Allergic Reaction Following Arachnoid Plasty With a Fibrin Sealant
—Case Report—

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Abstract
A 65-year-old woman underwent surgical treatment of an unruptured aneurysm in the left middle cerebral artery. Surgical craniotomy using arachnoid plasty with a fibrin sealant was completed without incident, but abrupt neurological deterioration occurred on the 9th postoperative day. Antibiotic treatment was given, but the symptoms did not resolve. Neuroimaging and physical findings indicated allergic reaction rather than infectious process. Therefore, systemic steroids were administered that resulted in dramatic resolution of symptoms. Nine months later, lymphocyte stimulation test of materials used in arachnoid plasty revealed positive response to a component of the combination pair in fibrin glue. The fibrin sealant placement method is a widely accepted and familiar technique, but surgeons should anticipate possible allergic reactions such as those observed in the present case.

Key words: fibrin glue, arachnoid plasty, craniotomy, allergic reaction, lymphocyte stimulation test

Introduction
The use of an intradural fibrin sealant was first reported as “cortical gluing” in 1991.4) Thereafter, several studies have reported the application of fibrin glue placement methods in covering unfolded sylvian fissures, so preventing postoperative subdural hygroma and contributing to the improvement of clinical outcomes in aged patients.6,7,11,13,14) Currently, this manipulation is widely accepted as an excellent option in arachnoid plasty. Arachnoid plasty with only fibrin sealant,6,13) and combined with collagen sheets7,14) or gelatin sponges10) has been reported. Allergic reactions to these hemostatic agents are possible,6,11,14) but antigenicities are estimated to be low. Anaphylactic shock has been reported after fibrin sealant injection for spontaneous spinal cerebrospinal fluid (CSF) leaks,12) and aseptic meningitis caused by an allergic reaction to fibrin glue used in microvascular decompression.15) In all these cases, remissions were achieved by administration of steroids. We report a case of an allergic reaction toward a type of fibrin glue used in arachnoid plasty.

Case Report
A 65-year-old woman came to our institution for surgical treatment of an unruptured aneurysm in the left middle cerebral artery. She provided informed consent for undergoing the procedure. Left frontotemporal craniotomy was performed using the pterional approach. After clipping, arachnoid plasty using absorbable gelatin sponge (Gelfoam®; Pfizer Inc., New York, N.Y., U.S.A.) and fibrin glue (Beriplast® P Combi-Set; CSL Behring LLC, King of Prussia, Pa., U.S.A.) and water-tight dural closure were performed according to the reported method.11) No remarkable events occurred during the first 8 days of the postoperative period. However, on the 9th postoperative day, the patient suddenly suffered aphasia and mild right hemiparesis.

Immediate neuroimaging evaluation was negative for intracranial bleeding and cerebral infarction. Fluid-atenuated inversion recovery (FLAIR) magnetic resonance (MR) imaging showed hyperintensity along the sulci in the operative field, and T1-weighted imaging indicated some mild hypertrophic transformation findings in the operative field (Fig. 1). T1-weighted MR imaging with gadolinium showed only the postoperative changes. We decided to administer antibiotic therapy due to the possibility of aggravated latent infection.

Physical examination revealed mild fervescence and no stiffness of the neck. White blood cells and C-reactive protein levels were not elevated. Differential white blood cell count was not performed. CSF examination was unavailable because the patient was not cooperative. The antibiotic treatment was continued for 3 days, but her symptoms did not change. Cerebral angiography was performed 3 days...
Fig. 1 Magnetic resonance images obtained 2 months before the operation (A), 6 days after the operation (B), just after symptom onset (C), and 9 months after the event (D), showing no significant ischemic complication throughout the period. Hyperintensity corresponding to subdural empyema was negative on diffusion-weighted images (left column, white arrows). Hyperintensity was noted along the sulci in the operative field on fluid-attenuated inversion recovery images (center column, black arrowheads) and these findings gradually progressed (C, white arrowheads), whereas the same regions appeared hypointense on diffusion-weighted images, which suggested some inflammatory reaction rather than postoperative subarachnoid hemorrhage. Some mild hypertrophic transformation findings were shown on the surface of the operative field on the T1-weighted images (right column, black arrow), but no mass effect was observed. These findings seemed to be characteristic and had entirely disappeared 9 months later (D).

Fig. 2 Digital subtraction angiograms before surgery (upper row) and during the middle period of neurological deterioration (lower row), showing obscure stains on the left middle cerebral artery in the early arterial phase (arrows) suggesting some inflammatory change. Such findings were absent on preoperative angiography.

after the onset of symptoms. In the early arterial phase, obscure stains were observed on the left middle cerebral artery thought to be a result of some inflammatory change (Fig. 2). Allergic reaction caused by arachnoid plasty using hemostatic agents was thought to be a plausible cause of the neurological deterioration. Intravenous steroid administration was initiated just after angiography without discontinuing the antibiotic treatment. Dramatic resolution of symptoms was observed within few hours, and the patient achieved complete recovery on the following day. Systemic steroid administration was continued for 3 days (250 mg of methylprednisolone sodium succinate [Solu-Medrol®; Pfizer Inc.] administered intravenously per day). On the 5th day, following termination of steroid therapy, the patient was discharged without neurological symptoms. The entire clinical course is summarized in Fig. 3. No relapse was observed during the 1-year follow-up period.

Nine months after the event, a lymphocyte stimulation test (LST) with the patient’s serum and hemostatic agents used was performed after obtaining the patient’s informed consent. A positive response (200%) was found against combination A (a mixture of fibrinogen, factor XIII, aprotinin, etc.), and negative responses against combination B (thrombin and calcium carbide) and gelatin (Gelfoam® base).

Discussion

In the present case, we speculate that the observed symptoms were due to an allergic reaction. Hyperintensity along the sulci in the operative field on FLAIR imaging could have been due to inflammatory transformation. The dramatic remission after steroid administration may support our speculation.

The glue consisted of combinations A and B.6,11,13) These materials are thought to be effective in preventing not only liquorhea, but also postoperative subdural hygroma following arachnoid plasty.6,7,11,13,14) However, several allergic reactions have been reported due to hypersensitivity to aprotinin.2,5,7,12,15,16) These findings should be more widely known.

The other material used for arachnoid plasty, Gelfoam®, can be embedded in the operative field. However, a case of paresis of the bilateral lower limbs was caused by an em-
bedded gelatin sponge. Complications have also been caused by absorbable hemostatic agents (oxidized cellulose or collagen sheets). "Mass effect" is representative of complications arising from these hemostatic agents, including Gelfoam, and may differ from the present case with respect to the onset of complications. Resorption of these materials depends on the quantity, so the minimum usage is recommended.

In the present case, the LST results suggest that neurological deterioration was caused by allergic reaction to combination A. This part of the investigation was performed 9 months after the event, as false-negative results are frequently obtained immediately after the onset of an allergy. However, it is difficult to conclude which causative element caused the allergic response, but readministration of aprotinin or fibrinogen to this patient would certainly be extremely hazardous. The fibrin sealant placement method is an excellent technique and has received wide recognition, but surgeons should anticipate possible allergic reactions like those observed in the present case.

References


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