〈Case Report〉

A Case of Sinus Pericranii Following Head Injury in a Child

Hisako KUYAMA[1)], Hideki SOH[1)], Atsushi YOSHIDA[1)], Kenji YAGI[2)]
Ryunosuke HARUTA[2)], Tomohito HISHIKAWA[2)], Shogo EBISUDANI[3)]

1) Department of Pediatric Surgery,
2) Department of Neurosurgery,
3) Department of Plastic Surgery, Kawasaki Medical School

ABSTRACT Sinus pericranii is a rare venous anomaly of the scalp, characterized by abnormal communication with the intracranial dural sinuses. This pathology typically presents as a soft vascular mass beneath the scalp and can result from congenital or acquired aberrant connections between the intra- and extracranial venous systems. We report a pediatric case of sinus pericranii following head trauma. A 2-year-old boy presented with persistent subcutaneous mass in the right temporal region following head trauma at 1 year old. After imaging evaluation, surgical excision was performed due to a lack of spontaneous regression and potential risk of hemorrhage. During surgery, indocyanine green fluorescence showed minimal blood flow, and the mass was found to communicate with small veins through foramina in the calvarium. The lesion was excised without needing craniotomy and postoperative recovery was uneventful. This case highlights the importance of considering sinus pericranii among the differential diagnosis of scalp masses in children, particularly after head trauma. Sinus pericranii following head trauma without congenital vascular malformations typically involves an extremely low risk of requiring craniotomy, as seen in this case. doi：10.11482/KMJ-E202551017 *(Accepted on February 5, 2025)*
Key words：Sinus pericrania, Trauma, Skull fracture, ICG fluorescence imaging

INTRODUCTION

Sinus pericranii is a rare venous anomaly of the scalp, characterized by abnormal communication with the intracranial dural sinuses, either directly or through intermediaries such as diploic veins or transcalvarial emissary veins[1-2)]. Sinus pericranii is a symptom-complex with a wide spectrum of clinical manifestations and is not an independent clinical entity. This condition typically presents as a vascular mass beneath the scalp, arising from congenital or acquired aberrant connections between the intra- and extracranial venous systems[2)].

Here, we report a case of sinus pericranii in a 2-year-old child who developed this condition following a history of head trauma. This case highlights the importance of considering sinus

Corresponding author
Hisako Kuyama
Department of Pediatric Surgery, Kawasaki Medical School, 577 Matsushima, Kurashiki, 701-0192, Japan
Phone : 81 86 462 1111
Fax : 81 86 462 1198
E-mail: hkuyama@med.kawasaki-m.ac.jp

pericranii as a differential diagnosis for scalp masses, particularly in the context of prior head injury.

CASE REPORT

Clinical course

The patient was a 2-year-old boy. At 1 year old, he had hit the side of his head against the corner of a pillar while running and was diagnosed with a "bump" at a local clinic, where he was managed conservatively. However, no improvement was observed after one year, prompting a visit to the referring hospital. Contrast-enhanced magnetic resonance imaging (MRI) of the head revealed a flat, 25-mm subcutaneous mass in the right temporal region with dilated and tortuous vessels (Fig. 1). The patient was referred to our hospital for further treatment, on suspicion of arteriovenous fistula.

Examination revealed a soft, 2-cm lesion in the right temporal area. The size of the mass increased during crying or straining. Head computed tomography (CT) angiography and venography revealed thinning of the calvarium without any apparent bone defect at the site of the mass. A branch of the superficial temporal artery appeared to flow into the lesion, suggesting a vascular malformation as a feeder. However, contrast enhancement of the mass itself was minimal and no definitive preoperative diagnosis could be established. No communication with intracranial arteries or veins was apparent (Fig. 2).

The decision was made to surgically excise the lesion due to the lack of spontaneous regression following the trauma and the potential risk of hemorrhage in the conference with the neurosurgeons who would participate in the procedure.

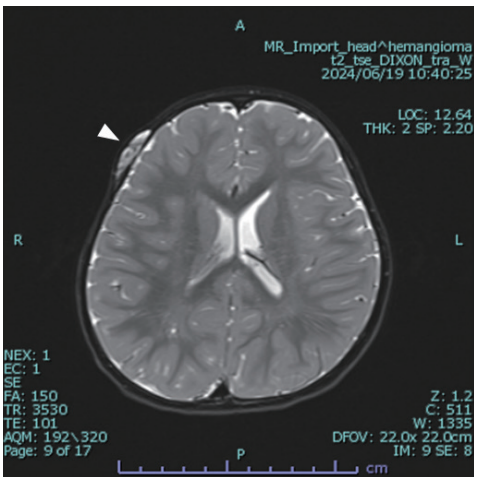

Fig. 1. Contrast-enhanced MRI
A flat, 25-mm subcutaneous mass is seen in the right temporal region with dilated and tortuous vessels (white arrow).

