

Hemispherectomy

Last updated: February 8, 2023

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hemispherectomy, to functional hemispherectomy, to hemispherotomy, which is the latest development in disconnective surgeries and represents a less invasive microsurgical procedure to disconnect the cortex of the affected hemisphere.

ANATOMICAL HEMISPHERECTOMY

- **entire hemisphere**, excluding *basal ganglia**, anatomically removed from cranium → potentially lethal **hydrocephalus** and progressive **superficial cerebral hemosiderosis**.

*so more accurate term is *hemicorticectomy*

SUPERFICIAL CEREBRAL HEMOSIDEROSIS

- unique complication to anatomic hemispherectomy - occurs in 16-25% cases.
- gradual but devastating neurologic deterioration beginning years after surgical procedure and eventually resulting in death.
- pathology - hemorrhagic subdural membrane within resected cavity, granular ependymitis along ventricular walls (granulomatous membrane indistinguishable from that of chronic subdural hematoma), and superficial hemosiderosis of remaining brain and cranial nerves.
- contralateral foramen of Monro or aqueduct of Sylvius becomes occluded → hydrocephalus leading to herniation and death.

- first introduced by Dandy in 1923 for malignant glioma.

INDICATIONS

- 1) hemimegalencephaly
 - 2) diffuse malformations of cortical development
 - 3) reoperation after other disconnective hemispherectomy techniques have failed (anatomical HE has success rate of 50% after functional HE has failed).
- anatomic removal of the affected tissue is preferred over disconnection to help ensure seizure activity ceases completely.
 - ideal candidate has a contralateral hemiparesis and hemianopsia without fine finger movements.

COUNSELLING

- parents need to be counseled about the presence of a contralateral hemianopsia postoperatively - will preclude driving later in life.
- although not an absolute contraindication, the evidence of independent bilateral hemispheric ictal patterns may influence postoperative seizure outcome and parents should be counseled appropriately.

TIMING OF SURGERY

- **earlier intervention** maximizes chances for neurodevelopment.
- risks (**blood loss, hypothermia**) are higher in younger patients.
- body weight of 10 kg is acceptable to undergo the procedure.
 - all patients and families are asked to donate red blood cells and plasma before operation.
- for the patient with catastrophic hemispheric epilepsy, surgery is performed earlier with informed consent on the risks of excessive blood loss and mortality.

WORK UP

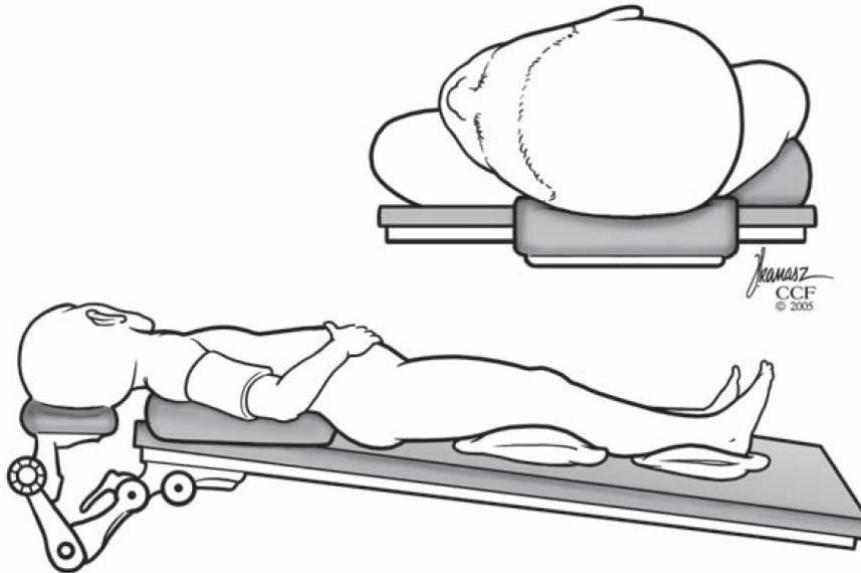
- **WADA test** may be of use in older patients who may not experience language transfer after dominant hemispherectomy.

PROCEDURE

- preop steroids.
- electrocorticography and cortical stimulation are not routinely used.
- two reports from German group of preoperative embolization to minimize blood loss.

