

## Endoscopic Approach to Cerebellar and Large Putaminal Bleed

### Abstract

**Objective:** To highlight the basic points of brain endoscopic procedure for Cerebellar and Large Putaminal Hemorrhage to achieve repeatability and reproducibility in the results among the new brain endoscopic surgeons. **Method:** Sharing the experience of 10 years as an endoscopic surgeon to bring out the basic insight into the method, challenges, points which need special attention during the surgery and discussion of recent advancements in the endoscopic equipment for safe surgery. **Conclusion:** Procedure of endoscopic evacuation of brain hematoma is simple with learning curve. In the beginning new endoscopic surgeons should operate in the presence of experience surgeon. They should follow standard technique to achieve the good surgical outcome and uniformity in the result every time they perform the surgery.

**Keywords:** Cerebellar, endoscope, large putaminal

### Introduction

Endoscopic procedure for hematoma evacuation has a learning curve. Beginners learn from the seniors and everyone has their own methods, so there is no repeatability and reproducibility. The aim of this article is to highlight the basic points of the endoscopic evacuation of the putaminal hemorrhage to achieve repeatability and reproducibility among the different new endoscopic surgeons. There is always controversy regarding timing of surgery, craniotomy, and stereotactic or endoscopic evacuation of the hematoma as this is an emergency case. In this study, we discuss only the safety and effectiveness of the endoscopic operation of cerebellar and the large putaminal hemorrhage.

### Before the Procedure

#### Timing of the operation

We should go for early intervention in the cases of Cerebellar and Large Putaminal Bleed. Patients with focal neurological deficit, altered consciousness, and hemiparesis should be first stabilized when brought to the hospital. Routine examination of blood should be made and cardiac evaluation should be done. Whether to opt for computed tomography (CT) or magnetic resonance imaging brain depends on the condition

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of the patient and facilities of the hospital. If CT shows cerebellar or large putaminal hemorrhage, magnetic resonance angiography or CT angiography (CTA) should be done. It is better to shift patients directly from emergency department to operation room in ideal conditions. Endoscopic operation has the advantage that operative preparation and execution can be done in a very short time. The authors prefer digital subtraction angiography to CTA as this can exclude arteriovenous malformation (AVM), arteriovenous fistula (AVF), Moyamoya disease, aneurysmal hemorrhage, high- or low-flow AVM/AVF, and venous angiomas. The authors use a hybrid operating room [Figure 1] where angiography can be followed by operation. If there is any vessel abnormality, endoscopic surgery is contraindicated. The authors prefer radial artery for angiogram and sheath can be used as an arterial line in operation.

### Anesthesia, Position, and Burr hole

General anesthesia (GA) is recommended in all the cases. Many times, GA facility is not available in the hospital or the patient is not fit for GA, and in such cases, we need to operate under local anesthesia (LA) to decompress the hematoma. For operating under LA, the patient should be cardiopulmonary stable. Position of the patient should be suitable for resuscitation

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**Daisuke Suyama,**  
**Brajesh Kumar<sup>1</sup>,**  
**Saiko Watanabe<sup>2</sup>,**  
**Riki Tanaka<sup>2</sup>,**  
**Yasuhiro Yamada<sup>2</sup>,**  
**Tsukasa Kawase<sup>2</sup>,**  
**Yoko Kato<sup>2</sup>**

*Department of Neurosurgery, Fuchu Keijinkai Hospital, Tokyo, <sup>2</sup>Department of Neurosurgery, Banbuntane Hotokukai Hospital, Fujita University, Nagoya, Japan, <sup>1</sup>Department of Neurosurgery, Ruban Hospital, Patna, Bihar, India*

#### Address for correspondence:

*Dr. Brajesh Kumar,  
House No 15, Gokul Marg,  
North S. K. Puri, Boring Road,  
Patna - 800 013, Bihar, India.  
E-mail: drbrajesh78@gmail.com*

