross-total resection, as long as it can be safely performed, should be the minimum goal of surgery.

Visual field defects (VFDs) due to optic radiation (OR) injury are a common complication of temporal lobe surgery. Faust and Vajkoczy analyzed whether preoperative visualization of the optic tract would reduce this complication by influencing the surgeon's decisions about surgical approaches. The authors also determined whether white matter shifts caused by temporal lobe tumors would follow predetermined patterns based on the tumor's topography.

One hundred thirteen patients with intraaxial tumors of the temporal lobe underwent preoperative diffusion tensor imaging (DTI) fiber tracking. In 54 of those patients, both pre- and postoperative VFDs were documented using computerized perimetry. Brainlab's iPlan 2.5 navigation software was used for tumor reconstruction and fiber visualization after the fusion of DTI studies with their respective magnetization-prepared rapid gradient-echo (MP-RAGE) images. The tracking algorithm was as follows: minimum fiber length 100 mm, fractional anisotropy threshold 0.1. The lateral geniculate nucleus and the calcarine cortex were employed as tract seeding points. Shifts of the OR caused by tumor were visualized in comparison with the fiber tracking of the patient's healthy hemisphere.

Temporal tumors produced a dislocation of the OR but no apparent fiber destruction. The shift of white matter tracts followed fixed patterns dependent on tumor location: Temporolateral tumors resulted in a medial fiber shift, and thus a lateral transcortical approach is recommended. Temporopolar tumors led to a posterior shift, always including Meyers loop; therefore, a pterional transcortical approach is recommended. Temporomesial tumors produced a lateral and superior shift; thus, a transsylvian-transcisternal approach will result in maximum sparing of the fibers. Temporocentric tumors also induced a lateral fiber shift. For those tumors, a transsylvian-transopercular approach is recommended. Tumors of the fusiform gyrus generated a superior (and lateral) shift; consequently, a subtemporal approach is recommended to avoid white matter injury. In applying the approaches recommended above, new or worsened VFDs occurred in 4% of the patient cohort. Total neurological and surgical morbidity were less than 10%. In 90% of patients, gross-total resection was accomplished.

Preoperative visualization of the OR may help in avoiding postoperative VFDs [3].

1)

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2)

Ruban D, Byrne RW, Kanner A, Smith M, Cochran EJ, Roh D, Whisler WW. Chronic epilepsy associated with temporal tumors: long-term surgical outcome. Neurosurg Focus. 2009 Aug;27(2):E6. doi: 10.3171/2009.5.FOCUS0998. PubMed PMID: 19645562.

3)

Faust K, Vajkoczy P. Distinct displacements of the optic radiation based on tumor location revealed using preoperative diffusion tensor imaging. J Neurosurg. 2015 Oct 2:1-10. [Epub ahead of print] PubMed PMID: 26430843.