Convexity meningioma surgery

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Indication

Convexity meningioma surgery indications.

Preoperative embolization of intracranial meningioma

Preoperative embolization of intracranial meningioma.

Surgical safety checklist

see Surgical safety checklist.

Preoperative antibiotic prophylaxis

see Preoperative antibiotic prophylaxis.

Skin Preparation

see Skin Preparation.

Positioning

For convexity meningioma, the head is positioned so that the center of the tumor is uppermost, the same position as described for parasagittal tumors or for tumors close to the midline.

Skin incision - Burr Holes - Dura mater opening

The incision and bone flap must be large enough to allow for excision of a good margin of dura around

the tumor attachments.

The meningeal arteries are occluded as they are exposed.

Technical issues

These tumors can be removed intact by placing gentle traction on the dural attachment and working circumferentially around the tumor to divide the attachments to the cortex. However, if the surface of the tumor cannot be easily visualized without placing significant retraction on the cortex, internal decompression of the tumor is done and the capsule is reflected into the area of decompression.

In a situation where the tumor arises over the frontal temporal junction and grows into the sylvian fissure, the medial capsule and the dural attachment may extend down onto the lateral floor of the anterior fossa and anterior wall of the middle fossa, and the medial capsule of the tumor can be attached to branches of the middle cerebral artery.

A study showed that meningioma recurrence was unlikely when autologous cranioplasty was done with refashioned hyperostotic bone. This could be done in the same setting with meningioma excision. There was no recurrence at a mean of 5-year follow-up in convexity meningiomas [1)].

Videos

<html><iframe src="https://player.vimeo.com/video/174236796" width="640" height="360" frameborder="0" allow="autoplay; fullscreen" allowfullscreen></iframe> Right Convexity Meningioma from Surgical Neurology International on Vimeo. </html>

<html><iframe src="https://player.vimeo.com/video/176204310" width="640" height="360" frameborder="0" allow="autoplay; fullscreen" allowfullscreen></iframe> Left Frontal Convexity Meningioma from Surgical Neurology International on Vimeo. </html>

Simulation

An accurate and real-time model of soft tissue is critical for surgical simulation for which a user interacts haptically and visually with simulated patients. A paper focuses on the real-time deformation model of brain tissue for the interactive surgical simulation, such as neurosurgical simulation.

A new Finite Element Method (FEM) based model with constraints is proposed for the brain tissue in neurosurgical simulation. A new energy function of constraints characterizing the interaction between the virtual instrument and the soft tissue is incorporated into the optimization problem derived from the implicit integration scheme. Distance and permanent deformation constraints are introduced to describe the interaction in the convexity meningioma dissection and hemostasis. The proposed model is particularly suitable for GPU-based computing, making it possible to achieve real-time performance.

Simulation results show that the simulated soft tissue exhibits the behaviors of adhesion and permanent deformation under the constraints. Experiments show that the proposed model is able to converge to the exact solution of the implicit Euler method after 96 iterations. The proposed model was implemented in the development of a neurosurgical simulator, in which surgical procedures such as dissection of convexity meningioma and hemostasis were simulated [2].

References

1)
Lau BL, Che Othman MI, Fakhri M, San Liew DN, San Lim S, Bujang MA, Hieng Wong AS. Does putting back hyperostotic bone flap in meningioma surgery causes tumor recurrence? An observational prospective study. World Neurosurg. 2019 Mar 26. pii: S1878-8750(19)30863-0. doi: 10.1016/j.wneu.2019.03.183. [Epub ahead of print] PubMed PMID: 30926555.
2)
Hou W, Liu PX, Zheng M. A new model of soft tissue with constraints for interactive surgical simulation. Comput Methods Programs Biomed. 2019 Jul;175:35-43. doi: 10.1016/j.cmpb.2019.03.018. Epub 2019 Apr 1. PubMed PMID: 31104713.