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Figure 1: Hybrid operating room

as well as the assistant and co-workers should be skillful when operating under LA. It is better to go for GA if we need to operate in lateral/prone position [Figure 2]. Microscopic craniotomy should be considered in case of uncontrolled hypertension and bleeding. In case of lateral or prone position, it is not possible to change from endoscope to microscope, so in those cases, endoscopic procedure should be done in the presence of adequate expertise, experience, and confidence. We need to change the anesthesia and position depending on the hematoma, complication, physique, and cardiopulmonary status. The authors recommend GA in case of large putaminal hemorrhage as many times we encounter arterial bleeding from the perforators as compared to small putaminal hemorrhage which can take longer operative period.

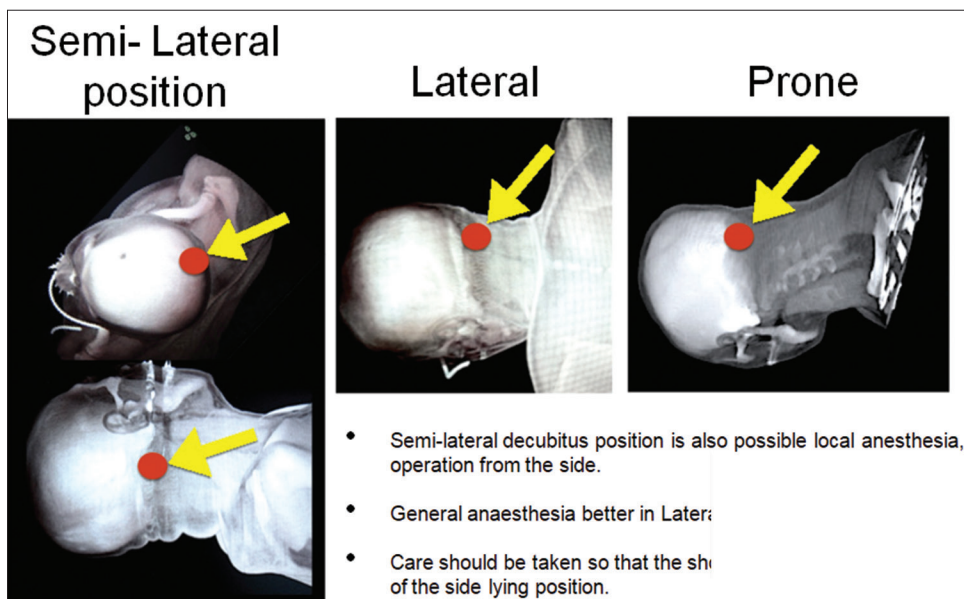


Figure 2: Position of patient in cerebral hemorrhage

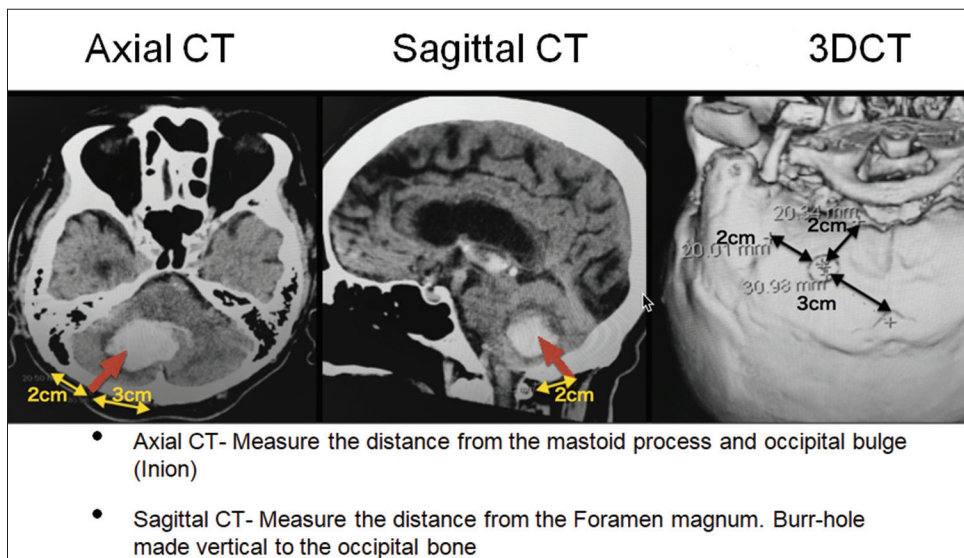


Figure 3: Burr hole and puncture point localization in cerebellar hemorrhage