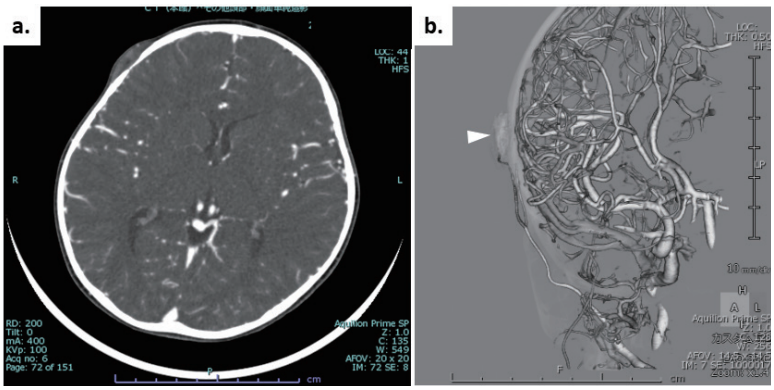

Fig. 2. CT angiography and venography
a) Subcutaneous mass and thinning of the calvarium at the site.
b) Images from 3D-CTA and CTV. The mass is located beneath the scalp (white arrow), with no visible communication to the intracranial arteries or veins.

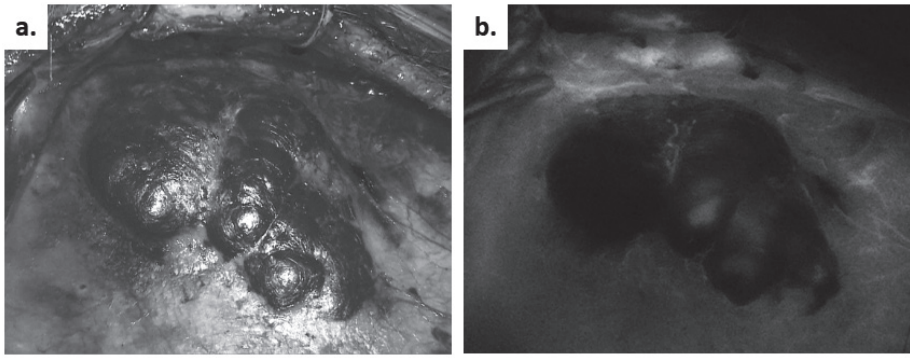

Fig. 3. Intraoperative ICG fluorescence
a) Appearance of the mass.
b) ICG fluorescence image. Mild fluorescence is detected following compression and release of the mass.

Surgical procedure

The patient was placed under general anesthesia with endotracheal intubation and positioned supine. The head was rotated to the left and an arcuate skin incision was made within the hairline to allow for intraoperative craniotomy. The scalp was dissected under the galea aponeurosis and reflected, revealing a varix-like, dark-red mass beneath the periosteum. Upon exposing the mass surface, no significant vascular inflow from the skin or superficial temporal artery was observed. Indocyanine green (ICG) fluorescence was performed. Blood flow was initially noted in the branch of the superficial temporal artery running subcutaneously near the mass, but no inflow from this artery into the lesion was noted. In the venous phase, little blood flow was observed within the mass, but mild fluorescence was detected following compression and release of the mass (Fig. 3). After the posterior aspect of the mass was dissected from the bone, communication was found with several small vessels less than 1 mm connecting to the diploic veins through small foramina in the outer table of the calvarium (Fig. 4). Minor venous bleeding was observed but was controlled using electrocoagulation and bone wax. The calvarium at the site of the mass showed mild depression.

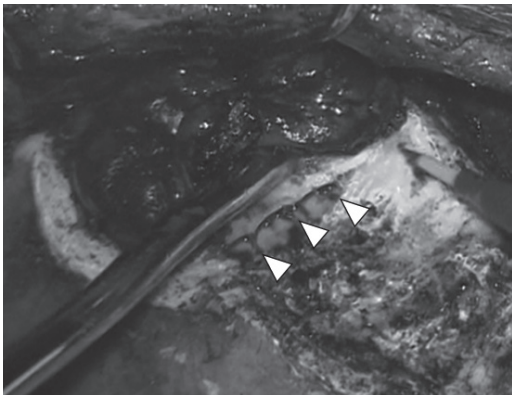

Fig. 4. Dissection of the posterior aspect of the mass
The mass is supplied by small veins (white arrow) passing through small foramina on the calvarial surface.

Pathological findings

Histological examination revealed a moderately dense distribution of dilated, thin-walled vascular structures set against a background of fibrous connective tissue stroma. Elastic fibers were indistinct on Elastica-Masson staining, and lumina were lined by a single layer of cells with minimal atypia. Some lumina showed features suggestive of organized thrombi. These findings were consistent with hemangioma.

Postoperative course

The patient was discharged on postoperative day 4 and showed an uneventful recovery with no

complications. No bone depression is apparent, and no recurrence has been observed.

DISCUSSION

The term "sinus pericrania" was coined by Stromeyer[3] in 1850 and has since become a widely accepted concept. This pathology is characterized by abnormal communication with the intracranial venous system and presents as a soft vascular mass beneath the scalp, with changes in size observed in response to fluctuations in venous pressure. However, pathologically, sinus pericranii is considered a clinical syndrome rather than a single disease entity[4].

