

Chronic Subdural Hematoma, Caused by Disseminated Intravascular Coagulation and/or Anticoagulation Therapy, after COVID-19

Yu NOMURA,¹ Masato NARAOKA,¹ Nozomi FUJIWARA,¹
Shouhei KINOSHITA,¹ Keita YANAGIYA,¹ Takao SASAKI,¹
Ryouta WATANABE,¹ Kouta UENO,¹ and Norihito SHIMAMURA¹

¹Department of Neurosurgery, Hirosaki University School of Medicine, Hirosaki, Aomori, Japan

Abstract

Chronic subdural hematoma (CSDH) typically develops in the supratentorial region in elderly patients. We treated a case of unilateral supratentorial and bilateral infratentorial CSDH, whereby the patient had a coronavirus disease 2019 (COVID-19) infection combined with disseminated intravascular coagulation 2 months earlier. The patient had not experienced any head trauma before the onset of the CSDH. The postoperative course was uneventful, and the patient experienced no neurological deficit. We propose that we should be aware not only of acute ischemic or hemorrhagic diseases after COVID-19 infection but also of chronic subdural hematoma caused by coagulopathy after a COVID-19 infection.

Keywords: supratentorial and infratentorial chronic subdural hematoma, COVID-19, disseminated intravascular coagulation, anticoagulation therapy

Introduction

Chronic subdural hematoma (CSDH) usually develops in the supratentorial region in elderly patients. Infratentorial CSDH is rare in adults.¹⁻³⁾ We treated a case of unilateral supratentorial and bilateral infratentorial adult CSDH, whereby the patient had been infected with coronavirus disease 2019 (COVID-19) 2 months earlier. A COVID-19 infection has been shown to induce acute ischemic stroke and intracranial hemorrhage due to coagulation disorders.^{4,5)} For the first time, we report supratentorial and infratentorial CSDH due to disseminated intravascular coagulation (DIC) after a COVID-19 infection. We present the clinical course of our case and discuss a review of the literature.

Case Report

A 70-year-old female patient without head trauma had a high fever on day X. She was admitted to our hospital on day X + 15 due to respiratory distress resulting from a COVID-19 infection. She showed no neurological deficit,

but a blood exam revealed DIC (Table 1). She was treated with remdesivir, dexamethasone, and heparin. Her symptoms and DIC were cured, and she was transferred to another hospital on day X + 28. The patient was discharged from the hospital on day X + 44. On day X + 55, she felt a headache that slowly increased in intensity. There had been no head trauma during the entire period of treatment. On day X + 62, her condition deteriorated and her right forehead was bruising. She was transferred to our emergency department with a disturbance of consciousness (Glasgow Coma Scale 8) with quadriplegia and with total aphasia. A blood examination did not reveal any coagulation disorder (Table 1). Computed tomography (CT) showed a right supratentorial CSDH and bilateral infratentorial CSDH (Fig. 1A, B). Evacuation and drainage of the supratentorial CSDH were done with a single burr hole under local anesthesia. The hematoma membrane was thickened, and its color was dark. She regained consciousness and had no neurological disturbance on the day after the surgery. CT and magnetic resonance imaging (MRI) showed a reduction of the right supratentorial CSDH, no change in the infratentorial CSDH, and no upper hernia-

