Total removal of a parasagittal meningioma of the posterior third of the sagittal sinus and its repair by autogenous vein graft

Case report

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Total removal is reported of a parasagittal meningioma that invaded the lateral wall and lateral recess of the posterior third of the superior sagittal sinus. The operation was performed by using a silicone rubber non-collapsible tube with an inflatable balloon cuff at each end for the bypass of the sinus blood, and entailed repair of the defect in the sinus wall by a saphenous vein graft. The clinical results and angiographic findings are presented.

KEY WORDS • parasagittal meningioma • superior sagittal sinus • autogenous saphenous vein graft • silicone rubber tube • venous microsuture

In the management of parasagittal meningiomas partially involving the superior sagittal sinus, incomplete removal of their extension into the dura often results in recurrence.4-10 Resection en bloc of a still functioning sinus may increase mortality and morbidity. Recently, Bonnal and Brotchi1 reported a technique to repair the sagittal sinus after total excision of the intrasinus portion of a parasagittal meningioma attached to the middle third of the sinus. Working with dogs, Sindou, et al.,12 carried out experimental bypass of the superior sagittal sinus with venous or arterial autogenous grafts. Several clinical cases involving repair of a traumatic injury of the sinus with autogenous vein graft have been reported.2,6,7,9,11 Donaghy, et al.,9 recommended a two-stage operative procedure to repair a traumatic injury of the sinus. The first step is immediate implantation of a vascular T-tube for making possible sinography, aspiration of the clot, and a rapid restoration of continuity of blood flow; at the second stage, the T-tube is replaced by an intima-lined stent. Kapp, et al.,6,7 recommended installation of a siliconized tube through the wound in the dural sinus to provide an internal dural sinus shunt.

In this paper, we describe the use of a special shunting tube in the removal of a part of the lateral wall of the posterior third of the superior sagittal sinus invaded by a parasagittal meningioma. The tube permits extracorporeal circulation of the venous blood in the sinus to bypass the area of tumor involvement during its resection and repair with autogenous vein graft.

Case Report

A 56-year-old woman was admitted to our service in April, 1978, complaining of frequent transient episodes of weakness in all her extremities. Nine months before admission, she had the sudden onset of faintness and weakness of all limbs, without loss of consciousness, while climbing stairs. She also noted a left lateral deviation of both eyeballs, lasting several hours. Twenty days after this, she had a sudden attack of cold sensation descending from the left arm to the left leg lasting for 30 minutes. She was admitted to a hospital and bilateral carotid angiography failed to show a mass lesion. After discharge, transient episodes of weakness in all her limbs occurred once or twice a week. No history of headache, nausea and vomiting, impairment of consciousness, or visual disturbance was noted.

Examination. There were no obvious abnormalities on physical and neurological examinations. Elec-
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FIG. 1. Preoperative right carotid angiogram. \textit{Left}: The tumor shadow (large arrows) and the prominent occipital artery feeding the tumor (small arrows) can be seen. \textit{Right}: Venous phase shows irregular filling defects of the superior sagittal sinus (arrow).

troencephalogram and visual field testing were normal. Plain x-ray films of the skull and cervical spine showed nonspecific findings. A computerized tomography (CT) scan disclosed a homogeneous high-density area, 3.3 cm in diameter, in the right posterior parasagittal area, with a minor shift of the falk to the contralateral side, and a large irregular low-density area in the white matter of the right cerebral hemispheres around the lesion. Technetium-99m brain scan demonstrated a high-uptake area in the right posterior parietal region.

A magnified subtraction view of a right carotid angiogram, late arterial to early capillary phase, showed tumor staining, $3 \times 3.5$ cm, in the posterior parietal area, and a prominent tumor feeder from the occipital artery (Fig. 1 \textit{left}). The venous phase revealed irregular filling defects in the wall of the superior sagittal sinus along the attachment of the tumor (Fig. 1 \textit{right}). These findings were strongly suggestive of a parasagittal meningioma involving the posterior third of the superior sagittal sinus.

