Supracerebellar infratentorial approach

see also Contralateral supracerebellar infratentorial approach.

Indications

Several surgical approaches have been described for falcotentorial meningioma treatment. These include infratentorial supracerebellar approach.

A steep tentorial angle is an unfavorable preoperative radiographic factor for achieving maximal resection with the supracerebellar infratentorial approach. Collectively, a study of Zhao et al. showed that versatility is required to treat patients with falcotentorial meningiomas and that treatment goals and surgical approach must be individualized to obtain optimal surgical results 1).

The supracerebellar infratentorial approach provides a direct corridor to pineal tumors caudal to the deep veins; for tumors invaginating the tectal plate in a caudal direction the occipital transtentorial approach provides a better view 2).

Videos

Supracerebellar-Infratentorial Approach for Resection of Tectal and Thalamic Cavernous Malformations: 3-Dimensional Operative Video 3).

Stein utilizing the Fedor Krause exposure, operated on 21 cases of tumors of the pineal region encountering a wide variety of histology with an overall 30% incidence of benign lesions. There has been no significant morbidity in the post-operative management of these patients and one surgical death in a patient with a highly malignant glioma who developed a delayed hemorrhage into the tumor following the operation. In those tumors of recognized malignancy, post-operative radiotherapy has been utilized. In tumors of the germinoma, variety radiation of the entire neural axis is advocated. Since many of the patients have undergone radiotherapy prior to our exposure of the pineal tumor, we have had an opportunity to witness the effects of radiation on this region. In those cases of benign tumors we have found dense adhesions between the tumor and the brain, making definitive surgical treatment of the tumor more difficult 4).

Variations

see Lateral supracerebellar infratentorial approach.

see Extreme lateral supracerebellar infratentorial approach.

Positioning

Positioning has traditionally involved the sitting, lateral, or prone position. The sitting position allows gravity retraction of the cerebellum, with less cerebellar swelling and venous congestion compared with the prone position. There is less need for cerebellar retraction away from the tentorium with the sitting position compared with the prone and lateral positions. However, the sitting position involves disadvantages related to surgeon comfort and fatigue in protracted cases, as well as possible venous air emboli.
Awad et al., present a gravity-dependent supine (GDS) positioning to avoid certain drawbacks of sitting, lateral, and prone positions in 2 illustrative cases.

The first patient underwent surgical resection of a right cerebellar arteriovenous malformation that drained superiorly with the draining vein adjacent to the tentorium after a ventricular/subarachnoid hemorrhage. The second patient underwent surgical resection of a brainstem cavernous malformation in the left pontomesencephalic region with the GDS supracerebellar approach.

Postoperative imaging demonstrated complete resection in both patients. There were no perioperative complications related to positioning or the surgical resections postoperatively, with an uneventful hospital course in both cases.

The GDS lateral SCIT approach allows natural cerebellar relaxation via gravity without the need for lumbar drainage and is a novel, straightforward operative technique with inherent advantages over the prone, lateral decubitus, and sitting positions.

**Technique**

A midline incision is used extending 1-2 cm superior to the inion to C1-C2. However, an inverted U-shaped incision can be used too.

Suboccipital muscles are dissected laterally and held in place using cerebellar retractors in a typical fashion to reveal underlying bone. The widest part of the exposure should be at the level of the transverse sinus. The bone landmarks must be recognized in order to place the craniotomy.

A craniotomy is preferred over a craniectomy because it is faster and seems to reduce postoperative discomfort. Slotted burr holes at the sagittal sinus just above the torcular and at the lateral aspect of the transverse sinus bilaterally. It is not necessary to open the foramen magnum.

The main purpose of the craniotomy is to expose, without injuring, the torcular (T), the inferior portion of the superior sagittal sinus (SSS), the occipital sinus (OS) and both transverse sinuses (TS).

The dura is opened with a gentle curving incision extending from the lateralmost exposure of the transverse sinus to its contralateral exposure. The incisions should extend from each side down to the midline, where the midline venous sinus can be ligated and the small cerebellar falx can be divided.