Received December 27, 2021; Accepted April 18, 2022

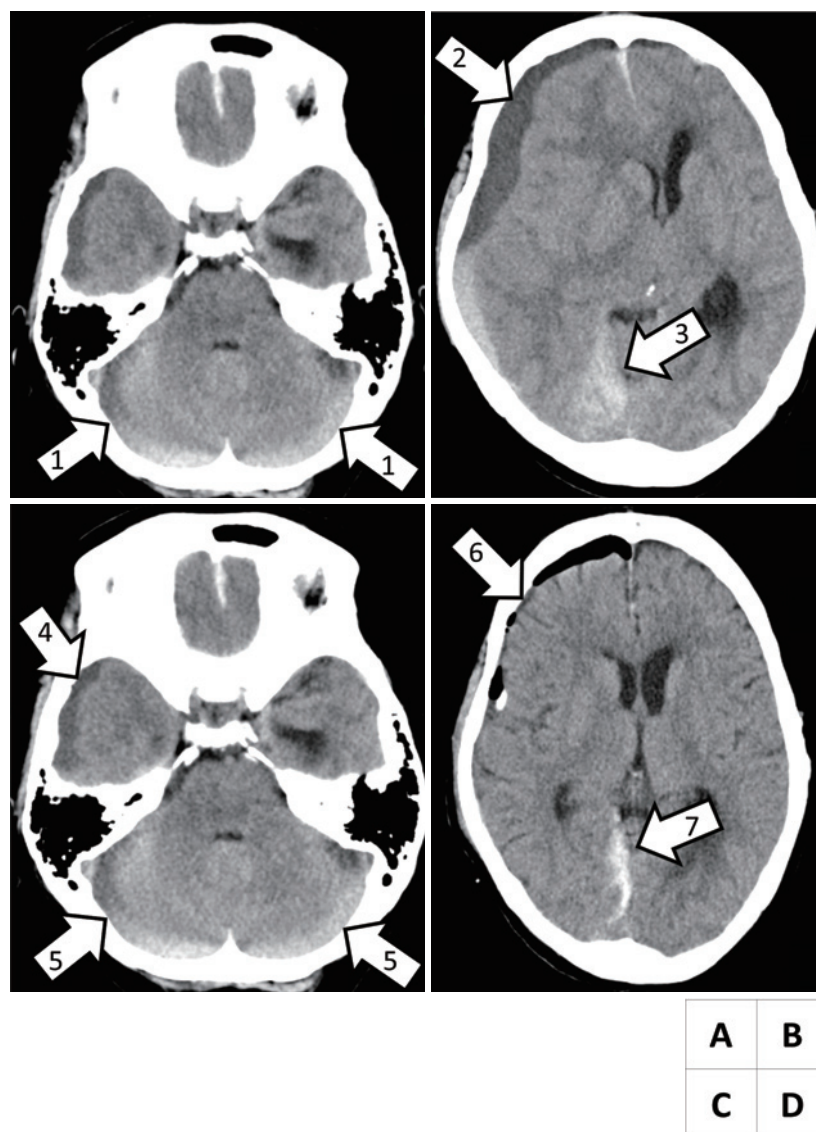
Copyright © 2022 The Japan Neurosurgical Society

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives International License.

Table 1 Blood exam score after COVID-19 infection

	After COVID-19 infection: X + 15 days	X + 18 days	X + 28 days	X + 62 days (Surgery for CSDH)
PT (s)	68	75	11.9	11.4
PT-INR	1.26	1.18	1.05	0.98
APTT (s)	47.7	36.5	38.6	29
Fibrinogen (mg/dL)	434	371	358	NA
D-dimer ($\mu\text{g/dL}$)	14.1	39.4	8.6	NA
Platelet ($/\mu\text{L}$)	10.1×10^4	7.6×10^4	4.1×10^4	16.3×10^4

APTT: activated partial thromboplastin time, CSDH: chronic subdural hematoma, NA: not applicable, PT: prothrombin time, PT-INR: prothrombin time–international normalized ratio

**Fig. 1** Computed tomography image of the present case.

A, B: Image on the day of surgery; **C, D:** Image on the day after surgery. Arrows 1 and 2 show subdural hematoma in the right supratentorial and bilateral infratentorial regions. Arrow 3 shows the hematoma at the rostral surface of the tentorium.

Arrows 4, 5, and 6 show a decrease in the subdural hematoma in the right supratentorial region, and the subdural hematoma in the infratentorial region has not increased. Arrow 7 shows that a hematoma at the rostral surface of the tentorial region has not increased.

