

Technical Note

Removal of a malignant cystic brain tumor utilizing pyoktanin blue and fibrin glue: Technical note

Nobuhide Hayashi, Takahiro Sasaki, Nagatsuki Tomura, Hideo Okada, Toshikazu Kuwata

Department of Neurosurgery, Wakayama Rosai Hospital, Wakayama, Wakayama, Japan

E-mail: *Nobuhide Hayashi - nbh-hayashi@wakayamah.johas.go.jp; Takahiro Sasaki - tsasaki@wakayama-med.ac.jp; Nagatsuki Tomura - tnagatuki@gmail.com; Hideo Okada - hide829@me.com; Toshikazu Kuwata - tsk-kuwata@wakayamah.johas.go.jp

*Corresponding author

Received: 10 August 16 Accepted: 13 December 16 Published: 20 February 17

Abstract

Background: The leakage of cystic fluid during metastatic cystic brain tumor resection may cause tumor dissemination. When the cyst wall is thin, excision without removing the wall is often difficult.

Methods: We were able to perform an en bloc resection of a cystic malignant brain tumor after aspirating the cystic fluid, injecting pyoktanin blue into the cyst to stain the cyst walls, and solidifying the empty cyst cavity by filling it with fibrin glue.

Results: Pyoktanin blue readily stained the thin cystic walls and enabled visualization of mural damage. Solidification of the tumor made it easier to grasp and facilitated the dissection of tumor margins.

Conclusions: This method has the potential to become a useful technique for the resection of malignant cystic brain tumors.

Key Words: Cystic malignant brain tumor, fibrin glue, operative technique, pyoktanin blue

Access this article online

Website:www.surgicalneurologyint.com**DOI:**

10.4103/2152-7806.200578

Quick Response Code:

INTRODUCTION

Leakage of cystic fluid during resection of a metastatic cystic brain tumor may cause tumor dissemination.^[4] Therefore, it is vital that care is taken to prevent the leakage of cystic contents during surgery. When the cyst wall is thin, excision without removing the wall is often difficult.^[5,6] Here, we describe a surgical operative technique that we used to resect a malignant cystic brain tumor after staining the cyst walls with pyoktanin blue and filling the cyst cavity with fibrin glue.

CASE REPORT

The patient, a 58-year-old man, suffered an epileptic seizure. Contrast-enhanced magnetic resonance imaging (MRI) revealed ring-enhancement lesions in the left

parietal lobe and peritumoral cerebral edema associated with a cystic mass lesion [Figure 1].

Surgical operative technique

After the craniotomy, we determined the tumor cyst location and depth by ultrasonography [Figure 2a]. First, we cauterized the cerebral surface, inserted an 18G needle into the cyst, and aspirated approximately 2 ml of cystic

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Hayashi N, Sasaki T, Tomura N, Okada H, Kuwata T. Removal of a malignant cystic brain tumor utilizing pyoktanin blue and fibrin glue: Technical note. *Surg Neurol Int* 2017;8:24.

<http://surgicalneurologyint.com/Removal-of-a-malignant-cystic-brain-tumor-utilizing-pyoktanin-blue-and-fibrin-glue:-Technical-note/>

fluid to reduce the volume of the cystic contents. After puncture and aspiration, we reconfirmed the location of the tumor by ultrasonography [Figure 2b]. During the course of the procedure, we extended the incision on the cerebral surface, found the opening into the cystic wall, and then aspirated and evacuated the remaining cystic fluid. We operated with utmost care during the procedure to ensure that there were no leaks onto the cerebral surface. Then, we injected 2 ml of pyoktanin blue into the cyst and waited a few minutes until it had stained the inner wall of the cyst. Then, we aspirated the pyoktanin blue from the cyst and solidified the tumor by injecting fibrin glue sealant (Bolheal®, Teijin, Japan) into the cyst cavity. This made it easier to grasp the tumor during resection because solidification prevented leakage of the cystic fluid. We introduced a microscope and performed dissection from areas with relatively distinct margins between the areas outside the cystic wall. There were some areas where the margin between the cystic wall and normal brain tissue was indistinct, and a diagnosis of glioblastoma was made by means of rapid intraoperative diagnosis (frozen section analysis). The viscous and grayish-white tumor-like areas were removed with a