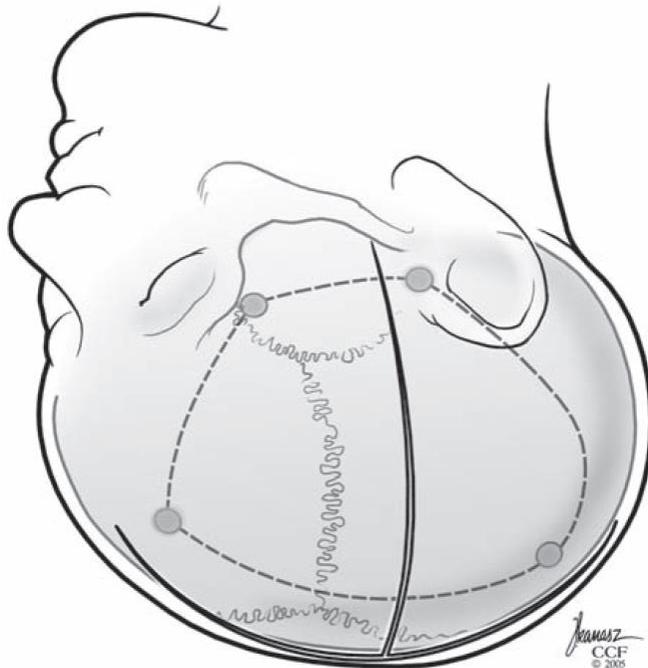
POSITIONING

- head is positioned with a 90 degree lateral turn with ipsilateral shoulder support.
- head is elevated above the level of the heart to assist with venous return and reduce risk of bleeding.
- vertex is slightly down to allow access to the mesial temporal lobe and interhemispheric fissure.



Source of picture: Starr, Barbaro, Larson "Neurosurgical Operative Atlas - Functional Neurosurgery" 2nd ed (2009); Publisher: Thieme (1899); ASIN: B01FJ0ZZN2 >>

INCISION



Source of picture: Starr, Barbaro, Larson "Neurosurgical Operative Atlas - Functional Neurosurgery" 2nd ed (2009); Publisher: Thieme (1899); ASIN: B01FJ0ZZN2 >>

FUNCTIONAL HEMISPHERECTOMY

- combination of ablation and disconnection:

- 1) removal of *sensorimotor cortex* and *temporal lobe*.
- 2) *frontal lobe* and *parieto-occipital lobes* are left intact but are disconnected from cortical and subcortical structures (interhemispheric commissures are divided).

INDICATION

- severely incapacitating unilateral seizures (when foci cannot be isolated) associated with permanent hemiplegia (with useless hand), hemisensory loss, hemianopia, hemiatrophy; i.e. intractable partial and secondarily generalized seizures when entire hemisphere is considered epileptogenic with **little or no remaining functional cortex**.

- **special indications** - infantile hemiplegia syndromes, Rasmussen's encephalitis, Sturge-Weber syndrome, hemimegalencephaly, large hemispheric infarctions.

OUTCOMES

- results in seizure control are comparable to anatomic hemispherectomy.
- function also improves (seizures may have caused functional impairment).
- 84% seizure freedom (Engel IA) at 6 months, 76% at 2 years, and 76% at 5 years and beyond.

Robert A. McGovern et al. Hemispherectomy in adults and adolescents: Seizure and functional outcomes in 47 patients. Epilepsia Nov 2019