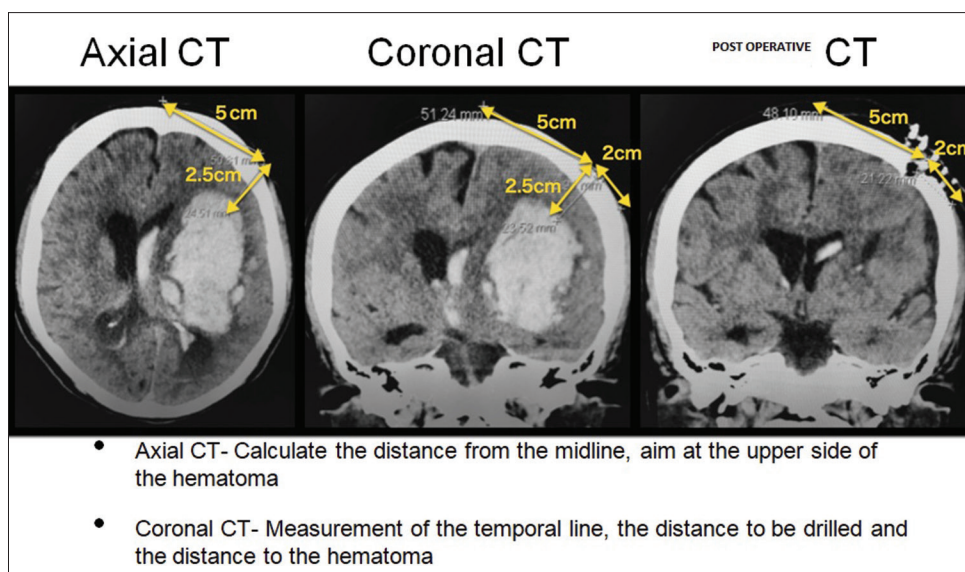


Figure 4: Puncture point localization

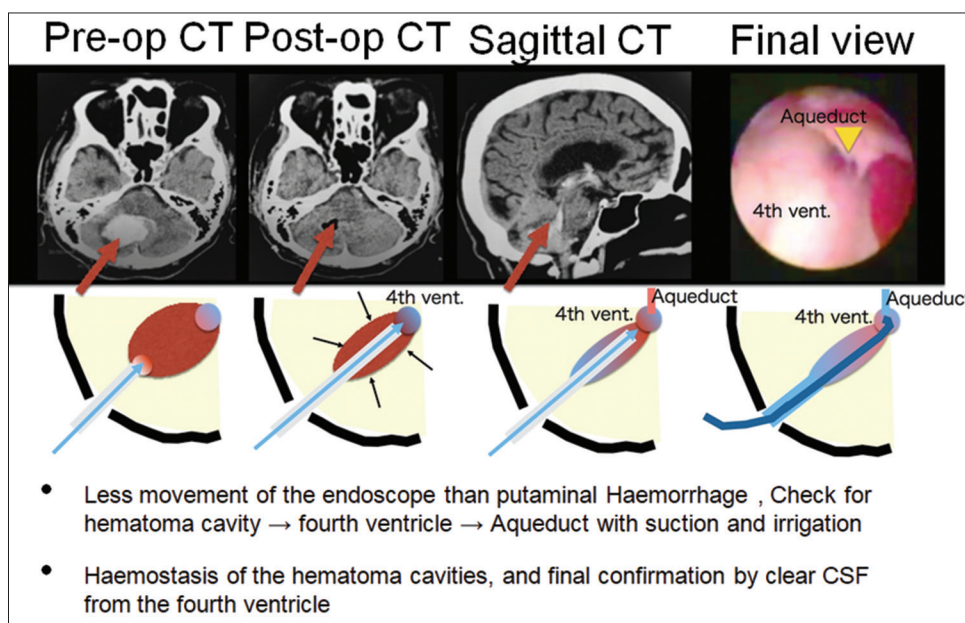


Figure 5: Pre- and postoperative

Burr holes need to be close to the hematoma and the direction of puncture should be vertical to the skull as it is easy to manipulate the sheath in this trajectory. The position of burr hole should be posterolateral to the burr hole for the frontal horn. We can mark the burr-hole point through the coronal image. It is very important to always keep the image of brain shift after the decompression.

### Trephination and Puncture

In cerebellar haemorrhage, we should take note of rotation of head, curvature of occipital bone, narrow occipital space and variations in the anatomy of the posterior fossa. For making burr hole we should visualize the direction to the hematoma, 4 th ventricle and aqueduct. We should measure

the distance from mastoid process, foramen magnum, and occipital protuberance (Inion) by CT axial, sagittal, and coronal images from the center of the hematoma [Figure 3]. Before puncture, we should always reconfirm the position of hematoma from the anatomical markers on the skull.

