Utility of a High-definition Neuroendoscope in Endoscopic-assisted Microneurosurgery

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Introduction

Many advancements have been made in the field of endoscopic surgery in recent years. Fully endoscopic surgery is being used in pituitary operations and for removing hematoma, and endoscope-assisted surgery has been reported to be useful in craniotomy. We tested a new endoscope capable of producing high-definition images that allow for detailed observations at high resolution, and investigated its utility in endoscope-assisted craniotomies performed.

Methods

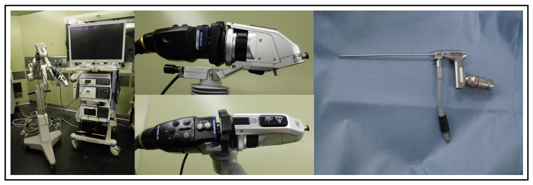
A new endoscope was compared to an old endoscope in endoscope-assisted craniotomies performed at our hospital. Images taken of the same field of view with the new endarm and old endarm were compared in each case. In this study, 47 cases (27 cases of cerebral aneurysm, 12 cases of acoustic schwannoma, 4 cases of microvascular decompression, 4 cases of skull base neoplasm) treated at our hospital from April 1, 2013, to April 1, 2014 were examined.

Results

The new endoscope improved differentiation of perforators and arachnoid trabeculae in aneurysm clipping. In cases of acoustic schwannoma and microvascular decompression, it allowed nerves and tumors to be distinguished at high levels of precision. The new microscope enabled highly precise identification of anatomical structures. However, many issues remain to be resolved, such as the difficulty of evaluating blood flow using the endoscope alone and the inability to obtain 3-dimensional images.

Learning Objectives

By the conclusion of this session, participants should be able to describe the importance of high definition image and neuroenoscope assisted craniotomy.



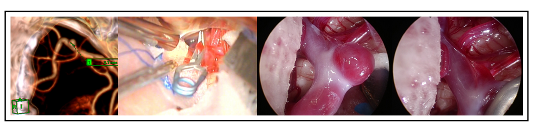
Conclusions

Use of a new, high-definition endoscope in endoscope-assisted craniotomy enabled the operation to be performed with a high degree of precision.

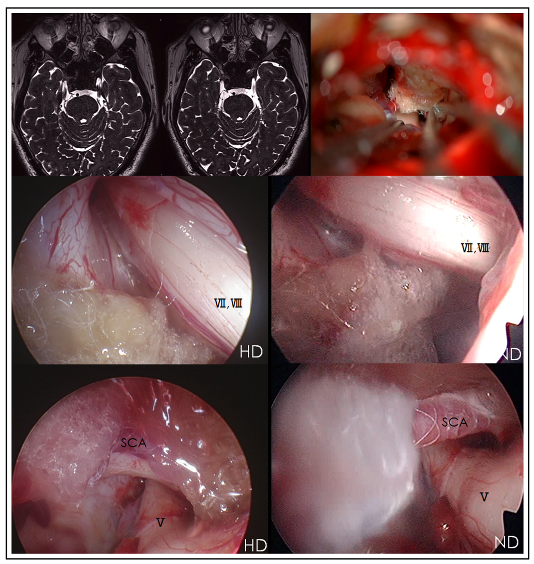
Figure

Left: The main body and endoscope monitor of the new endarm.
Center: The tip of the new endarm. This can be removed for freehand use.
Right: Rigid endoscopes are equipped with 2.7-mm and 4-mm diameters and 30° and 70° tip angles.

Female, 55 years old. Right middle cerebral artery aneurysm. The new endoscope, with a 30° tip angle and a rigid scope, was used.
Left: 3D-CTA (Three-dimensional computed tomographic angiography) showed a saccular aneurysm on the right middle cerebral artery, with early bifurcation immediately proximal to the aneurysm.
Center left: Microscopic image after clipping. The clip was applied while inserting the endoscope from the left side of the screen.
Center right: Endoscopic image before clipping. The early bifurcation can be observed proximal to the aneurysm.
Right: Endoscopic image after clipping. Blood flow in the early bifurcation was preserved.



Male, 51 years old. Right trigeminal neuralgia.
Upper row, left: Preoperative MRI (magnetic resonance imaging) and FIESTA (fast imaging employing steady-state acquisition) images. The right trigeminal nerve is in contact with a tortuous superior cerebellar artery.
Upper row, center: Postoperative MRI and FIESTA images. Pressure on the trigeminal nerve from the superior cerebellar artery has been relieved.
Upper row, right: Inserting the endoscope while confirming with the microscope.
Middle row, left: An image captured using the new endoscope confirms that the internal auditory canal, with the facial nerve, auditory nerve, and superior cerebellar artery, have been lifted with fibrin glue-reinforced Teflon.
Middle row, right: The surgical field in the middle row, left image, as viewed with the old endoscope.
Lower row, left: Image captured using the new endoscope. The superior cerebellar artery that was compressing the trigeminal nerve was lifted with fibrin glue-reinforced Teflon to release pressure. An indentation in the trigeminal nerve, from pressure from the superior cerebellar artery, can be seen.
Lower row, right: The surgical field in the middle row right image as viewed with the old endoscope.



Female, 63 years old. Subarachnoid hemorrhage due to ruptured anterior communicating artery aneurysm. Rigid scopes with 30° tip angles were used on both the new and old endoscopes.
Upper row, left: 3D-CTAshows a forward-facing saccular aneurysm on the anterior communicating artery. Upper row, center: An anterior communicating artery aneurysm observed in a microscopic image. Upper row, right: Microscopic photograph after the clip was applied.
Middle row, left: Imaging with a 30° neuroendoscope inserted from the aneurysm side.
Middle row, center: An image captured with the new endoscope clearly shows the hypothalamic artery originating from the anterior communicating artery, and that the clip fully reaches the tip of the aneurysm. Middle row, right: An image captured with the old endoscope. The tip of the clip can be confirmed, but the hypothalamic artery is somewhat indistinct.
Lower row, left: A view of the aneurysm, from the same side as the anterior communicating artery aneurysm. Lower row, center: An image captured with the new endoscope. The hypothalamic artery can clearly be seen emerging from the anterior communicating artery. Lower row, right: An image captured using the old endoscope of the same surgical field depicted in the center image in the lower row.