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ILLUSTRATIVE ORIGINAL SURGICAL VIDEO

Exoscope-endoscope-assisted minimal invasive contralateral interhemispheric approach for a lateral ventricular subependymal giant cell astrocytoma

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Subependymal giant cell astrocytoma (SEGA) is a slow-growing, WHO grade 1 tumor that often arises near the foramen of Monro within the lateral ventricles and predominantly occurs in patients with tuberous sclerosis complex. Traditionally, transcortical-transventricular and interhemispheric-transcallosal approaches have been established for SEGA resection. In this paper, we present advanced visualization tools such as exoscopes and endoscopes that offer enhanced surgical precision by improving depth perception, illumination, and ergonomics for the resection of SEGA through a minimally invasive contralateral interhemispheric keyhole approach. A 55-year-old lady presented to us with a progressively worsening headache for 1 year. MRI showed a subependymal tumor in the right lateral ventricle, suggestive of SEGA. She was positioned with her head turned to the left. A linear incision was marked across the midline as per the shortest contralateral trajectory in neuronavigation guidance. A left parasagittal keyhole craniotomy was made, and the dura was reflected over the SSS. Under 3D exoscopy, dissection was advanced via an interhemispheric approach, and both pericallosal arteries were identified and safeguarded. Targeted callosotomy was performed after confirmation on navigation. The tumor was grayish, soft, and partly suckable. Following maximal resection with an exoscope, an angled endoscope was introduced to identify hidden slivers of tumor tissue, which were then carefully excised. She improved following surgery, with a post-op scan showing no residual tumor. The histopathology was in favor of SEGA. The exoscopic-endoscopic assisted minimally invasive excision of SEGA demonstrates promise as a safe and effective alternative to traditional microscopy, with particular advantages for deep-seated lateral ventricular tumors where enhanced visualization and improved ergonomics can significantly benefit surgical outcomes.

Keywords: exoscope, endoscope, lateral ventricle, SEGA, minimal invasive

Background

Subependymal giant cell astrocytoma (SEGA) is a benign, slow-growing tumor classified as WHO grade I. It commonly arises in the region of the foramen of Monro within the lateral ventricles and is frequently associated with tuberous sclerosis complex (TSC). SEGA often leads to obstructive hydrocephalus, seizures, and raised intracranial pressure when it enlarges. Traditionally, transcortical-transventricular and interhemispheric-transcallosal approaches are used for SEGA resection, but these techniques can be associated with cortical injury, disconnection syndromes, and postoperative morbidity. Advances in minimally invasive surgery, particularly the use of exoscopes and endoscopes, offer superior depth perception, illumination, and ergonomics, allowing us to access deep-seated ventricular tumors with reduced morbidity (1). Here, we report a case of a minimally invasive exoscope-endoscope–assisted resection of SEGA via a contralateral interhemispheric keyhole approach.

Technique

A 55-year-old woman presented with a progressively worsening headache over 1 year, suggestive of raised intracranial pressure. MRI revealed a subependymal lesion in the right lateral ventricle near the foramen of Monro, consistent with SEGA. Given the deep-seated location and the need for maximal tumor resection, a contralateral interhemispheric keyhole approach was chosen.

The patient was positioned supine with the head rotated to the left. Using neuronavigation, a linear incision was planned across the midline to provide the shortest contralateral trajectory. A left parasagittal keyhole craniotomy was performed, and the dura was reflected over the superior sagittal sinus. The interhemispheric fissure was dissected under 3D exoscopic visualization, and both pericallosal arteries were carefully identified and preserved (**Video 1**). A targeted callosotomy was performed under navigation guidance to enter the contralateral ventricle (**Figure 1**). The tumor was encountered—it appeared grayish, soft, and partly suckable. Gross resection was performed with the exoscope (**Figure 2**), following which an angled endoscope was introduced to inspect blind corners and remove residual tumor tissue (**Figure 3**, **Video 1**).

The patient tolerated the procedure well. Postoperative imaging confirmed near-total excision of the tumor without residual mass obstructing the foramen of Monro. Histopathological examination confirmed the diagnosis of SEGA. Clinically, the patient experienced symptomatic improvement in headaches, and no new neurological deficits were observed postoperatively.

