

Case Report

Fibrin glue injection into the hematoma cavity for refractory chronic subdural hematoma: A case reportSaiko Watanabe, Kenichi Amagasaki, Naoyuki Shono¹, Hiroshi NakaguchiDepartment of Neurosurgery, Mitsui Memorial Hospital, ¹Department of Neurosurgery, Tokyo University, Tokyo, JapanE-mail: *Saiko Watanabe - s-watanabe@mitsuihosp.or.jp; Kenichi Amagasaki - amagasaki@mitsuihosp.or.jp; Naoyuki Shono - nshono@mbp.nifty.com; Hiroshi Nakaguchi - hnakaguti@gmail.com

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Abstract**Background:** Repeat burr hole irrigation and drainage has been effective in most cases of recurrent chronic subdural hematoma (CSDH), however, refractory cases require further procedures or other interventions.**Case Description:** An 85-year-old male presented with left CSDH, which recurred five times. The hematoma was irrigated and drained through a left frontal burr hole during the first to third surgery and through a left parietal burr hole during the fourth and fifth surgery. The hematoma had no septation and was well-evacuated during each surgery. Antiplatelet therapy for preventing ischemic heart disease was stopped after the second surgery, the hematoma cavity was irrigated with artificial cerebrospinal fluid at the third surgery, and the direction of the drainage tube was changed to reduce the postoperative subdural air collection at the fourth surgery. However, none of these interventions was effective. He was successfully treated by fibrin glue injection into the hematoma cavity after the fifth surgery.**Conclusion:** This procedure may be effective for refractory CSDH in elderly patients.**Key Words:** Chronic subdural hematoma, fibrin glue, recurrence, refractory**Access this article online****Website:**www.surgicalneurologyint.com**DOI:**

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Quick Response Code:**INTRODUCTION**

Chronic subdural hematoma (CSDH) is the most common disorder encountered in daily neurosurgical practice, and the incidence increases with higher age.^[5] Burr hole craniostomy and irrigation with or without closed drainage is considered to be the first-line treatment with a low rate of complications. However, high postoperative recurrence rates of up to 20% have been reported.^[3,7,17,21] Repeat surgery has been effective in most cases of recurrent CSDH, however, refractory cases require further procedures or other interventions. We successfully treated an elderly patient with refractory CSDH by fibrin glue injection into the hematoma cavity.

CASE REPORT

An 85-year-old male, who had been able to walk with a wheeled walker and had no definitive cognitive problem, was admitted to our hospital because of mild disturbance

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of consciousness and right hemiparesis. He had no history of head trauma but had been taking oral antiplatelet agent for previous ischemic heart disease. Computed tomography (CT) revealed left CSDH with moderate rightward midline shift [Figure 1, left]. Emergency irrigation and drainage through a left frontal burr hole was performed under local anesthesia. Thick outer membrane was observed during the operation. After removal of the hematoma with irrigation [Figure 1, right], a drainage tube was placed posteriorly. His symptoms disappeared immediately and he was discharged after 12 days. He visited our hospital again because of headache and mild right hemiparesis 8 days after the discharge. CT revealed recurrence of the CSDH [Figure 2, left]. Second irrigation and drainage was performed similar to the first operation. His symptoms improved, however, he was transferred to a rehabilitation hospital because of general muscle weakness 37 days after the surgery. The oral antiplatelet medication was stopped after the second surgery. Fifteen days after the transfer, he was admitted to our hospital again because of right hemiparesis. CT showed recurrent CSDH [Figure 2, right], and hence we considered applying middle meningeal artery (MMA) embolization to him. However, because his previous imaging studies revealed severe arteriosclerosis, we abandoned the procedure. Instead, we performed third irrigation and drainage through the same burr hole. The hematoma cavity was irrigated with artificial cerebrospinal fluid (CSF). The right hemiparesis disappeared after the surgery. The patient was admitted to observe any recurrence of CSDH as well as for rehabilitation. Twenty-seven days after the third surgery, he suffered gait disturbance, and CT revealed recurrent CSDH [Figure 3 left]. Fourth irrigation and drainage through another burr hole on the left parietal convexity was performed. The drain was placed anteriorly to reduce postoperative air collection [Figure 3, right]. Unfortunately, the CSDH recurred with mild right hemiparesis after 9 days [Figure 4, left].

