Cerebellar hemangioblastoma surgery

Preoperative embolization of cerebellar hemangioblastoma may help reduce the vascularity.

Solid HGBs tend to be more difficult to remove. They are treated like AVMs (avoid piecemeal removal), working along margin and devascularizing blood supply. A helpful technique is to shrink the tumor by laying a length of bipolar forceps along tumor surface and coagulating. HGBs with attachment to floor of 4th ventricle may be hazardous to remove (cardio-respiratory complications).

Multiple lesions: if ≥ 0.8–1 cm diameter: may treat as in solitary lesion. Smaller and deeper lesions may be difficult to locate at the time of surgery.

Surgical treatment of cerebellar hemangioblastoma is total resection, with the main goal being the preservation of surrounding neural tissue.

The tumors usually are well demarcated from the surrounding brain or spinal cord, but this border of separation does not contain any particular membrane or capsule.

Multiple feeding arteries are often present, as well as more than one abnormally thick draining vein, with large diameters and thick walls.

Simultaneous 3D visualization of feeding arteries, draining veins, and surrounding structures is needed.

The surgical approach must be wide enough to avoid compression of the healthy tissues during retraction. Thorough evaluation of preoperative imaging studies is the key to the safest possible exposure of the tumor.

A study evaluated the usefulness of high-resolution 3D multifusion medical imaging (hr-3DMMI) for preoperative planning of hemangioblastoma. The hr-3DMMI combined MRI, MR angiography, thin-slice CT, and 3D rotated angiography. Surface rendering was mainly used for the creation of hr-3DMMI using multiple thresholds to create 3D models, and processing took approximately 3-5 hours. This hr-3DMMI technique was used in 5 patients for preoperative planning and the imaging findings were compared with the operative findings. Hr-3DMMI could simulate the whole 3D tumor as a unique sphere and show the precise penetration points of both feeding arteries and draining veins with the same spatial relationships as the original tumor. All feeding arteries and draining veins were found intraoperatively at the same position as estimated preoperatively, and were occluded as planned preoperatively. This hr-3DMMI technique could demonstrate the precise locations of feeding arteries and draining veins preoperatively and estimate the appropriate route for resection of the tumor. Hr-3DMMI is expected to be a very useful support tool for surgery of hemangioblastoma [1].

Occasionally, a localized flow and rich blood supply within the tumor is observed and the color of intravenous blood is bright red [2].

The surface of the tumor may be coagulated with wide bipolar forceps; however, avoid penetration of the tumor itself because of its extreme vascularity and difficulties with hemostasis. Try to dissect the tumor circumferentially by careful coagulation and cutting the small feeding vessels and adhesions between the tumor and the surrounding parenchyma and by putting cottonoid strips into the

developing plane to avoid direct pressure.

Once the feeding vessels are identified, they are coagulated and cut. Try to coagulate the arterial feeders prior to the draining veins, but this is not as crucial as it is in arteriovenous malformations. After the tumor is totally removed, the raw surface of the cerebellum remains relatively bloodless, and the oozing blood stops after a few minutes of gently packing the resection cavity with wet cotton balls, avoiding the need for additional coagulation.

Cerebrospinal fluid diversion is rarely necessary after complete tumor removal in patients with preoperative hydrocephalus.

Tumor recurrence is avoided by meticulous extracapsular resection [3].

If an associated hydrocephalus exists, it must be addressed separately, usually by means of external ventricular drainage (EVD) prior to tumor resection. After the tumor is removed, the need for permanent shunt placement may be determined by the patient's response to EVD clamping.

Indocyanine green videoangiography for cerebellar hemangioblastoma

Indocyanine green videoangiography for cerebellar hemangioblastoma.

Cystic cerebellar hemangioblastoma surgery

The tumor is usually easy to visualize because of its reddish-colored solid component and the yellow fluid inside the cyst.

Cystic HGBs require removal of the mural nodule (otherwise, the cyst will recur). The cyst wall is not removed unless there is evidence of tumor within the cyst wall on MRI (typically thick-walled cysts) or visually at the time of surgery.

5-ALA fluorescence may aid in the visual localization of small hemangioblastomas within the cyst wall.

Cystic brainstem HGB: the solid nodule of the tumor is removed under the microscope by bipolar- ing and cutting the gliotic adhesions to the parenchyma. Removal of the cyst wall is not necessary. There is often a cleavage between the tumor and the floor of the fourth ventricle which facilitates tumor removal. To reduce bleeding, avoid piecemeal removal. Preserve large draining veins until the arterial feeders to the mural nodule have been isolated and resected.

Surgical resection is the most effective treatment for cerebellar hemangioblastomas with an enhanced cystic wall [4]. However, for this type of lesion, the tumor must not be punctured, biopsied or blocked via resection due to the rich blood supply. The enhanced tumor wall indicates that it contains partial tumor cells, therefore to avoid recurrence of the tumor, the wall and the solid part of the tumor require total resection [5].

If the cyst is present, it may be emptied by cutting the covering pial membrane or by aspirating the cystic contents using a syringe with a short small-caliber needle. Decompression of the cyst allows for improved delineation of the interface between the tumor.

Videos

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Case reports

2 patients with von Hippel-Lindau disease-related hemangioblastomas successfully treated by a fully endoscopic transcranial approach via a short skin incision and a 2 cm × 2 cm small bony window. Before surgery, a three-dimensional virtual reality model was created to determine the ideal trajectory.

Patient 1 had 2 serial large cystic tumors that equally contributed to obstructive hydrocephalus and were resected sequentially via a single endoscopic trajectory. Patient 2 had a progressive large cystic tumor that was resected endoscopically. Complete resection of the tumors was achieved without any complications in either patient.

Small nodular tumors accompanying a large cyst are plausible candidates for endoscopic transcranial surgery. The spatial relationship of nodules, cyst, and cerebellar parenchyma is important to determine the applicability of the present technique. Preoperative three-dimensional virtual reality simulation helps assess the feasibility of this approach [6].

Krüger et al. presented the case of a minimally invasive removal of a superficial cerebellar hemangioblastoma with tumor-associated cyst and indicate the potential benefits and limitations of this technique [7].

References

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