Operations. On May 5, 1978, under endotracheal general anesthesia, the patient was placed in a semi-sitting position with the table tilted so that the head was elevated 30° from the horizontal plane, then the head was flexed anteriorly and tilted 45° from the sagittal plane toward the opposite side of the tumor. A right temporoparieto-occipital bone flap with its medial edge about 1 cm from the midsagittal line was elevated and hinged to the temporal muscle. An additional free bone flap over the midline was carefully elevated so that the superior sagittal sinus could be explored. Involved bone was excised. A spherical, partially encapsulated mass was revealed; it was pinkish white, rubbery, and relatively hard, measuring $4 \times 3.5 \times 3$ cm in size. The tumor was removed piecemeal, without injury to the bridging veins, with the help of magnifying glasses and a bipolar coagulator; a small part of the mass invading the sinus was left.

At the next step, both tips of a silicone rubber tube 18 cm long (3.5 mm in interior diameter, 5 mm in outer diameter)* were then introduced into the superior sagittal sinus through incisions made on the sinus distal and proximal to the tumor attachment. Major bleeding was controlled by inflating the balloons at

\*Silicone rubber tube manufactured by Marui Ika Co., 2-31-27 Yuzima, Bunkyo-ku, Tokyo 113, Japan.
Removal of meningioma with repair of sagittal sinus

FIG. 3. Left: Schematic drawing of the parasagittal meningioma. The sinus (S.S.) is patent and the tumor is shown invading the lateral wall and lateral recess of the sinus. H.C. = healthy hetero-lateral cortex; D = dura mater. Right: Specimen removed at operation. The internal surface of the lateral wall of the superior sagittal sinus, disclosing multiple nodules (upper part) protruding into the sinus, but not large enough to occlude it.

each end of the tube (Fig. 2). After removal of the lateral wall and the lateral recess of the superior sagittal sinus invaded by the tumor (Fig. 3), venous grafting with an autogenous saphenous vein, 5 cm in length and 1.5 cm in width, obtained from the right thigh, was performed by continuous suture with 4-0 Dexon suture† under the surgical microscope. After removing the silicone rubber tube, the incisions in the sinus made for insertion of the tube were closed (Fig. 4). Total blood loss during the whole procedure was 2000 ml. Histological diagnosis was a mixed form of fibroblastic and meningiotheliomatous meningioma.

Postoperative Course. The patient had an uneventful recovery without neurological deficits. One month after operation, right carotid angiography demonstrated good patency of the superior sagittal sinus (Fig. 5). In a CT scan, no detectable mass shadow was demonstrated.

Discussion

There is general agreement that the patent superior sagittal sinus can be safely ligated or resected en bloc only in the anterior third of the vessel. In the management of parasagittal meningiomas involving the posterior portion of the superior sagittal sinus, cerebral edema and/or infarction causing death or severe neurological deficits almost always occurs after excision of a still-functioning sinus or occlusion of its tributary veins.1,2,4,5,8,10,12 Because of the anatomical structure of the major intracranial sinuses and the frequent entry of bridging veins along their course, application of clamps or tourniquets from outside is not an easy procedure.

To avoid unnecessary blood loss during repair of the sinus with autogenous vein graft after excision of the wall of the central third of the vessel invaded by

†Dexon, a polyglycolic acid synthetic and absorbable suture, supplied by American Cyanamid Co., Pearl River, New York.
meningioma, Bonnal and Brotchi\textsuperscript{1} used digital compression on both openings of the sinus. However, the posterior third of the sagittal sinus cannot easily be occluded with finger pressure for a prolonged period because rapid and extensive brain swelling and herniation of the brain secondary to venous obstruction will occur.\textsuperscript{7,8} Therefore, in parasagittal meningiomas partially involving the posterior third of the sinus, as in our case, a shunt should be used to preserve blood flow while excising and repairing the involved portion of the sinus wall. Major bleeding is easily controlled by inflating balloons within the lumen on each end of the shunt to occlude the sinus. In our case, annoying bleeding occurred from bridging veins opening into the sinus between the balloons, but we did not occlude these vessels for fear of damaging them, as recommended by Kapp, \textit{et al}.\textsuperscript{7}

The shunt we have described can be used to reduce blood loss, and to eliminate the problem of brain herniation due to severe generalized venous distention during resection and repair of the posterior third of the sagittal sinus.

\textbf{References}


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