Fifth surgery was supplemented by a simple noninvasive treatment, fibrin glue injection into the hematoma

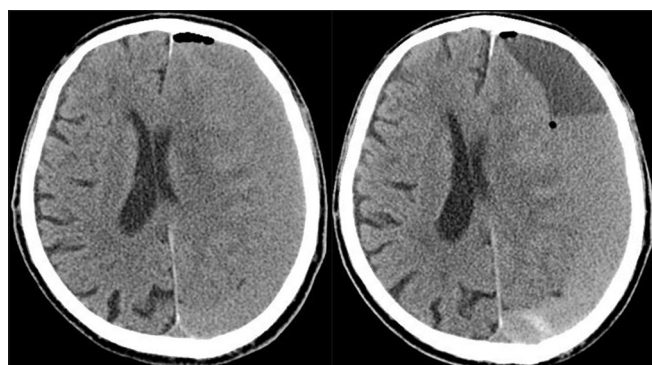


Figure 1: CT scan on admission showing left CSDH with moderate rightward midline shift (left). CT scan obtained 1 day after first burr hole irrigation and drainage showing the hematoma is replaced with air collection (right)

cavity through the drainage tube. Fifth irrigation and drainage through the former parietal burr hole was performed, the hematoma was removed and the cavity thoroughly irrigated, and then a drainage tube was placed anteriorly toward the frontal tip, minimizing the hematoma cavity. On the following day, CT confirmed the collapsed hematoma cavity with minimum air collection [Figure 4, right]. After obtaining informed consent, fibrin glue was injected through the drainage tube. The patient was placed in the left lateral position so that the affected side was lower. First, 12 ml of the residual hematoma was carefully evacuated through the drainage tube. Then, 5 ml of solution A of fibrin glue (Beriplast® P Combi-Set, Aventis Behring GmbH) was injected through the drainage tube and flushed with a few ml of saline, and subsequently 5 ml of solution B was injected. Finally, the drainage tube was slowly pulled away during flushing with a few ml of saline [Figure 5]. No harmful event occurred during and after the procedure. CSDH did not recur after the procedure and the patient was discharged. No further recurrence was confirmed in 6 months after the treatment [Figure 6], and the patient has been free from symptoms for over 2 years.

DISCUSSION

CSDH is generally considered to be benign. The goal of the treatment is to return the patients to previous daily life regardless of age, and is successful in most patients. However, the recurrence rates are not particularly low,^[3,7,17,21] and the clinical course is not always benign, especially for elderly patients,^[12] with greater perioperative risk in patients aged over 85 years.^[2] The implications in daily neurosurgical practice are that burr hole surgery does not involve high risk, however, recurrence and reduced daily activity with comorbidity may occur in elderly patients. Therefore, repetition of the accepted procedure should be the first choice to avoid perioperative risks for elderly patients with recurrent CSDH. However, management may present difficulties after further recurrence.

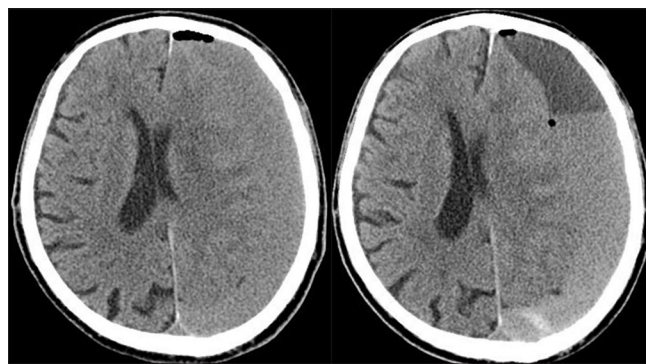


Figure 2: CT scans before the second surgery (left) and the third surgery (right)