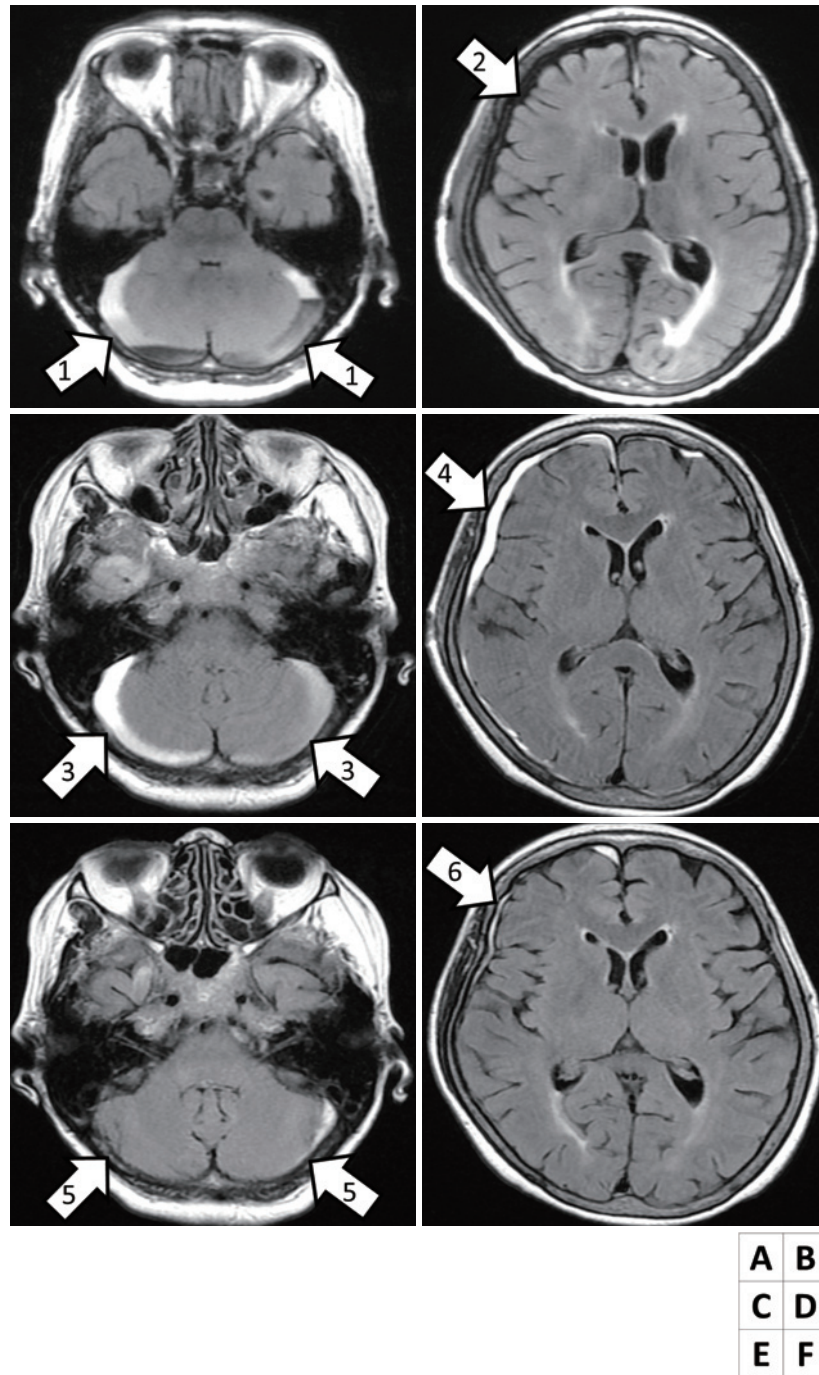


Fig. 2 Magnetic resonance image of the present case.

A, B: Image on the day after surgery; **C, D:** Image 1 week after surgery; **E, F:** Image 1 month after surgery.

Arrows 1 and 2 show that the hematoma in the supratentorial and infratentorial regions has not increased. Arrows 3 and 4 show that a subdural hematoma in the supratentorial and infratentorial regions has decreased. Arrows 5 and 6 show that the subdural hematoma in the supratentorial and infratentorial regions is cured.

tion (Fig. 1C, D, Fig. 2A, B). She was discharged 2 days after the surgery without any neurological deficit. One week after surgery, an MRI image showed that the bilateral infratentorial subdural hematoma had decreased, and the supratentorial and bilateral infratentorial CSDH were

cured 1 month after the surgery (Fig. 2C-F).

