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Technical Note

Intraoperative head rotation for clipping anterior communicating artery aneurysms

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Abstract

Background: The anterior interhemispheric approach provides wide exposure of the anatomy around the anterior communicating artery aneurysm. A disadvantage of this approach is that splitting the interhemispheric fissure is a complicated surgical maneuver. One solution is to hold the fissure horizontally in the operation field. Surgical procedures for bicoronal scalp incision and craniotomy are difficult in the horizontal head position. We developed a modified low anterior interhemispheric approach to minimize damage to the frontal lobe and olfactory nerve by rotating the head after opening the dura.

Methods: The head is fixed in a prerotated Sugita head holder in a neutral head position. Bicoronal scalp incision and frontal craniotomy are performed and the head holder is rotated 30 degrees clockwise to allow gravity to retract the right frontal lobe. The surgeon can then move to the right side of the patient to obtain a horizontal operation field parallel to the interhemispheric fissure.

Results: This method was used for 12 patients in the past 6 years. All aneurysms were successfully clipped without any complications related to the procedure. Damage to the frontal lobe was avoided and the olfactory nerve was preserved in all the patients.

Conclusion: Intraoperative head rotation minimizes surgical damage to the neural structures in the anterior interhemispheric approach.

Key Words: Anterior communicating artery aneurysm, anterior interhemispheric approach, clipping, head holder

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INTRODUCTION

The pterional approach and anterior interhemispheric approach are standard surgical procedures for clipping anterior communicating artery aneurysms. The advantage of the anterior interhemispheric approach is that it provides better visualization of the anterior communicating artery complex and is especially suitable for large, high-positioned, and posteriorly- or superiorly projecting aneurysms.[1,2,8] The disadvantage of this method is that it is a relatively complicated surgical maneuver to split the interhemispheric fissure compared with the pterional approach. We have recently developed a method to minimize damage to the frontal lobe and olfactory nerve by rotating the head holder after the craniotomy.

METHODS

A lumbar spinal drainage tube is routinely introduced in patients with ruptured aneurysms before the head fixation. The head is fixed with the sagittal midline vertically in a Sugita head holder that was rotated 30 degrees counterclockwise before head fixation [Figure 1a].[7] Bicoronal scalp incision and a frontal craniotomy are performed with a neutral head position. We make a right-side dominant frontal bone flap and one of the burr holes at the glabella to perform a low anterior interhemispheric approach [Figure 2a].[1,8] The falx cerebri is usually unsectioned in the right-sided unilateral approach. The head holder is rotated 30 degrees clockwise to allow the right frontal lobe to fall downward with gravity after the craniotomy [Figure 1b]. Then the surgeon moves from the top of the patient's head to the right side to acquire a horizontal operation field parallel to the anterior interhemispheric fissure [Figure 2b and c]. A brain spatula connecting the self-retaining retractor is used with its tip on the falx cerebri to prevent the left frontal lobe from falling into the surgical field [Figure 2d].

RESULTS

In the past 6 years, this method has been used in 12 patients with anterior communicating aneurysms. Five patients were women and seven were men. The age range was between 51 and 79 years old with a mean of 64.9 years. Eight aneurysms were ruptured and treated within 3 days after subarachnoid hemorrhage except for one patient, in which the aneurysm ranged from 5 to 18 mm with a mean of 9.2 mm. The falx cerebri was finally cut after splitting the fissure in three patients with large aneurysms. Retraction of the right hemisphere with a brain spatula was usually unnecessary, while the right rectal gyrus was retracted temporarily in the vicinity of the aneurysm. All aneurysms were successfully clipped with minimal damage to the frontal lobe and the olfactory nerves were preserved in all of the patients [Figure 2e and f]. There were no complications related to the procedure.

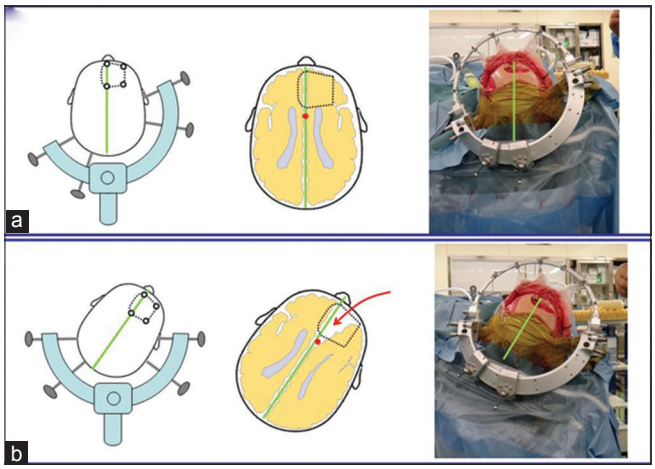

Figure 1: The head is fixed in a Sugita head holder that was rotated 30 degrees counterclockwise before head fixation (a). The head holder is rotated 30 degrees clockwise so that the right frontal lobe falls with gravity after opening the dura (b). The red arrow indicates the approach route from the right side of the patient

