



# How I do it: endoscopic supracerebellar infratentorial approach for torcular meningioma removal

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## Abstract

**Background** Torcular meningioma is a rare type of brain tumor with few reports regarding the appropriate resection approach for this disease. In cases without sinus occlusion, surgeons are advised to spare the sinus; however, the sinus may interfere with the visual field.

**Method** Endoscopic supracerebellar infratentorial approach for removal of torcular meningioma was performed in the prone position. The tumor attachment to sinus or confluence was removed or coagulate safely due to an optimal look-up view with the 0° and 30° endoscope.

**Conclusion** Endoscopic supracerebellar infratentorial approach for infratentorial torcular meningioma is a safe and less invasive technique.

**Keywords** Endoscopic supracerebellar infratentorial approach · Torcular meningioma · Endoscopic keyhole surgery

## Abbreviations

MRI	Magnetic resonance imaging
CT	Computed tomography
F	Female
Exo	Exoscope
Endo	Endoscope
Micro	Microscope

## Introduction and relevant surgical anatomy

Torcular meningioma is defined as being attached near the confluence of the sinuses (within 1 cm) and with or without

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torcular infiltration. Torcular meningioma accounts for about 1% of all meningioma, [3, 5] and there are few reports regarding the resection of torcular meningioma [1, 4]. Torcular herophili, confluence of sinuses, is connecting point of superior sagittal sinus, transverse sinus, straight sinus, (occipital sinus sometimes exists). It is difficult to completely resect infratentorial torcular meningiomas, due to the existence of sinuses and tentorium. The location of these tumors surrounds the sinuses and their confluence (superior sagittal, transverse, and straight sinus; sometimes the occipital sinus). As long as the sinus is not occluded, incisions of the sinus may cause extensive venous congestion and may lead to adverse conditions. An occipital transtentorial approach and/or infratentorial supra-cerebellar approach with a microscope may be considered but viewing and manipulation around the front of the confluence of the sinuses is very difficult by microscopy alone because of the sinus veins and tentorium.

## Description of the technique

The patient was fixed in a prone position. We use 0°, 30°, and 45° high-definition endoscope and 3-dimensional exoscope systems. These scopes are held by an endoscope holder. After fixation of the patient's head, the tumor site is identified with navigation and the craniotomy was designed on the skin

as follow. A burr hole was made next to confluence, and then 3-cm craniotomy is conducted (Fig. 1). We believe a 2–3 cm craniotomy is suitable for endoscopic surgery. With a more than 4 cm craniotomy, endoscopes, and forceps move highly freely, and it is rather unstable on the contrary. Skin incision was designed to be a paramedian, slight oblique incision, because of the visual axis of exoscope in reference to the lesion. Furthermore, the posterior muscles are very tough, and the thickness of the muscle interferes with the field of view and endoscope placement. To view along the inferior side of the tentorium, you should place the endoscope at an angle as low from the neck as possible. Therefore, the skin incision should be made in the direction toward the object, which in this situation, is the torcular herophili. After opening the dura, detachment from the tentorium could be conducted. The tumor attaches to not only tentorium but also sinuses (Fig. 2) We used mainly endoscope for detaching the tumor from the tentorium. In particular, we could easily get the view of the area just under the bony edge and the transverse sinus, where viewing with a microscope or exoscope is difficult (Fig. 3, video1). Malleable bipolar, suction, and dissectors were also key devices used in this approach. Adjustment to an appropriate angle makes it easy to coagulate and dissect tissue in small spaces.

Dissecting between cerebellum and tumor was also performed with endoscope. It is possible to remove tumor with preserving arachnoid with endoscopic view. It led to preserve normal tissue.

After safe tumor removal, the dura matter is sutured in a watertight fashion. The bone flap is fixed with a titanium plate. A wound drain is not used.

## Indications

The optimal indication for our approach is relatively small meningioma limited to the infratentorial torcular. Tumor

development under the tentorium is not a large issue. The inferior surface of the tentorium is sufficiently visible with endoscopy, even on the lateral side.