Discussion

This is the first case report that reveals supratentorial

Table 2 Summary of supratentorial CSDH after COVID-19 infection

No	Age	Gender	Side	Symptom	Onset of CSDH after COVID-19 infection	Thrombocytopenia	Antithrombotic therapy	Surgery	Outcome	Reference
1	82	M	Lt	Unknown	Unknown	No	Yes	Burr hole surgery	Death	
2	86	M	Blt	Unknown	Unknown	No	No	MMA embolization	Death	
3	77	M	Rt	Unknown	Unknown	Yes	No	Craniotomy	Death	6)
4	85	M	Lt	Unknown	Unknown	Yes	Yes	Burr hole surgery	Death	
5	78	M	Lt	Consciousness disturbance	Unknown	No	Yes	No	Good	
6	70	F	Blt	Consciousness disturbance	48 th day	Yes	Yes	Burr hole surgery	Good	Present case

Blt: bilateral; F: female; Lt: light; M: male; MMA: middle meningeal artery; Rt: right

Table 3 Summary of supra- and infratentorial CSDH

No	Age	Gender	Side	Symptom	Antithrombotic therapy	Treatment of supratentorial hematoma	Treatment of infratentorial hematoma	Outcome	Reference
1	64	M	Lt	Headache, Vomiting	Yes	Conservative	Suboccipital craniotomy	Good	3)
2	86	M	Rt	Consciousness disturbance, Tetra-paresis	Yes	Conservative	Burr hole surgery	Good	10)
3	74	M	Rt	Somnolence	Yes	Burr hole surgery	Burr hole surgery	Good	11)
4	72	F	Lt	Left hemiparesis, Gait disturbance	Yes	Burr hole surgery	Conservative	Good	12)
5	70	M	Blt	Right hemiparesis	No	Burr hole surgery	Conservative	Good	
6	70	F	Lt	Consciousness disturbance	Yes	Burr hole surgery	Conservative	Good	Present case

Blt: bilateral; F: female; Lt: light; M: male; Rt: right

and infratentorial CSDH after a COVID-19 infection and an absence of head trauma.

We discovered several cases of unilateral or bilateral supratentorial CSDH after a COVID-19 infection (Table 2).⁶⁾ Panciani PP et al. reported relatively poor outcomes for five cases of CSDH that were also being treated for COVID-19 and which included thrombocytopenia and/or anticoagulation therapy. Our case here presented CSDH after COVID-19 was cured; there have been no previous reports of CSDH after cure of a COVID-19 infection. The incidence of general hemorrhage after cure of a COVID-19 infection has been reported to be 0.7%-2.9%.^{7,8)} Another report described DIC complicated with a COVID-19 infection as inducing significant general bleedings.⁹⁾ We speculate that our present CSDH was produced by DIC complicated with a COVID-19 infection and/or anticoagulation therapy.

We know that CSDH of the posterior fossa is rare in an adult, especially in the supratentorial and infratentorial regions (Table 3).^{1-3,10-12)} Those CSDH cases were caused by

craniotomy,¹⁾ bleeding from the venous sinus due to trauma,¹³⁾ anticoagulation therapy,^{10,11)} or thrombocytopenia.¹⁴⁾ Our case was complicated by DIC and received antithrombotic therapy and was therefore compatible with previous reports.

COVID-19 infection sometimes induces arterial and venous thrombosis along with an abnormality of coagulation markers and thrombosis.¹⁵⁻¹⁷⁾ DIC has been shown to develop in 2% of patients with COVID-19, and thrombocytopenia, in 10.3% of patients with COVID-19.⁹⁾ The International Society of Thrombosis and Haemostasis thus recommends using heparin for COVID-19-infected patients with coagulopathy.¹⁸⁾ However, ischemic stroke has also been shown to develop in 1.2% of patients with COVID-19.¹⁵⁾ We assume that more and more people who are treated with anticoagulation therapy, especially with DIC, will be diagnosed with CSDH without head trauma.

To conclude, we propose that we should be aware of not only acute ischemic disease and acute bleeding diseases

but also CSDH after a COVID-19 infection treated with anticoagulation therapy, especially in the presence of DIC.

Abbreviation List

CSDH: chronic subdural hematoma
 CT: computed tomography
 DIC: disseminated intravascular coagulation
 ISTH: International Society of Thrombosis and Haemostasis
 MRI: magnetic resonance imaging

Conflicts of Interest Disclosure

The authors report that there are no competing interests to declare.