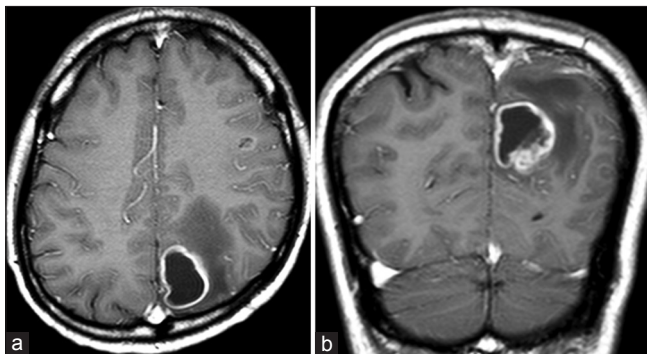


Figure 1: Gadolinium-enhanced magnetic resonance images (a, axial; b, coronal) reveal a ring-shaped enhancement in the left parietal lobe and peritumoral cerebral edema associated with a cystic lesion

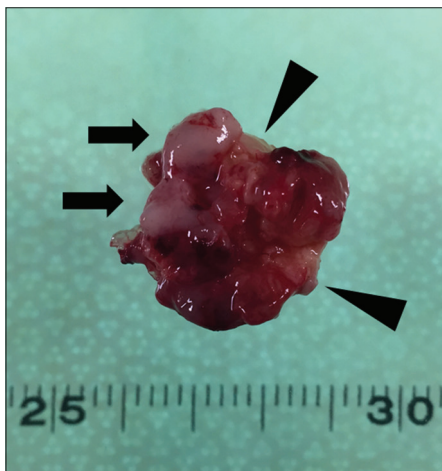


Figure 3: Resected tumor: thin cyst wall is well stained by pyocyanin blue (arrow) and fibrin glue is in the tumoral cavity (arrow head)

Cavitron Ultrasonic Surgical Aspirator (CUSA) to achieve macroscopic total resection. 8-sheet Gliadel® (Eisai, Nobelpharma, Japan), carmustine (BCNU) wafers were placed at the same site, and the cranium was closed. The resected tumor [Figure 3], permanent sections [Figure 4], and MRI image one day after surgery [Figure 5] were observed.

Postoperative clinical course

At 19 months postoperatively, no adverse events due to this procedure were noted, and the clinical course of the patient was favorable with no neurological deficit and no epilepsy noted.

DISCUSSION

Thin cystic walls make dissection difficult during the resection of metastatic cystic brain tumors, and there is a danger that the leakage of cystic fluid will cause dissemination.^[4] The disseminated cells are said to have the ability to adhere to tissues and to proliferate, and high numbers of disseminated cells facilitate colonization.^[1] In the present case, we did not know whether the preoperative diagnosis was a metastatic or primary brain tumor. However, we employed two techniques during surgery, namely, intracystic injection of pyoktanin blue^[7] and cyst solidification.^[5,6] We aspirated the cystic fluid, collapsed the inside of the cyst, stained the cystic wall by using pyoktanin blue, and solidified the cyst lumen with Bolheal® (Teijin, Japan) fibrin glue sealant. In doing so, we were able to reduce the danger of cystic fluid leakage, and made it easier to grasp the tumor itself, facilitating the dissection of the surrounding areas.