## Advantage of this method

The endoscopic supracerebellar infratentorial approach has been already reported. However, most of these studies reported on the efficacy of use in the pineal region or the posterior third ventricle [6, 7]. To the best of our knowledge, this is the first article reporting the efficacy of a supracerebellar infratentorial endoscopic approach for the infratentorial torcular region. The advantages of this approach for torcular region are (1) clear and wide view around torcular herophili, and (2) avoiding the disadvantage due to sitting or semi-sitting position, that is, a risk of air embolism and ergonomical disadvantage for surgeon or ergonomical disadvantage for the surgeon due to keeping their arm high for a long period [2]. The exoscope contribute to the second advantage. By using exoscope, the operator can get more flexible visual axis in natural posture.

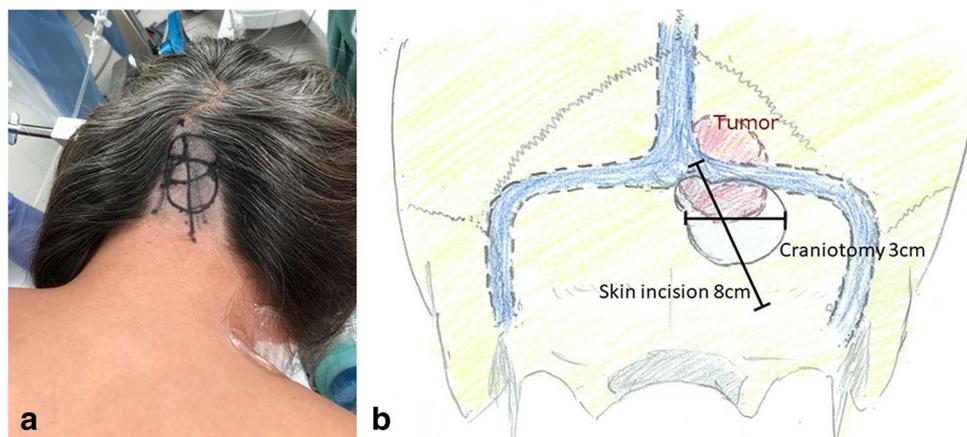
## Limitations

The contra-indication of our approach is huge meningioma which occupied both supratentorial and infratentorial space.