References

- 1) Mochizuki Y, Kobayashi T, Kawashima A, Funatsu T, Kawamata T: Chronic subdural hematoma of the posterior fossa treated by suboccipital craniotomy. *Surg Neurol Int* 9: 20, 2018
- 2) Miles J, Medlery AV: Posterior fossa subdural haematomas. *J Neurol Neurosurg Psychiatry* 37: 1373-1377, 1974
- 3) Miyamoto J, Sasajima H, Owada K, Mineura K: Bilateral supra- and infratentorial chronic subdural hematoma: Case report. *Jpn Neurosurg (Tokyo)* 12: 803-806, 2003
- 4) Lucatelli P, De Rubeis G, Citone M, et al.: Heparin-related major bleeding in Covid-19-positive patient: perspective from the outbreak. *Cardiovasc Intervent Radiol* 43: 1216-1217, 2020
- 5) Tabibkhouei A, Hatam J, Mokhtari M, Abolmaali M: COVID-19-associated spontaneous subacute subdural haematoma: report of two cases. *New Microbes New Infect* 40: 100848, 2021
- 6) Panciani PP, Saraceno G, Zanin L, Renisi G, Signorini L, Fontanella MM: Letter: COVID-19 infection affects surgical outcome of chronic subdural hematoma. *Neurosurgery* 87: E167-E171, 2020
- 7) Patell R, Bogue T, Koshy A, et al.: Postdischarge thrombosis and hemorrhage in patients with COVID-19. *Blood* 136: 1342-1346, 2020
- 8) Rungjirajitranon T, Owattanapanich W, Leelakanok N, et al.: Thrombotic and hemorrhagic incidences in patients after discharge from COVID-19 infection: a systematic review and meta-analysis. *Clin Appl Thromb Hemost* 21: 1-14, 2021
- 9) Al-Samkari H, Karp Leaf RS, Dzik WH, et al.: COVID-19 and coagulation: bleeding and thrombotic manifestations of SARS-CoV-2 infection. *Blood* 136: 489-500, 2020
- 10) Kurisu K, Kawabori M, Niiya Y, Ohta Y, Mabuchi S, Houkin K: Bilateral chronic subdural hematomas of the posterior fossae. *Neurol Med Chir (Tokyo)* 52: 822-825, 2012
- 11) Inoue T, Hirai H, Shima A, Suzuki F, Matsuda M: Bilateral chronic subdural hematoma in the posterior fossa treated with a burr hole irrigation: a case report and review of the literature. *Case Rep Neurol* 11: 87-93, 2019
- 12) Izumihara A, Orita T, Kajiwara K, Tsurutani T: Simultaneous supra- and infratentorial chronic subdural hematoma. *Eur J Radiol* 16: 183-185, 1993
- 13) Stendel R, Schulte T, Pietilä TA, Suess O, Brock M: Spontaneous bilateral chronic subdural hematoma of the posterior fossa. Case report and review of literature. *Acta Neurochir* 144: 497-500, 2000
- 14) Pollo C, Meuli R, Porchet F: Spontaneous bilateral subdural haematomas in the posterior cranial fossa revealed by MRI. *Neuroradiology* 45: 550-552, 2003
- 15) Tan YK, Goh C, Leow AST, et al.: COVID-19 and ischemic stroke: a systematic review and meta-summary of the literature. *J Thromb Thrombolysis* 50: 587-595, 2020
- 16) Qureshi AI, Abd-Allah F, Al-Senani F, et al.: Management of acute ischemic stroke in patients with COVID-19 infection: report of an international panel. *Int J Stroke* 15: 540-554, 2020
- 17) Kwee RM, Adams HJA, Kwee TC: Pulmonary embolism in patients with COVID-19 and value of D-dimer assessment: a meta-analysis. *Eur Radiol* 31: 8168-8186, 2021
- 18) Thachil J, Tang N, Gando S, et al.: ISTH interim guidance on recognition and management of coagulopathy in COVID-19. *J Thromb Haemost* 18: 1023-1026, 2020

Corresponding author: Norihito Shimamura, MD, PhD
 Department of Neurosurgery, Hirosaki University School of Medicine, 5 Zaifu-cho, Hirosaki, Aomori 036-8562, Japan.
 e-mail: shimab@hirosaki-u.ac.jp