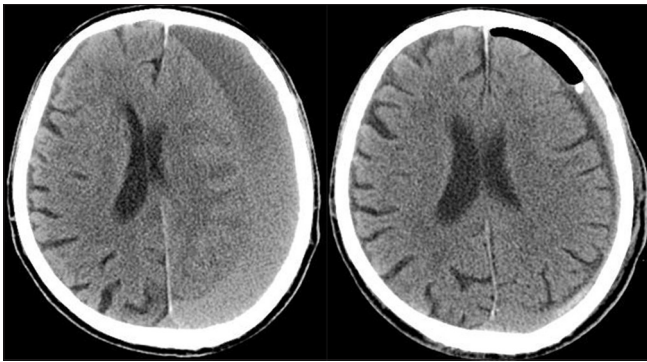


Figure 3: CT scans obtained before (left) and 1 day after (right) the fourth surgery. The tip of the drainage tube is placed on the frontal side and the subdural air collection is reduced compared to the finding after the first surgery (Figure 1, right)

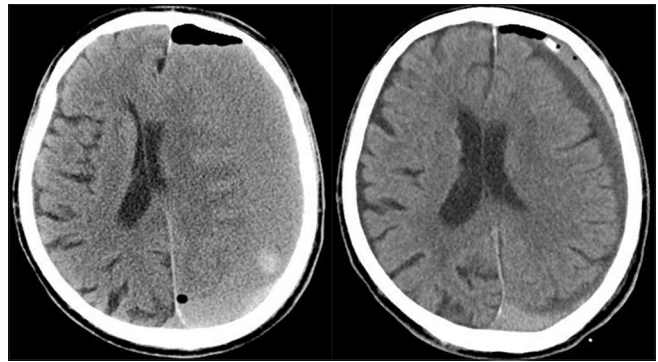


Figure 4: CT scans obtained before (left) and 1 day after (right) the fifth surgery. The tip of the drainage tube is placed more anteriorly with thin subdural space with minimum air collection

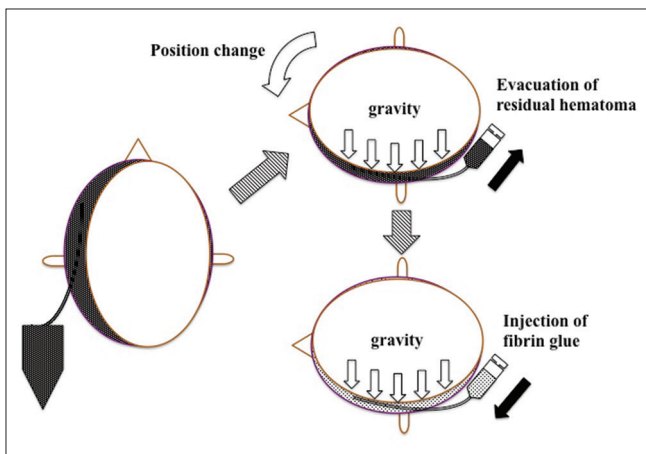


Figure 5: The patient was placed in the left lateral position. Through the drainage tube, 12 ml of the residual hematoma was evacuated, and then they were injected in order of 5 ml of solution A of fibrin glue, few ml of saline, and 5 ml of solution B. Finally, the drainage tube was slowly pulled away during flushing with a few ml of saline

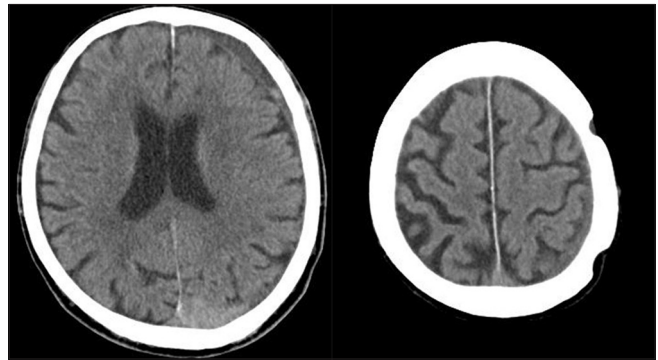


Figure 6: CT scans obtained 6 months after fibrin glue injection into the hematoma cavity. No further recurrence is apparent