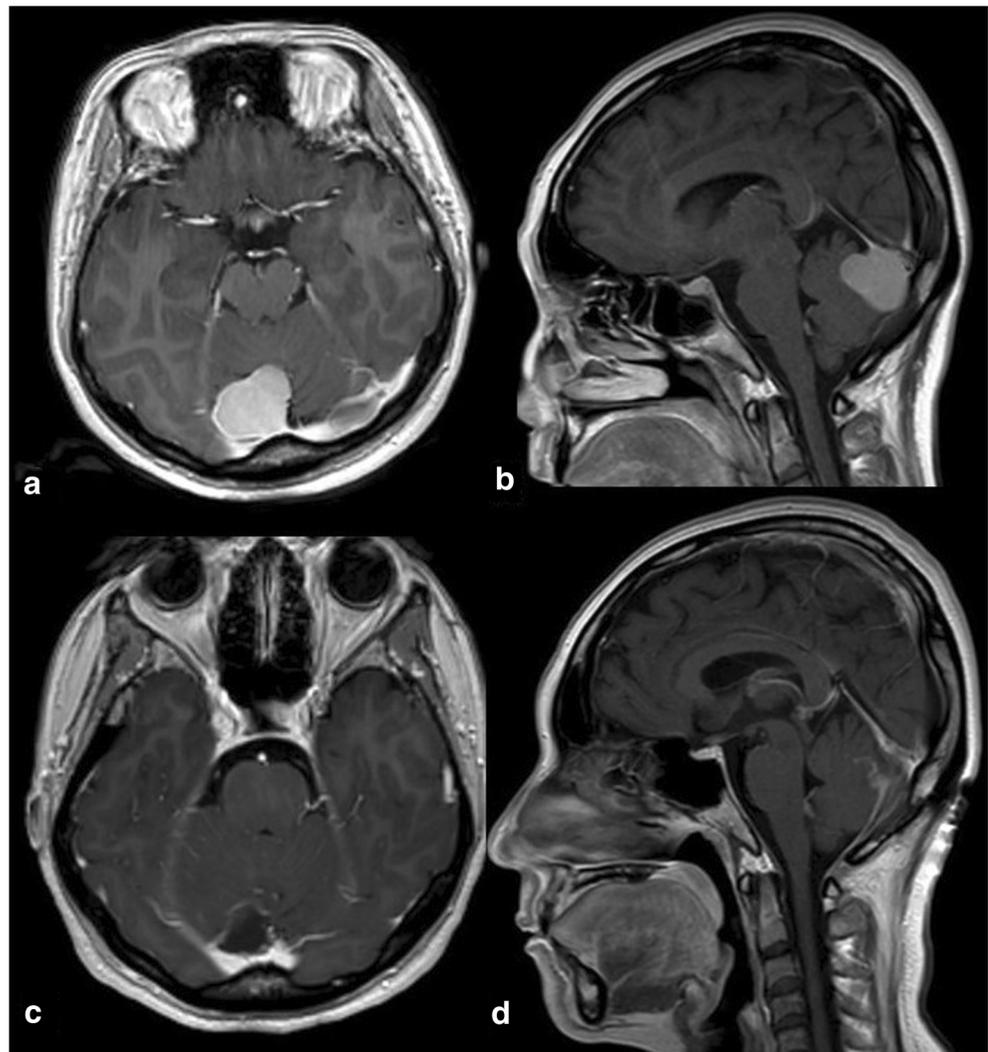
## How to avoid complications

Tumor invasion to venous sinus was not removal. In such cases, you need to leave membrane of the tumor on the surface, where you should coagulate well.

**Fig. 1** Keyhole craniotomy and skin incision. **a** Photograph of actual patient with the head in the fixed prone position. **b** Illustration of a keyhole craniotomy; the burr hole was made at the point of confluence, and a 3-cm craniotomy incision was made. The craniotomy was conducted just below transverse sinus instead of above the tumor



**Fig. 2** Perioperative MRI. **a** Axial and **b** sagittal views of Gd-enhanced T1 preoperative MRI, which reveals tumor attached to the tentorium and torcular. **c** Axial and **d** sagittal views of Gd-enhanced T1 postoperative MRI, where the tumor was removed completely from the tentorium and torcular



### Specific perioperative considerations

A neuroradiological routine (brain CT and MRI) must be performed before surgery. And craniotomy and skin incision design should be under neuronavigational system.