After the dura is opened, the bridging veins will be visible. The inferior vermian (IVv) and hemispheric veins (IHv) on both halves of the suboccipital surface ascend and pass below the transverse sinus to empty into the sinuses in the tentorium. These should be cauterized and divided thereby freeing up the cerebellum from the tentorium.

In the infratentorial supracerebellar approach to the pineal region, it may be necessary to divide numerous bridging veins entering the torcular and the tentorial sinuses, including some of the superior and inferior hemispheric and vermian veins, and the vein of the cerebellomesencephalic fissure. These veins have commonly been sacrificed without adverse effect to open the quadrigeminal region and the incisura. The posterior group of superior vermian (SVV) and superior hemispheric veins (SHV) arise on the posterior part of the tentorial surface and descend to empty into tentorial sinuses.

The superior hemispheric veins (SHV), which drain the tentorial surface, are divided into an anterior group, which empties into the Galenic system, and a posterior group.
With the microscope in place, the arachnoid overlying the quadrigeminal region is opened sharply. This arachnoid is usually thickened and partially opaque when tumors are present.

After opening of the arachnoid membrane of the quadrigeminal region, it was possible to further define the region and the confluence of veins lying rostral to the straight sinus and the veins of Rosenthal laterally. Because of the tentorial notch and upper vermis, the operative field was very limited. Although bilateral SCAs and medial posterior choroidal arteries were clearly visible, the PCAs were not apparent (except for the P3 segments). The venous complex could be gently displaced to expose the lower part of the splenium, the pineal body, and the superior colliculus, but the area below the level of the superior colliculus was not visible. The deep posterior third ventricle was easily recognized through the space between the pineal body and the internal cerebral veins. The lateral margin of the operative field was the pulvinar.

In the paramedian variant of the infratentorial supracerebellar approach, the retraction was advanced above the hemisphere lateral to the vermis. This approach was not as upwardly steep as the approach above the vermal apex and provided access to the pineal region, the lower part of the splenium, and gave greater access to the ipsilateral half of the cerebellomesencephalic fissure.

Both the superior and inferior colliculi can be exposed and the arteries can be followed forward into the ipsilateral ambient cistern.

Complications

It carries some risk of associated complications including cerebellar venous infarction with possible serious sequelae. The objective of a study was to address the incidence of cerebellar venous infarction.

A search through the currently available literature was performed in September 2019 from the year 2000 until September 2019 dealing with 'supracerebellar infratentorial approach'. Out of the 578 patients found in thirteen case series, two venous infarctions were present; the remaining four patients were published as case reports. By analysing the case series, they calculated the risk of such a complication to be 0.345% (95% CI [0.061%, 1.248%]). Case reports were not included. The real risk is estimated to be higher. The risk of cerebellar venous infarction is an unpredictable, infrequent but real complication with potentially dreadful sequelae. Each neurosurgeon using this approach should be aware of this event when employing this approach. The avoidance of cerebellar venous infarction can be lowered by leaving as many bridging veins intact as possible.

Case series

1995

Kanno has treated 30 cases of pinealoma by the infratentorial supracerebellar approach with the patient in the sitting position. Long-term outcome has been excellent in 26 cases, poor in 1, and death in 3 cases. Postoperative deaths were due to: (i) high venous pressure in the jugular vein caused by a tourniquet placed around the neck to prevent air-embolism, making hemostasis more difficult, (ii) the absence of retraction resulting in a narrow surgical field when acute brain swelling developed, and (iii) high coagulation and ablation of the precentral cerebellar vein causing diffusion thrombosis of deep veins.

1992

Laborde et al report about the infratentorial supracerebellar approach in 23 patients operated on for
lesions located in the posterior part of the third ventricle, quadrigeminal plate, culmen cerebelli and cerebellar peduncle. Three patients had transient worsening of their deficits immediately after surgery. Three patients developed haemorrhages postoperatively requiring surgical evacuation. One of them died. None of the patients developed specific complications which could without any doubt be attributed to the approach. We concluded that in combination with intra-operative CSF drainage and the sitting position the infratentorial supracerebellar approach allows safe access to lesions situated in an area limited by the posterior part of the third ventricle, the fastigium level and both cerebellar peduncles.

References


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