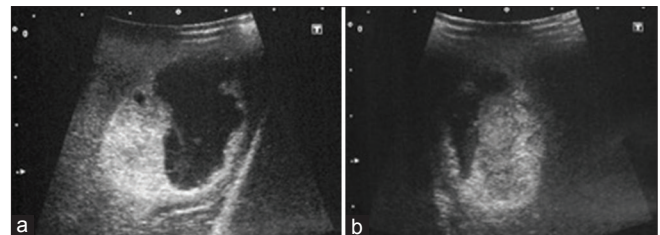


Figure 2: Intraoperative echo examination. (a) Pre-punctured cystic tumor is stored its fluid contents. (b) Post-punctured cystic tumor is deflated by aspirating its fluid contents

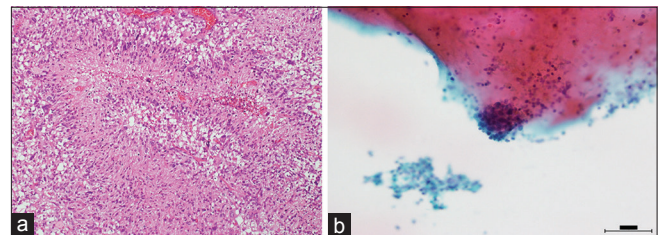


Figure 4: Permanent histopathology is glioblastoma multiforme (GBM). (a) H and E staining pathology show the central necrosis, pseudopalisading, and mitosis. (b) Atypical cell is presented in the cystic liquid contents by Papanicolaou staining pathology (Class IV)

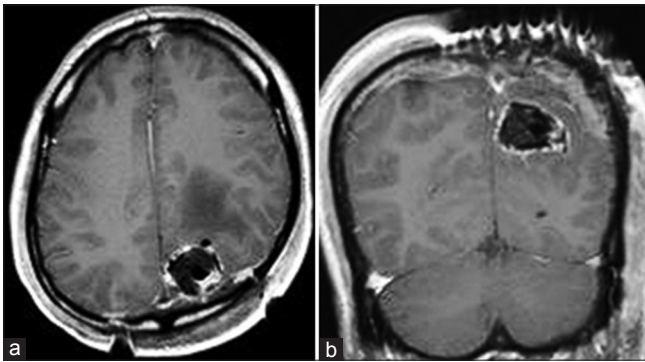


Figure 5: Gadolinium-enhanced magnetic resonance images (a, axial; b, coronal) show no contrast tumor as of one day postoperatively

The advantage of using pyoktanin blue^[7] is that it is a simple and inexpensive technique that allows visualization of the cyst inner wall without damage to the brain tissue. After removing the outer cyst wall and when the staining surface appears, the inner cyst wall can be seen. Because a concentration of 0.01% or higher of pyoktanin blue is desirable, we used 0.2% concentration in the present patient. Pyoktanin blue stains the thin areas of the cystic wall more deeply, however, it does not stain thicker portions of the cystic wall as effectively. When performing dissection of the tumor, as it is less likely for tearing and the leakage of cystic fluid to occur in areas with a thick cystic wall, the fact that pyoktanin blue does not stain these areas well is usually not a problem. In areas where the cystic wall is thin, the cystic wall can rupture easily. We filled the cyst with fibrin glue in advance to reinforce the cystic wall. We were also easily able to recognize damage to the cystic wall, even in areas where the wall was thin because of effective staining with pyoktanin blue. Any anomalies within the cyst would also have become apparent through the use of fibrin glue. The present technique is useful when performing resection of cystic malignant brain tumors with thin walls. However, if suction of the cyst fluid cannot be performed, adaptation of the procedure is difficult, and in the case of multilocular cysts, it is necessary to perform staining for each cyst.

Two methods have been reported for solidifying cysts: A method using autologous fibrin glue^[5] and another using a hydrofiber dressing.^[6] For autologous fibrin glue, cryoprecipitate (6 ml) is extracted from fresh frozen plasma (300 ml), and a 5000-unit vial of thrombin (Mochida, Japan) with physiological saline (7.5 ml) are injected into the cyst to solidify it. Because uniform solidification can be performed even in the case of complex morphology, separation and gripping can be easily performed when the mass is solid. In addition, autologous fibrin glue has been indicated to suppress the growth of enteric bacteria and contribute to the prevention of surgical site infection. Because a large quantity can be collected, it is an effective method when

the cyst is large. However, collection of autologous blood is difficult in patients with anemia, and the method is cumbersome and time consuming. Because the cyst was small in the present patient, we used a commercially available fibrin glue product, Bolheal® (Teijin, Japan), however, other products such as Beriplast P® (CSL Behring, USA) or TachoSil® (Takeda, Japan)^[3] could have been substituted. Hydrofiber dressing is a material used for covering bedsores; it is a simple and useful method to prevent intraoperative cyst fluid leakage by completely filling the cyst wall through absorption of moisture and absorbing cyst fluid.^[6]

