Eloquent area

Name for areas of cortex that—if removed—will result in loss of sensory processing or linguistic ability, minor paralysis, or paralysis.

see pyramidal tract, optic radiation and arcuate fasciculus

The most common areas of eloquent cortex are in the left temporal lobe and frontal lobes for speech and language, bilateral occipital lobes for vision, bilateral parietal lobes for sensation, and bilateral motor cortex for movement.

To avoid permanent neurologic deficits and preserve brain function in and near the eloquent area, intraoperative electrical stimulation mapping (IESM) is necessary.

Classification

Eloquent locations in the Sawaya study are the motor/sensory cortices, visual center, speech center, internal capsule, basal ganglia, hypothalamus/thalamus, brainstem, and dentate nucleus

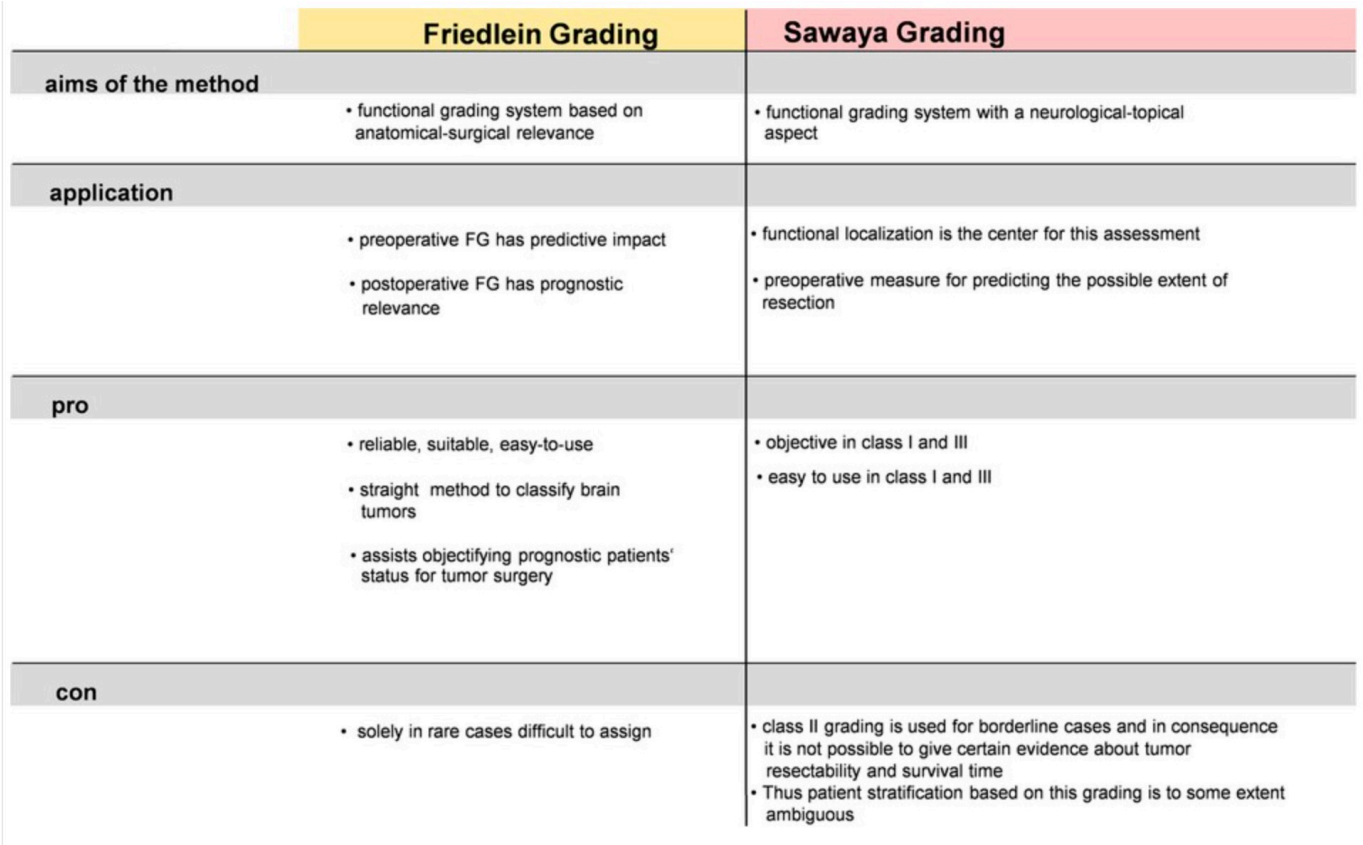
Grade I lesions are located in noneloquent brain