DISCUSSION

The horizontal interhemispheric approach was originally developed for a transcallosal approach, because the surgeon can use both hands to manipulate the surgical instruments more efficiently in a horizontal rather than a vertical operation field.[5,6] Another advantage of the horizontal head position is the lower cerebral hemisphere retraction by gravity, while the upper hemisphere is supported by the falx cerebri. The horizontal head position was also utilized in the clipping procedure for distal anterior cerebral artery aneurysms.[3,4] The advantage of the horizontal head position for anterior communicating artery aneurysms was first reported by Hayashi *et al.*[2] They found the method contributed to preservation of the olfactory nerve. However, when using this method for the anterior communicating artery, initial surgical procedures, such as the bicoronal scalp incision and frontal craniotomy, are more difficult because the right side of the patient's head faces downward. We found that a 90-degree head rotation is not needed and a 30-degree head rotation is enough to obtain the gravitational retraction of the lower hemisphere to approach anterior communicating aneurysms. Hayashi *et al.* recommended not using the horizontal head position for a ruptured anterior communicating artery

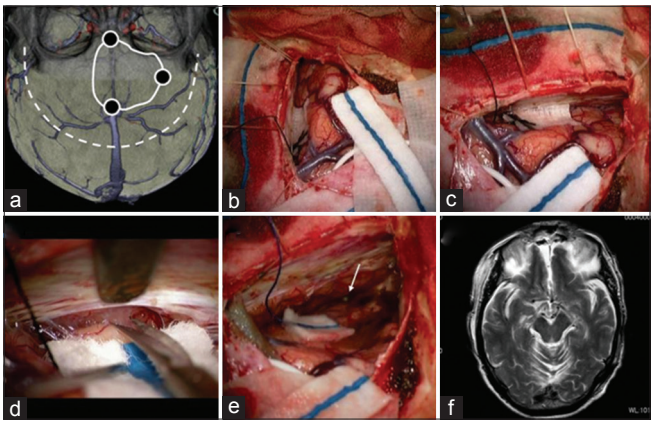

Figure 2: A right-side dominant frontal bone flap is made after bicoronal skin incision for the unilateral approach (a). The head is rotated after opening the dura and the surgeon moves to the right side of the patient to obtain the horizontal operation field (b and c). A brain spatula is used with its tip on the falx cerebri to prevent the left frontal lobe from falling into the surgical field (d). A wide operation field is finally obtained (e). The arrow points to the clip head. The postoperative T2-weighted magnetic resonance image shows minimal damage to the frontal lobe (f)

aneurysm because proximal securing of the left A1 segment was difficult.[2] We found a 30-degree head rotation has an advantage to secure the left A1 segment even in surgeries for a ruptured aneurysm in the acute phase.

If there is a cortical vein at the frontal pole obscuring the operation field in the unilateral anterior interhemispheric approach, the vein can be dissected when it is small. Although, fortunately, there were no large bridging veins in the present series, the surgical approach should be switched from the unilateral interhemispheric approach to the bifrontal basal interhemispheric approach by sectioning the falx to preserve the vein when the bridging vein is large.

Sugita *et al*. reported a multipurpose head frame in 1978.[7] The Sugita frame consists of three semicircular frames of a head holder, a basal frame, and a subframe [Figure 1a]. The basal frame and subframe are connected to the head holder after draping of the patient's head. Self-retaining retractors are connected to the basal frame. Therefore, it is recommended to rotate the head holder counterclockwise before fixation of the head as shown in the present method to keep the basal frame horizontal during the microscopic procedures [Figure 1].

One of the advantages of the Sugita head holder is intraoperative head rotation to obtain an ideal direction of the surgical approach. The head holder has six holes for head pins. Four pins are usually enough to fix the head in adult patients. Therefore, the range of the head holder rotation is 70 degrees in the original model and 90 degrees in the current model using four pins. If you use all six pins in infants, the rotation is almost impossible in the original model and restricted to 20 degrees in the current one. Intraoperative head rotation has a potential risk of slippage of the endotracheal tube or the electric wires for electrophysiological monitoring. Therefore, it is essential to simulate the head rotation before draping and for the anesthesiologist to confirm these during the head rotation.

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