VIDEO 1 | Surgical video of minimally invasive contralateral interhemispheric approach.
https://youtu.be/d1kNcqRsxM8

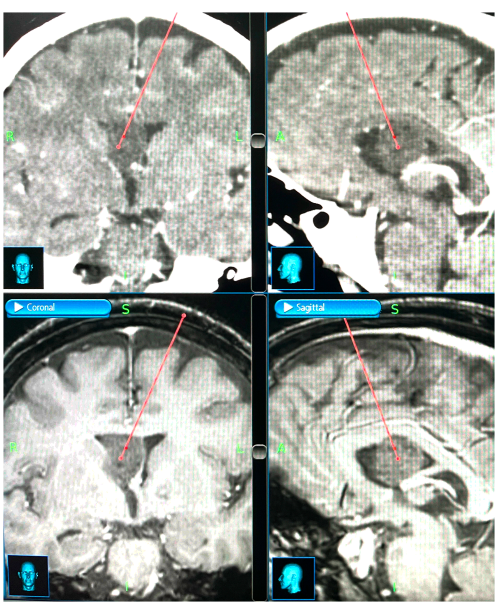

FIGURE 1 | MRI & CT navigation showing the lesion in the right lateral ventricle with the planned surgical trajectory.

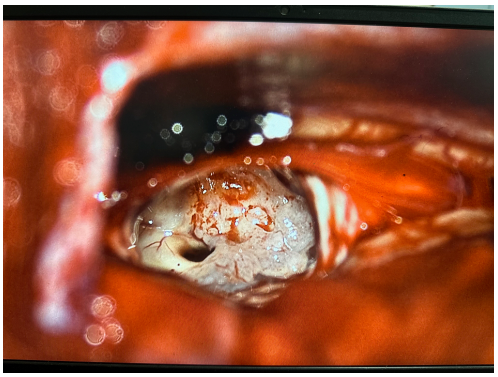

FIGURE 2 | Intraop image showing exoscopic view of tumour resection.

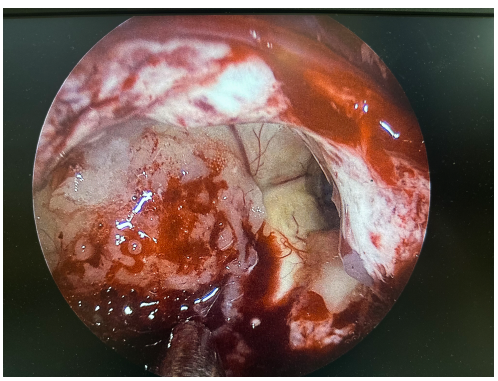

FIGURE 3 | Endoscopic view better delineating the slivers of hidden tumour.

Discussion

The management of SEGA continues to pose a surgical and clinical challenge. Surgical resection remains the definitive treatment for symptomatic or progressively enlarging lesions; the procedure carries notable risks, especially for large or bilateral tumors and in very young children. Kotulska et al. reported that complication rates rise significantly with increasing tumor size, with lesions greater than 3–4 cm demonstrating morbidity rates exceeding 67% (2). This reinforces the need for surgical strategies that minimize collateral injury while achieving maximal safe resection. In our case, the combined use of exoscope and endoscope within a minimally invasive keyhole approach allowed tailored access to the ventricular system with reduced cortical transgression, potentially lowering the complication profile.

A previous study reviewed over 1,700 neurosurgical cases and found that exoscopes provided comparable safety and efficacy to operating microscopes, offering superior ergonomics, visualization, and team involvement in complex cranial and spinal procedures (3). Importantly, combining exoscopic wide-field visualization with angled endoscopy offers complementary advantages—broad, high-definition orientation and the capacity to inspect hidden recesses (4, 5). This hybrid philosophy has also been successfully applied to challenging skull base tumors, where exoscopic clarity and endoscopic versatility jointly expand the safety margin of minimally invasive keyhole surgery (6, 7). Our application of this combined technique to SEGA shows its adaptability to intraventricular tumors, where narrow operative corridors and critical neurovascular anatomy necessitate precision.

Despite the availability of multiple other therapeutic options, such as mTOR inhibitors, such as everolimus, for residual or complex cases, surgical resection remains the most reliable means of achieving durable control in symptomatic, obstructive, or rapidly growing tumors (2). Our case illustrates how advanced visualization can improve operative efficacy and functional preservation, promoting maximum tumor control with minimal perioperative complications.

Conclusion

Exoscope-endoscope–assisted minimally invasive resection of SEGA is a feasible and safe surgical option, particularly for tumors located deep within the lateral ventricles. Compared to conventional microscopic surgery, this approach provides
enhanced visualization, improved ergonomics, and the ability to achieve maximal safe resection while minimizing collateral brain injury. In select cases, it may represent a superior alternative to traditional approaches.

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Conflict of Interest

The authors declare no financial or personal relationships with any organizations that could inappropriately influence the content of this article. The mention of specific brand names or products is solely for accurate identification of the surgical instruments used and does not imply endorsement of one product over another.

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