Various therapeutic options with burr hole surgery have been described to reduce the recurrence of CSDH, including postoperative drainage,^[8] direction of the drainage tube,^[15] and irrigation with artificial CSF.^[1,19] Such procedures may avoid recurrence, however, various risk factors may result in further recurrence for elderly patients, such as atrophic brain resulting in postoperative subdural air collection,^[15,19] or antiplatelet or anticoagulant agents given for comorbid disease.^[3,7,21-22]

In our case, the antiplatelet therapy was stopped after the second surgery, the hematoma cavity was irrigated with artificial CSF at the third surgery, and the drainage tube was inserted in the frontal direction to reduce postoperative subdural air collection during the fourth surgery. However, none of these interventions was effective. Therefore, some other therapeutic option was required. Possible procedures include craniotomy with removal of the outer membrane,^[10] reservoir implantation,^[16] shunt implantation,^[13] endoscopic resection of neomembranes,^[4] and embolization of the

MMA.^[9,11] However, we selected a less invasive treatment, fibrin glue injection in the hematoma cavity, because of the high age of our patient.

Pathological studies of the outer membrane have suggested that the membrane proliferates with vascularization with or without inflammatory change.^[14] Continuous blood accumulation with enhanced vascularity must be present in the outer membrane of refractory cases, and the blood can be supplied through the dura mater.^[20] Embolization of the MMA is intended to terminate the vascular supply of the outer membrane from outside. If such a procedure is effective, hemostasis should also be possible from inside.

Review of the postoperative course of our case before the fifth surgery showed that the hematoma had a smooth density gradient with no septation, and each surgical evacuation of the hematoma had been effective. These findings implied that large areas of the outer and inner membranes were exposed in the single hematoma cavity after drainage. Therefore, fibrin glue injection could be effective for hemostasis as well as to maintain collapse of the cavity. However, various tactics have been considered to accomplish maximum spread of the limited volume of fibrin glue over the large area of membrane. The subdural dead space should be minimized and deep placement of

the drainage tube in the cavity should be advantageous for optimum injection of the fibrin glue. Therefore, the drainage tube was intentionally inserted deeply toward the frontal tip to reduce air collection during the fifth surgery [Figure 4, right]. The left lateral position was considered to be preferable for the injection because the hematoma cavity might be narrowed by gravity. Furthermore, measures were taken to avoid dilution of the fibrin glue in the cavity and setting of the glue in the tube during the injection. Drainage for 1 day was presumably helpful for emptying the irrigation fluid that could dilute the glue. In addition, the residual hematoma was gently removed to avoid dilution before the injection. The tube was flushed with the minimum volume of saline to avoid setting in the tube and for maximum injection.

The observed effectiveness of fibrin glue injection for the prevention of further recurrence in our case may suggest the pathophysiology of the development and evolution of CSDH. Presumably, a cycle of microbleeding with changes in coagulation and fibrinolysis in the hematoma cavity occurs during proliferation of the outer membrane.^[6] Fibrin glue contains fibrinogen, thrombin, coagulation factor XIII, calcium chloride, and aprotinin. Therefore, any of these factors may have been important for breaking the vicious cycle of hematoma production. For example, reduction in recurrence of CSDH by irrigation with thrombin solution has been reported.^[18]

