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Gross total resection of a rare epidermoid cyst in the supplementary motor area without postoperative SMA syndrome. A case report and literature review

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ABSTRACT

Epidermoid cysts rarely occur in the supplementary motor area (SMA), where resection carries a particular risk of postoperative SMA syndrome. We present the case of a 25-year-old woman who developed persistent headache and intermittent dizziness. Preoperative MRI revealed a right medial frontal lesion with low T1, high T2, and restricted diffusion, consistent with an epidermoid cyst. Microsurgical resection was performed via a right interhemispheric approach under neuronavigation. Internal decompression was followed by capsule dissection along the tumor-brain interface. Particular care was taken to preserve bridging veins, avoid fixed retractors, and minimise traction on the SMA cortex. A superficial cortical vein with focal wall irregularity was reinforced with hemostatic material instead of being sacrificed. Gross total removal was achieved with minimal blood loss.

The patient recovered without neurological deficits, was mobilised on the third postoperative day, and was discharged home. Histopathology confirmed the diagnosis. Follow-up MRI at six months showed no recurrence, and her modified Rankin Scale score was 0.

This case highlights that, although SMA epidermoid cysts are exceedingly rare, complete resection with full functional preservation is achievable. Careful surgical planning, venous preservation, and low-traction microsurgical techniques are crucial to avoid SMA syndrome in this eloquent cortical region.

INTRODUCTION

Epidermoid cysts are rare congenital lesions of ectodermal origin, representing only 0.2-1.8% of all intracranial tumors¹. They arise from ectodermal inclusions during neural tube closure² and are usually located in the cerebellopontine angle, sellar region, or fourth ventricle. In contrast, their occurrence in the supplementary motor area (SMA) is exceptionally unusual^{1, 3}.

Keywords

epidermoid cyst,
supplementary motor area,
microsurgery,
SMA syndrome,
neuronavigation



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The SMA occupies the medial aspect of the superior frontal gyrus (Brodmann area 6) and plays an important role in motor planning, initiation of voluntary movement, and speech activation within the dominant hemisphere^{4,5}. Surgical intervention in this particular region is occasionally faced with the specific risk of SMA syndrome, characterized by transient contralateral weakness, mutism, urinary incontinence, and apathy. While recovery usually occurs within days to weeks, these deficits can be distressing for both patients and surgeons^{6,7}. Thus, resection in this eloquent area requires careful balancing of tumor clearance with functional preservation.

Here, we describe the management of a young woman with an epidermoid cyst in the SMA. Using a right interhemispheric approach guided by neuronavigation, gross total resection was achieved without postoperative SMA syndrome. We also review the relevant literature on SMA and parasagittal lesions to place our surgical strategy and outcome in a broader clinical context.

DESCRIPTION

History and Examination

A 25-year-old right-handed female surgical nurse presented with a 2-week history of persistent headache accompanied by intermittent dizziness. She denied nausea, vomiting, motor weakness, dysarthria, or sphincter disturbances. On admission, her neurological examination was normal. Her past medical history was notable only for a previous cesarean section.

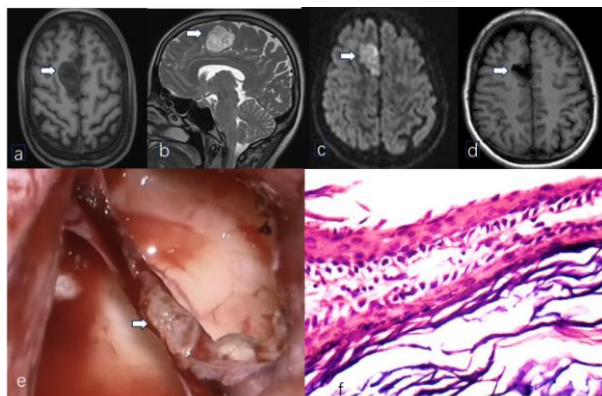


Figure 1 **a.** Axial T1-weighted MRI showing hypointensity. **b.** Sagittal T2-weighted MRI showing hyperintensity **c.** Diffusion-weighted imaging (DWI) demonstrating marked hyperintensity, consistent with an epidermoid cyst. **d.** Axial postoperative MRI

confirming gross total resection of the lesion. **e.** After tumor removal, superficial cortical vein showed thinning and focal irregularity of the wall. **f.** Histopathological examination (hematoxylin–eosin stain, original magnification $\times 200$) showing keratinized stratified squamous epithelium, consistent with an epidermoid cyst