Grade II lesions in near-eloquent brain

Grade III lesions in eloquent brain [1)].

see Friedlein grading

see Sawaya grading



	Friedlein Grading	Sawaya Grading
aims of the method		
	• functional grading system based on anatomical-surgical relevance	• functional grading system with a neurological-topical aspect
application		
	• preoperative FG has predictive impact • postoperative FG has prognostic relevance	• functional localization is the center for this assessment • preoperative measure for predicting the possible extent of resection
pro		
	• reliable, suitable, easy-to-use • straight method to classify brain tumors • assists objectifying prognostic patients' status for tumor surgery	• objective in class I and III • easy to use in class I and III
con		
	• solely in rare cases difficult to assign	• class II grading is used for borderline cases and in consequence it is not possible to give certain evidence about tumor resectability and survival time • Thus patient stratification based on this grading is to some extent ambiguous

Identification

The integration of anatomical and functional studies allows a safe functional resection of the brain tumors located in eloquent areas. Multimodal navigation allows integration and correlation among preoperative and intraoperative anatomical and functional data. Cortical motor functional areas are anatomically and functionally located preoperatively thanks to MR and functional magnetic resonance imaging and subcortical motor pathways with DT imaging and tractography. Intraoperative confirmation is done with CS and N20 inversion wave for cortical structures and with sCS for subcortical pathways [2)].

Neuroimaging

Neuroimaging techniques such as magnetic resonance imaging, electroencephalography, or magnetoencephalography are especially useful non-invasive tools to locate eloquent cortex.

Imaging techniques such as functional MRI and diffusion tensor imaging fiber tracking, and neurophysiological methods like navigated transcranial magnetic stimulation and magnetoencephalography, make it possible to identify eloquent areas prior to resective surgery and to tailor indication and surgical approach but also to assess the surgical risk. Intraoperative monitoring with direct cortical stimulation and subcortical stimulation enables surgeons to preserve essential functional tissue during surgery. Through tailored pre- and intraoperative mapping and monitoring the EOR can be maximized, with reduced rates of surgery-related deficits.

Electrocorticography

Much higher spatial and temporal resolution maps of cortical activity can be achieved with a technique called electrocorticography, however this requires placement of subdural electrodes on the surface of the brain and this must be done during surgery.

Since functional magnetic resonance imaging and intraoperative neurophysiological mapping are not available in all neurosurgical departments

Motor eloquent

Eloquent tumor location proved as significant risk factors for encountering a therapy associated complication. Not extensive surgery or tumor size but surgery at eloquent locations impacts complication occurrence the strongest with a 2 fold increased complication occurrence risk [3].

Several studies claimed that surgery in eloquent areas is possible without causing severe cognitive decline. However, this conclusion was relatively ungrounded due to the lack of extensive neuropsychological testing in homogenous patient groups.

1)
Sawaya R, Hammoud M, Schoppa D, Hess KR, Wu SZ, Shi WM, et al. Neurosurgical outcomes in a modern series of 400 craniotomies for treatment of parenchymal tumors. Neurosurgery 1998;42:1044-56.
2)
González-Darder JM, González-López P, Talamantes F, Quilis V, Cortés V, García-March G, Roldán P. Multimodal navigation in the functional microsurgical resection of intrinsic brain tumors located in eloquent motor areas: role of tractography. Neurosurg Focus. 2010 Feb;28(2):E5. doi: 10.3171/2009.11.FOCUS09234. PubMed PMID: 20121440.
3)
Ening G, Osterheld F, Capper D, Schmieder K, Brenke C. Risk factors for glioblastoma therapy associated complications. Clin Neurol Neurosurg. 2015 Jan 9;134:55-59. doi: 10.1016/j.clineuro.2015.01.006. [Epub ahead of print] PubMed PMID: 25942630.