After the present case, we have had no other patients suffering from refractory CSDH with the need for fibrin glue injection. We recognize the limitation of single case presentation and further study is needed to validate this technique. However, we believe that fibrin glue injection is an effective treatment option for recurrent CSDH. This therapy may depend on optimal placement of the drainage tube with adequate evacuation of hematoma, but is minimally invasive and may be suitable for refractory cases.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Adachi A, Higuchi Y, Fujikawa A, Machida T, Sueyoshi S, Harigaya K, et al. Risk factors in chronic subdural hematoma: Comparison of irrigation with artificial cerebrospinal fluid and normal saline in a cohort analysis. *PLoS One* 2014;9:e103703.
- Borger V, Vatter H, Oszvald A, Marquardt G, Seifert V, Guresir E. Chronic subdural haematoma in elderly patients: A retrospective analysis of 322 patients between the ages of 65-94 years. *Acta Neurochir* 2012;154:1549-54.
- Chon KH, Lee JM, Koh EJ, Choi HY. Independent predictors for recurrence of chronic subdural hematoma. *Acta Neurochir* 2012;154:1541-8.
- Hellwig D, Kuhn TJ, Bauer BL, List-Hellwig E. Endoscopic treatment of septated chronic subdural hematoma. *Surg Neurol* 1996;45:272-7.
- Karibe H, Kameyama M, Kawase M, Hirano T, Kawaguchi T, Tominaga T. Epidemiology of chronic subdural hematomas. *No Shinkei Geka* 2011;39:1149-53.
- Kawakami Y, Chikama M, Tamiya T, Shimamura Y. Coagulation and fibrinolysis in chronic subdural hematoma. *Neurosurgery* 1989;25:25-9.
- Leroy HA, Aboukais R, Reyns N, Bourgeois P, Labreuche J, Duhamel A, et al. Predictors of functional outcomes and recurrence of chronic subdural hematomas. *J Clin Neurosci* 2015;22:1895-900.
- Liu W, Bakker NA, Groen RJ. Chronic subdural hematoma: A systematic review and meta-analysis of surgical procedures. *J Neurosurg* 2014;121:665-73.
- Mandai S, Sakurai M, Matsumoto Y. Middle meningeal artery embolization for refractory chronic subdural hematoma. Case report. *J Neurosurg* 2000;93:686-8.
- Markwalder TM. Chronic subdural hematomas: A review. *J Neurosurg* 1981;54:637-45.
- Mino M, Nishimura S, Hori E, Kohama M, Yonezawa S, Midorikawa H, et al. Efficacy of middle meningeal artery embolization in the treatment of refractory chronic subdural hematoma. *Surg Neurol Int* 2010;1:78.
- Miranda LB, Braxton E, Hobbs J, Quigley MR. Chronic subdural hematoma in the elderly: Not a benign disease. *J Neurosurg* 2011;114:72-6.
- Misra M, Salazar JL, Bloom DM. Subdural-peritoneal shunt: Treatment for bilateral chronic subdural hematoma. *Surg Neurol* 1996;46:378-83.
- Nagahori T, Nishijima M, Takaku A. Histological study of the outer membrane of chronic subdural hematoma: Possible mechanism for expansion of hematoma cavity. *No Shinkei Geka* 1993;21:697-701.
- Nakaguchi H, Tanishima T, Yoshimasu N. Relationship between drainage catheter location and postoperative recurrence of chronic subdural hematoma after burr-hole irrigation and closed-system drainage. *J Neurosurg* 2000;93:791-5.
- Sato M, Iwatsuki K, Akiyama C, Kumura E, Yoshimine T. Implantation of a reservoir for refractory chronic subdural hematoma. *Neurosurgery* 2001;48:1297-301.
- Schwarz F, Loos F, Dunisch P, Sakr Y, Safatli DA, Kalff R, et al. Risk factors for reoperation after initial burr hole trephination in chronic subdural hematomas. *Clin Neurol Neurosurg* 2015;138:66-71.
- Shimamura N, Ogasawara Y, Naraoka M, Ohnkuma H. Irrigation with thrombin solution reduces recurrence of chronic subdural hematoma in high-risk patients: Preliminary report. *J Neurotrauma* 2009;26:1929-33.
- Takayama M, Terui K, Oiwa Y. Retrospective statistical analysis of clinical factors of recurrence in chronic subdural hematoma: Correlation between univariate and multivariate analysis. *No Shinkei Geka* 2012;40:871-6.
- Tanaka T, Fujimoto S, Saitoh K, Satoh S, Nagamatsu K, Midorikawa H. Superselective angiographic findings of ipsilateral middle meningeal artery of chronic subdural hematoma in adults. *No Shinkei Geka* 1998;26:339-47.
- Torihashi K, Sadamasa N, Yoshida K, Narumi O, Chin M, Yamagata S. Independent predictors for recurrence of chronic subdural hematoma: A review of 343 consecutive surgical cases. *Neurosurgery* 2008;63:1125-9.
- Wada M, Yamakami I, Higuchi Y, Tanaka M, Suda S, Ono J, et al. Influence of antiplatelet therapy on postoperative recurrence of chronic subdural hematoma: A multicenter retrospective study in 719 patients. *Clin Neurol Neurosurg* 2014;120:49-54.