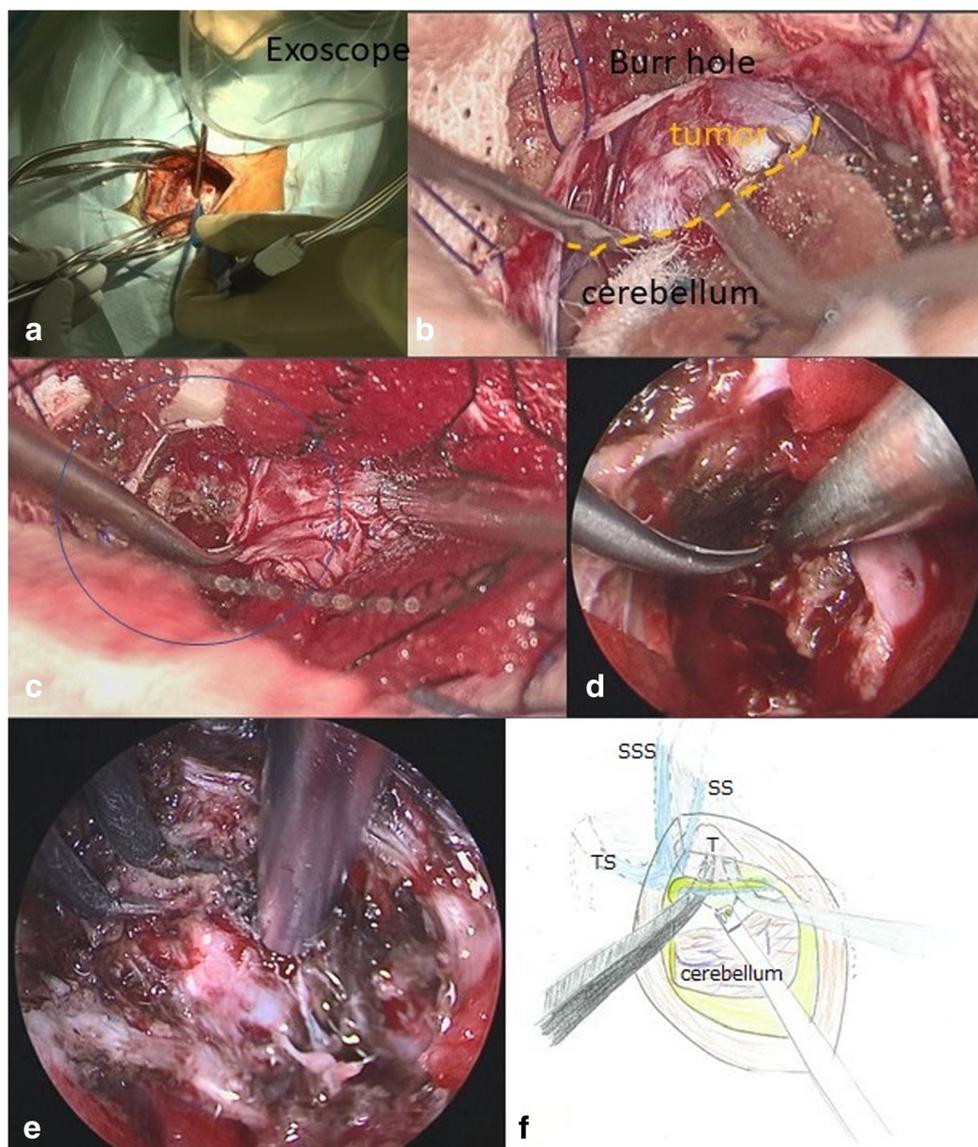
### Specific information to give to the patient about surgery and potential risks

Besides the classic infectious, and hemorrhagic risks, particular risk of this approach is an occipital numbness if the occipital nerve is injured.

### Key points

1. The torcular meningioma is rare, and there are few reports about removal of the tumor.
2. Using endoscope, you can operate in a prone position and avoid the sitting or semi-sitting position.
3. The burr hole should be made nearby posterior occipital protuberance. And the position should be identified with navigation.
4. Skin incision should be designed to be a paramedian, slight oblique incision, because of the prevention of interfering of occipital muscle to visual axis and endoscope shaft.
5. About 3 cm-craniotomy should be made. Handling may be bad under 2 cm or over 4 cm-craniotomy.
6. Detaching behind confluence or sinuses should be under endoscopic view. You can get a wide view.
7. There are many feeding arteries on the surface of tentorium. Bleeding may occur, but you must coagulate all of these arteries carefully. If you leave them, tumor recurrence will occur with high probability.
8. Arachnoid of the cerebellum should be kept as long as possible. It leads to the preserving of normal structure.

**Fig. 3** Intraoperative view. **a–c** Exoscope view. Operator and assistants share a very clear 3D view, with ease of manipulate in the operation field. Moreover, the exoscope has more degrees of freedom for the view axis than a microscope, with a look-up-view being possible to some extent. **d–f** Endoscopic view. **d** Acquired by the endoscope just after the image in **c** and shows the extent surrounded by the blue circle observed in **c**. Although tumor is pressed slightly downward, the back side of the bone and dura matter can be clearly observed with the endoscope. **e** Coagulation of the tentorium, directly in front of the torcular and transverse sinus, with malleable bipolar. **f** Schema of **e**



9. Malleable bipolar forceps, suctions, and dissectors are useful in this approach. You can change the angle of tip freely in addition to be a certain degree of hardness. Adjustment to an appropriate angle makes it easy to coagulate and dissect tissue in small spaces.
10. Huge meningiomas or high intrusion over the tentorium should not be operated in this approach.

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### Compliance with ethical standards

**Conflict of interest** The authors do not have any disclosures or conflicts of interest to declare.

**Ethical approval** All procedures performed in this study were in accordance with the ethical standards of Nagoya Daini Red Cross hospital research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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