Imaging

Magnetic resonance imaging (MRI) demonstrated a well-circumscribed lesion in the right supplementary motor area (SMA). The mass appeared hypointense on T1-weighted sequences, hyperintense on T2, and showed marked restricted diffusion on diffusion-weighted imaging (DWI). Computed tomography (CT) revealed a hypodense lesion without contrast enhancement. These radiological features were consistent with an epidermoid cyst. (Figure a.b.c)

Surgical Technique

Surgery was performed under general anesthesia, patient was placed positioned supine and the head secured using Mayfield clamp. Neuronavigation was used to localize the lesion and guide the craniotomy. A small right frontal parasagittal bone flap was used to expose the superior sagittal sinus. After the opening of the dural, the interhemispheric fissure was carefully dissected under high magnification, then particular attention was paid to preserve the bridging veins. Sharp dissection of arachnoid adhesions provided access to the lesion.

The removal of the tumor was started with internal decompression, followed by capsule dissection along the tumor-brain interface. Sharp dissection was used to minimize traction on the SMA cortex. Bridging veins and the superior sagittal sinus were preserved carefully during the process. No fixed retractors were applied; instead, minimal dynamic retraction was achieved using gentle suction. Intraoperatively, superficial cortical vein showed thinning and focal irregularity of the wall (Figure e); which was finally wrapped around with hemostatic material rather than sacrifice. The resection cavity was irrigated with saline containing dexamethasone. Gross total resection was obtained, with an estimated blood loss of 50 mL.

Postoperative Course

The patient awoke without motor or language deficits. She was mobilized on postoperative day 3 and discharged home, with normal motor strength and intact cranial nerves. Histopathology confirmed

an epidermoid cyst (Figure d). At 6 months, MRI confirmed no recurrence (Figure d) and her mRS score remained 0.

DISCUSSION

Although intracranial epidermoid cysts are benign and slow-growing, their management in eloquent areas such as the supplementary motor area (SMA) is particularly challenging. The SMA is responsible for motor planning, initiation, and speech activation, and injury to this region or its connections can produce a transient SMA syndrome with contralateral akinesia or mutism^{4–6}.

Most patients recover spontaneously, reflecting a reversible functional disconnection rather than permanent tissue damage^{7,8}.

Functional imaging and electrophysiological studies suggest that postoperative SMA syndrome is associated with temporary disturbance of the inter-hemispheric and intra-hemispheric motor network. Preservation of the cingulum and callosal fibers and maintenance of venous drainage are crucial for rapid functional recovery^{7,8}. After SMA surgery, plastic recruitment of the contralateral SMA and adjacent premotor areas contributes to restoration of motor function^{9,10}.

Compared with intra-axial lesions such as gliomas or meningiomas, epidermoid cysts offer distinct surgical advantages. They are extra-axial, relatively avascular, and possess a well-defined tumor-brain interface, allowing for internal decompression and gentle capsule dissection without traction on the eloquent cortex^{1–3}. Several series have demonstrated that gross or near-total resection achieves excellent long-term control with low recurrence rates^{5,6}. However, when bridging veins or cortical venous complexes are involved, the goal should be complete resection while preserving venous outflow.

In this case, a small parasagittal craniotomy and neuronavigation-guided interhemispheric approach were used to expose and resect the tumor. Cerebrospinal fluid release enabled adequate relaxation, and no fixed retractor was needed. A superficial cortical vein with focal irregularity was reinforced rather than sacrificed, preventing postoperative venous infarction and SMA syndrome. Similar microsurgical strategies—minimal retraction, precise capsule dissection, and venous preservation—have been shown to reduce neurological deficits after SMA and parasagittal lesion surgery^{9,10}.

Table 1. Summary of Reported SMA or Parasagittal Lesion Cases and Postoperative SMA Syndrome

No	Author (Year)	Study type	Lesion type	Surgical approach	Intraoperative adjuncts	SMA syndr.	Rec. time	Key findings / comments
1	Yamakawa et al., 1989 ¹	Retrospective series (n=33)	Intracranial epidermoid (incl. frontal)	Various	None	Not reported	—	Early large series; total removal key to long-term control.
2	Hasegawa et al., 2022 ⁵	Large cohort (n=63)	Intracranial epidermoid cysts	Various	Neuronavigation, microsurgery	—	—	Extent of resection determines recurrence; GTR safest.
3	Schembri & Grech, 2015 ⁷	Case report	Interhemispheric epidermoid cyst	Interhemispheric	Neuronavigation	None	—	Demonstrates rare parasagittal location; full recovery.
4	Pinson et al., 2022 ⁹	Review	SMA lesions (various tumors)	Various	Mapping, MEP	33–75%	2–8 weeks	Comprehensive SMA-syndrome review; deficits