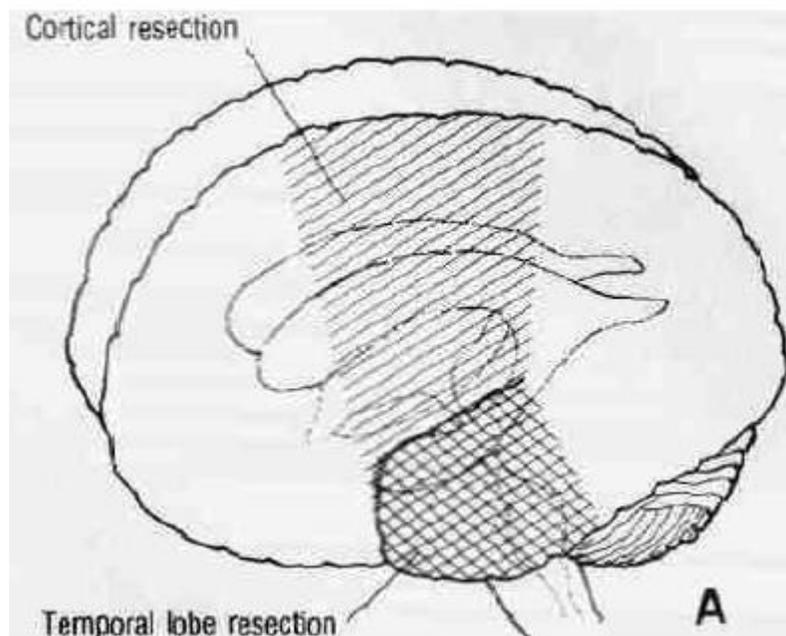
- postoperative seizures and contralateral interictal spikes at 6-month follow-up EEG were associated with seizure recurrence.
- patients who could walk unaided preoperatively and had no cerebral peduncle atrophy on MRI were more likely to experience worsening of motor function postoperatively.

TECHNIQUE

<http://www.neurosurgicalatlas.com/grand-rounds/hemispherotomy-techniques-pearls-and-pitfalls>

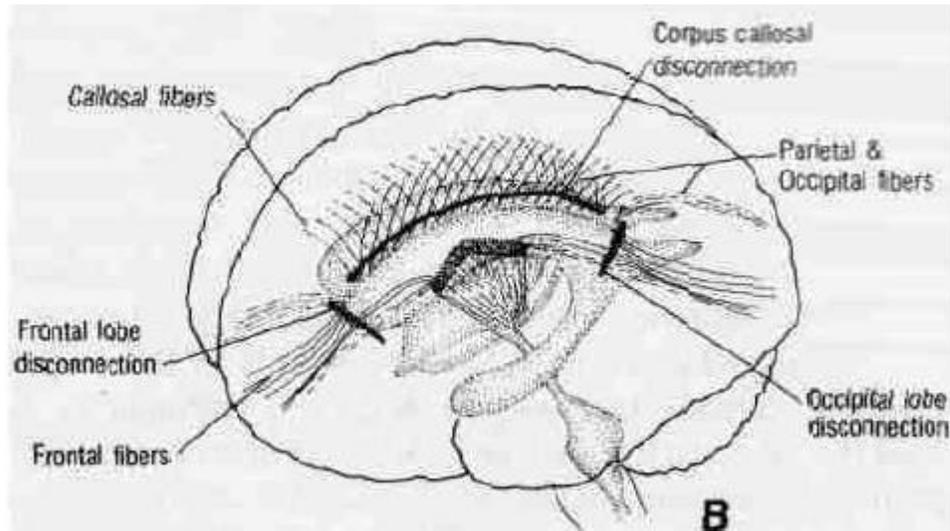
Schematic view of functional hemispherectomy:

A. Shaded area - cortical resection in central region, cross-hatched area - temporal lobe resection.



Source of picture: Marshall B. Allen, Ross H. Miller "Essentials of Neurosurgery: a guide to clinical practice", 1995; McGraw-Hill, Inc.; ISBN-13: 978-0070011168 >>

B. Incisions in corpus callosum and deep projection fibers in white matter disconnecting remaining frontal and occipital lobes.



Source of picture: Marshall B. Allen, Ross H. Miller "Essentials of Neurosurgery: a guide to clinical practice", 1995; McGraw-Hill, Inc.; ISBN-13: 978-0070011168 >>

- resection of central cortex is followed by temporal lobectomy.
- blood supply to basal ganglia and frontal and occipital lobes is preserved.
- after sectioning corpus callosum, projection fibers to frontal and occipital lobes are divided, isolating these structures but leaving them in place.
- degree of resection or isolation may be modified to adjust to presenting pathological and electrocorticographic changes and function to be preserved.

MRI following functional hemispherectomy - note ablated area and disconnection incisions:



Source of picture: Marshall B. Allen, Ross H. Miller "Essentials of Neurosurgery: a guide to clinical practice", 1995; McGraw-Hill, Inc.; ISBN-13: 978-0070011168 >>

BIBLIOGRAPHY for ch. "Epilepsy and Seizures" → follow this [LINK](#)