The condition has been subject to various classifications in the past, but no clear classification based on both pathophysiology and histopathological findings has been devised, leading to some confusion[4]. Mastin[5] classified sinus pericranii based on etiology into three types: 1) traumatic; 2) congenital; and 3) idiopathic. Gerlach and colleagues[6] classified the condition based on the size of the communication between the dural venous sinus and mass, comprising: 1) varix communicating with several small veins; 2) varix communicating with dilated draining veins; and 3) varix with larger communication to the dural venous sinus and evident bone defects. Sinus pericranii with calvarial defects suggests a large communication with the dural venous sinus and requires careful management of venous sinus bleeding during surgery[4]. In congenital cases, the affected region may serve as the dominant drainage pathway for intracranial venous blood flow (dominant sinus pericranii), and can be associated with life-threatening complications, requiring cautious evaluation and management[1, 7].

Various imaging modalities can be used for diagnosis, including ultrasound, contrast-enhanced dynamic MRI and CT, direct puncture venography[4, 8, 9], and digital subtraction angiography (DSA)[7]. DSA plays a critical role in the diagnosis and treatment planning of sinus pericranii by identifying the vascular anomaly and intracranial communication. It has been suggested, particularly in cases of congenital sinus pericranii, to perform DSA after the patient reaches 1 year of age[7]. In this case, MRI did not reveal any apparent vascular communication with the intracranial space, and evaluation was conducted using CT angiography and venography. As a result, no significant intracranial vascular abnormalities were observed, and there was minimal blood flow within the mass. Based on these findings, surgical resection was chosen without performing DSA because general anesthesia is required in pediatric patients. Intraoperative ICG fluorescence revealed slow, weak fluorescence, likely due to very slow blood flow from the small veins through the calvarial foramina, explaining the lack of venous blood flow observed on MRI and CT. Intraoperative ICG fluorescence proved useful in real-time visualization of blood flow to the mass, allowing evaluation of arterial components and venous shunting and providing diagnostic value.

This case involved sinus pericranii in a young child following a mild traumatic head injury. The injury was thought to have formed a subperiosteal hematoma, subsequently leading to communication with diploic veins which drain into dural sinus. Although the evident calvarial depression suggested possible cranial fracture, the exact details of the initial injury remain unclear and no fracture could be confirmed. Past reports have indicated that minor trauma leading to subperiosteal hematomas, without fracture, may cause this condition[10].

As in the present case, sinus pericranii following trauma without congenital vascular malformations usually shows minimal blood flow through small veins passing through foramina in the calvarium. As a result, these cases typically involve an extremely low risk of requiring craniotomy during surgical

treatment.

CONCLUSION

We treated a rare case of sinus pericranii following head trauma during early childhood. The lesion received blood flow from small veins communicating with the diploic veins, and was safely excised without needing craniotomy

DECLARATIONS OF INTEREST

none

ROLE OF THE FUNDING SOURCE

Institutional funding was provided by Kawasaki Medical School, which was not involved in preparing this article and/or conducting this research.

REFERENCES

1）Khodarahmi I, Alizai H, Chalian M, Alaia EF, Burke CJ, Slasky SE, Wenokor C: Imaging Spectrum of Calvarial Abnormalities. Radiographics. 2021; 41: 1144-1163.

2）Sheu M, Fauteux G, Chang H, Taylor W, Stopa E, Robinson-Bostom L: Sinus pericranii: dermatologic considerations and literature review. J Am Acad Dermatol. 2002; 46: 934-941.

3）Stromeyer L: Ueber sinus pericrania. Dtsch Klin. 1850; 2: 160-161.

4）Sawamura Y, Abe H, Sugimoto S, Tashiro K, Nakamura N, Gotoh S, Takamura H: Histological classification and therapeutic problems of sinus pericrania. Neurol Med Chir (Tokyo). 1987; 27: 762-768.

5）Mastin WM: Venous blood tumors of the cranium in communication with the intracranial venous circulation, especially the sinuses of the dura mater. JAMA. 1886; 7: 309-320.

6）Gerlach J, Jensen HP, Kraus H: Pädiatrische Neurochirurgie. Stuttgart, Germany, Georg Thieme. 1967, p7.

7）Pavanello M, Melloni I, Antichi E, Severino M, Ravegnani M, Piatelli G, Cama A, Rossi A, Gandolfo C: Sinus pericranii: diagnosis and management in 21 pediatric patients. J Neurosurg Pediatr. 2015; 15: 60-70.

8）Asano K, Sobata E, Kubo O: Subepicranial varix mimicking sinus pericranii: usefulness of three-dimensional computed tomography angiography and bone window computed tomography--case report. Neurol Med Chir (Tokyo). 2000; 40: 467-471.

9）Nakayama U, Tanaka A, Ueno Y, Yoshinaga S, Takano K: Scalp cavernous angioma presenting as sinus pericranii: diagnostic value of cerebral angiography and magnetic resonance imaging. Childs Nerv Syst. 2000; 16: 598-602.

10）Hahn E: Sinus pericrania (reducible blood tumor of the cranium): its origin and its relation to hemangioma and abnormal arteriovenous communication: report of a case. Arch Surg. 1928; 16: 31-43.