								usually transient.
5	Palmisciano et al., 2022 ¹⁰	Systematic review	SMA tumors	Various	Mapping, MEP	30–70%	2–12 weeks	Recovery correlates with preserved SMA–cingulate network.
6	Potgieser et al., 2014 ¹¹	Review/fMRI analysis	SMA syndrome (functional study)	—	—	Yes (transient)	—	SMA syndrome due to reversible network dysfunction.
7	Acioly et al., 2015 ¹⁵	fMRI case study	Medial frontal tumor	Interhemispheric	fMRI-guided mapping	Present	3 weeks	Contralateral SMA recruitment supports recovery.
8	Berg-Johnsen et al., 2018 ¹⁶	Case series	Parasagittal meningioma	Interhemispheric	Mapping, MEP	43%	2–6 weeks	SMA syndrome frequent but transient; low morbidity.
9	Tsai et al., 2022 ¹⁷	Case report + review	Parasagittal meningioma	Interhemispheric	Navigation, MEP	Present	4 weeks	Low-traction microsurgery ensures full recovery.

SMA, supplementary motor area; CPA, cerebellopontine angle; MEP, motor evoked potential; GTR, gross total resection; fMRI, functional magnetic resonance imaging.

A summary of reported SMA and parasagittal lesions, including lesion type, approach, and functional outcome, is presented in Table 1. Across published series, the incidence of SMA syndrome after tumor surgery ranges from 30% to 75%, but symptoms are almost always transient.

Our experience confirms that, with careful microsurgical planning and functional awareness, gross total resection of an epidermoid cyst in the SMA region can be achieved without postoperative SMA syndrome.

CONCLUSION

SMA epidermoid cysts are exceptionally rare. Combining precise preoperative planning, neuronavigation, low-traction microsurgical techniques, and venous preservation can enable gross total resection without SMA syndrome. This case reinforces that eloquent cortex tumors can be resected safely while preserving neurological function.

ABBREVIATIONS

SMA = Supplementary Motor Area;
MEP = Motor Evoked Potential;
SEP = Somatosensory Evoked Potential;
MRI = Magnetic Resonance Imaging;
DWI = Diffusion Weighted Imaging;
CT = Computed Tomography.

REFERENCES

1. Yamakawa K, Shitara N, Genka S, Manaka S, Takakura K. Clinical course and surgical prognosis of 33 cases of intracranial epidermoid tumors. *Neurosurgery*. 1989;24:568–73.
2. Samii M, Tatagiba M, Piquer J, Carvalho GA. Surgical treatment of epidermoid cysts of the cerebellopontine angle. *J Neurosurg*. 1996;84:14–19.
3. Schembri M, Grech R. Interhemispheric epidermoid cyst. *BMJ Case Rep*. 2015;2015:bcr2015213393.
4. Pinson H, Martens G, Deblaere K, Van Roost D. The supplementary motor area syndrome: a neurosurgical review. *Acta Neurochir (Wien)*. 2022;164:2431–45.

5. Palmisciano P, Haider AS, De Leo A, et al. Supplementary motor area syndrome after brain tumor surgery: a systematic review. *World Neurosurg.* 2022;165:e132–45.
6. Hasegawa H, Vakharia K, Carlstrom LP, et al. Long-term surgical outcomes of intracranial epidermoid tumors. *J Neurosurg.* 2022;136:1592–600.
7. Potgieser ARE, de Jong BM, Wagemakers M, Groen RJM. Insights from the supplementary motor area syndrome. *Front Hum Neurosci.* 2014;8:960.
8. Berg-Johnsen J, Torp SH, Solheim O. Supplementary motor area syndrome after surgery for parasagittal meningiomas. *Acta Neurochir (Wien).* 2018;160:1195–203.
9. Tsai CC, Su YF, Tsai FJ, Wu CT, Lin JW. Supplementary motor area syndrome after removal of parasagittal meningioma. *Medicina (Kaunas).* 2022;58:1126.
10. Acioly MA, Cunha AM, Parise M, Rodrigues E, Tovar-Moll F. Recruitment of contralateral supplementary motor area in functional recovery. *J Neurol Surg A Cent Eur Neurosurg.* 2015;76:508–12.