In large putaminal hemorrhage, puncture point is not a big problem. We should better use the meeting point of superior temporal line and coronal suture and assume the wideness of hematoma from CT axial, sagittal, and coronal images [Figure 4]. Burr-hole point is marked to the nearest point of hemorrhage, vertically from the skull. Bigger size sheath and suction tube should be used as many times we encounter big perforators with atherosclerotic changes.



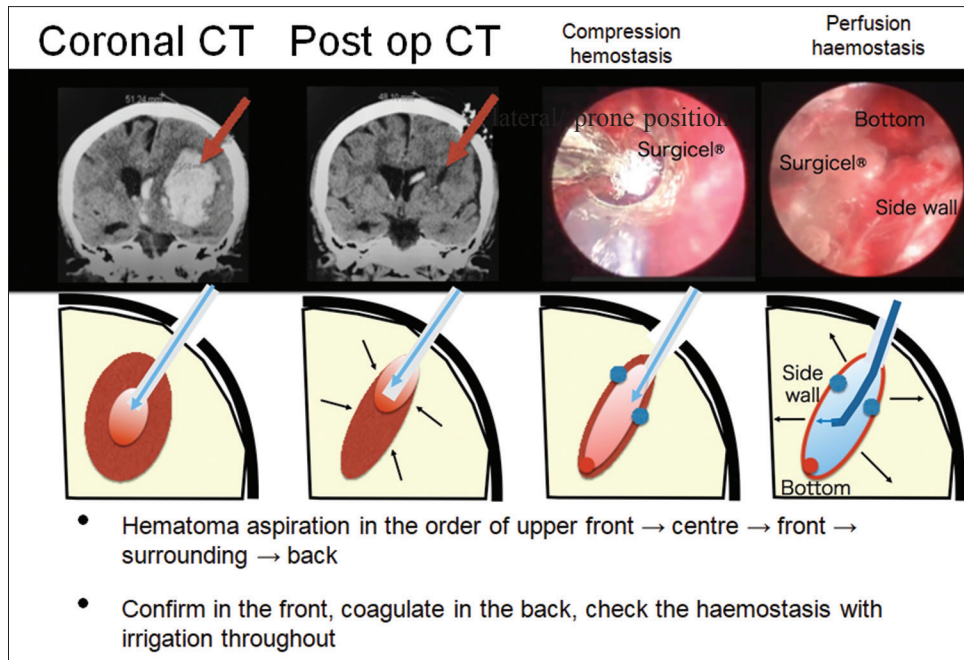


Figure 6: Evacuation and hemostasis putaminal hemorrhage

### Evacuation of Hematoma

In case of cerebellar hemorrhage, it is better to look for any bleeding from larger vessels. Cerebellar tissue is softer than cerebral tissue. Here, some larger craniotomy is needed as the puncture point is very close to the hematoma. Puncture should be in the direction of the aqueduct. Evacuation is done from the proximal side to the deeper side. When we evacuate the deeper part of the hematoma, the 4<sup>th</sup> ventricle is seen and cerebrospinal fluid (CSF) comes through it.