In the present case, frozen section pathology demonstrated a cystic glioblastoma and not a metastatic cystic brain tumor. To our knowledge, there are no reports concerning dissemination caused by cyst fluid leakage of cystic glioblastoma, nevertheless, the technique described was useful in insuring complete resection of the thin portions of the tumor cyst wall. If a tumor has been solidified by being filled with fibrin glue, the cystic fluid is aspirated, a working space is secured, and the tumor around the cystic wall is dissected away from the normal tissue. In contrast, when the working space is reduced, there is increased compression of the normal tissues, and the surrounding functional cerebral regions may also be affected. However, injection of fibrin glue into the collapsed cyst does not increase the tumor volume remarkably. In the present case, the neighboring cerebral surface was shaped like the tumor, although it was relatively easy to aspirate the cystic fluid and solidify the cyst lumen.

With regard to benign brain tumors that form cysts, in the cases of hemangioblastoma and pilocytic astrocytoma, excision of the mural nodule is sufficient and excision of the entire cyst is unnecessary. In addition, the method is difficult to adapt for deep lesions such as Rathkes's cleft cyst, cystic pituitary adenoma, craniopharyngioma and endodermal cyst. Therefore, this method may only be useful for metastatic cystic brain tumors with well-defined borders, and may be limited to comparatively superficial lesions. The technique we used to facilitate resection in this tumor case may also be useful for the management of brain abscess. Regarding the abscess capsule, if the wall is thick and pyoktanin blue staining is generally ineffective, depending on the bacterial species, pyoktanin blue exhibits antibacterial effects,^[2] by filling the capsule lumen with fibrin glue, excision can be performed while preventing abscess leakage.

CONCLUSIONS

Here, we report our experience with an excision method utilizing pyoktanin blue and fibrin glue for a cystic malignant brain tumor. Excision of the tumor as a lump could be performed without leakage of cyst fluid and

removal of the cyst wall; this simple method may be a useful technique.

Acknowledgements

The authors thank Dr. Okuda for providing us the documents.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Glasgow BJ, Brown HH, Zargoza AM, Foos RY. Quantification of tumor seeding from needle aspiration of ocular melanomas. *Am J Ophthalmol* 1988;105:538-46.

2. Hoffmann CE, Rahn O. The bactericidal and bacteriostatic action of crystal violet. *J Bacteriol* 1944;47:177-86.
3. Mastronardi L, Cacciotti G, Caputi F, Roperto R, Tonelli MP, Carpineta E, et al. Underlay hourglass-shaped autologous pericranium duraplasty in "key-hole" retrosigmoid approach surgery: Technical report. *Surg Neurol Int* 2016;7:25.
4. Nakagawa H, Kimura S, Kubo S, Fujita T, Tsuruzono K, Hayakawa T. Prognostic Factors in Patients Surviving for more than 1 or 5 years after removal of metastatic brain tumors. *Neurol Med Chir* 1992;32:947-51.
5. Okuda T, Fujita M, Yoshioka H, Tasaki T, Kato A. Novel surgical technique to solidify cyst-type metastatic brain tumors using autologous fibrin glue for complete resection. *Surg Neurol Int* 2014;5:100.
6. Okuda T, Teramoto Y, Yugami H, Kataoka K, Kato A. Surgical technique for a cystic-type metastatic brain tumor: Transformation to a solid-type tumor using hydrofiber dressing. *Surg Neurol* 2009;72:703-6.
7. Tomita Y, Sasaki T, Tanabe T, Idei M, Muraoka K, Terada K, et al. Pyocytanin blue injection for resection of cystic brain tumor: A case report. *No Shinkei Geka* 2013;418:687-91.