Tips – For cerebellar hemorrhage, a wide craniotomy with smaller sheath and suction tube is used.

For large putaminal hemorrhage, it is important to decompress as fast as possible. In acute phase, it is difficult to remove hematoma as it is hard. Bigger sheath should be used so that larger suction tube can be negotiated through it. Sheath side of internal diameter 6 mm or more, endoscope of 2.7 mm, and suction of 4 mm and 6 mm is usually preferred. During evacuation of the hematoma, we first evacuate the central hematoma with a larger suction tube, then we move proximally (toward the puncture site), the margin is evacuated with suction of the lower size, and the deepest part is done in the last. If there is red fresh bleeding, it is mostly from the tract or the puncture site. Any bleeding should be coagulated immediately [Figure 5]. The principle of hemostasis after the completion of the procedure should not be followed as the working space is lost after the decompression. If the patient is young and there is no brain atrophy, hematoma is usually pushed by the brain to the center, and there is no need to move the sheath. How to evacuate hematoma depends on the hardness and the duration of the bleeding. In some cases, we do not decompress hematoma too much due to larger perforators [Video].

Tips – The sequence of evacuation in large putaminal hemorrhage is as follows: center, proximal, margin, and last the deeper part [Figure 6].

### Hemostasis

In cerebellar hemorrhage, cavity is fragile and can be injured easily when we try to evacuate the margin. We should try hemostasis with irrigation with artificial CSF and pressure hemostasis with Surgicel® and cotton. In case of ventricular extension, we irrigate the 4<sup>th</sup> ventricle with flexible endoscope and look at the aqueduct.

Tips – Flexible endoscope expands the hematoma cavity and hemostasis is achieved by irrigation.

In case of large putaminal hemorrhage, bleeding should be coagulated immediately each time we encounter the bleeding. The difference from microscopic approach is that bleeding point can be found directly. We use monopolar in endoscopic approach whereas bipolar in microscopic approach. Lateral and proximal sides are blind in endoscopy, and hemostasis can be achieved with pressure and irrigation as we cannot see the bleeding point. The authors recommend using flexible endoscope for observing the hematoma cavity.

### Closure of Craniotomy

In cerebellar hemorrhage, CSF leak can happen even with a small burr hole. Gelfoam® should be kept in sheath tract. Dura should be closed tight and enforced with fibrin glue and DuraSeal®. Muscle closure should be done in a way so that there should be no dead space. In putaminal hemorrhage, there is no special point in closure. It is the same as usual craniotomy. Intracranial

pressure (ICP) monitoring can be used, if there is incomplete hematoma evacuation. The authors do not put drainage tube in endoscopic operation unless there is associated hydrocephalus. Peridural hematoma is absorbed spontaneously. Endoscopic evacuation can be tried again in case of incomplete evacuation.

### **Conclusion**

The authors have discussed endoscopic evacuation of the hematoma as the lifesaving procedure. In such emergency cases, all staff and coworkers should understand the steps of the operation so that operation can be performed without stress. Many people have an opinion that in severe cases

bigger craniotomy should be used and bone should be removed. The authors use ICP monitoring in severe cases and remove the bone flap if required. The most important thing is fast decompression, not to lose the valuable time and control of the ICP. The principle of operation is the same in both endoscopy and microsurgery. Decompression is important, not the complete evacuation.

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Nil.

### **Conflicts of interest**

There are no conflicts of interest.