

Infantile Chronic Subdural Hematoma Infected by *Escherichia Coli*

—Case Report—

Yasushi IIMURA, Satoshi TSUTSUMI, Yumiko MITOME, Yasuomi NONAKA,
Yusuke ABE, Yukimasa YASUMOTO, and Masanori ITO

Department of Neurological Surgery, Juntendo University Urayasu Hospital, Urayasu, Chiba

Abstract

A 6-month-old boy presented with a rare case of infected subdural hemorrhage manifesting as sustained fever and focal seizure. The boy had been well without contributory medical history. Physical examination found no neurological impairment with intact superficial appearance and soft fontanelles. The parents denied recent head trauma or shaking injury. Blood examination was normal except for white blood cell count of $19200/\mu\text{l}$ and C-reactive protein level of 6.7 mg/dl . Bacterial culture of nasal swab, urine, stool, and venous blood samples was negative. Cerebrospinal fluid examination showed normal findings. Cranial computed tomography revealed an expansive subdural fluid collection in the right frontotemporal region. Magnetic resonance imaging showed the lesion as hypointense on T1- and hyperintense on T2-weighted images with intense enhancement of the outer membrane. The patient underwent burr-hole drainage, which identified the subdural hematoma encapsulated in a thick outer membrane and intermingled with pus material. Culture of the pus identified *Escherichia coli*. The patient received antibiotic therapy for 8 weeks that resulted in complete resolution of the infection. We assumed that preexisting subdural hematoma formed after minor head trauma was followed by hematogenous infection by *E. coli*. Infected subdural hematoma is possible in infants presenting with subdural hemorrhage with clinical symptoms of bacteremia.

Key words: infected subdural hematoma, *Escherichia coli* infection, treatment, infant

Introduction

Infected subdural hematoma is rare in the pediatric population. The mechanism is thought to involve hematogenous infection of preexisting subdural hematoma, forming a localized infectious focus, not associated with meningitis. Only a few case series have been reported.^{5,6,9,10)} The causative organisms included *Streptococcus* species, *Haemophilus influenzae*, *Escherichia coli*, *Salmonella* species, and *Staphylococcus aureus*, indicating common pathogens with subdural empyema.⁴⁾ The appropriate management for this peculiar entity has not been determined, although previous cases had satisfactory outcomes, in contrast with the meningitis and poor outcome very frequently associated with subdural empyema.

Here we present a case of subdural hematoma associated with *E. coli* infection that was successfully treated by burr-hole surgery and intensive antibiotic administration.

Case Report

A 6-month-old male infant presented with persistent high-grade fever and focal seizure localized in the left upper ex-

tremity. The boy was born at full term with normal delivery but had not reached the appropriate developmental milestones despite the absence of contributory medical conditions such as otitis media, hemophilia, or congenital heart disease. The patient was not irritable and showed good feeding. Physical examination found no neurological deficit or superficial abnormalities. The abdomen was soft and he did not suffer persistent diarrhea. His head circumference was 48.8 cm, with soft fontanelles, compatible with his age, and his body weight and height were normal. The parents denied recent head trauma or non-accidental shaking injury.

Chest radiography showed no abnormalities. Echocardiography revealed intact ventricular functions without abnormal right-to-left shunting. Blood examination was normal except for white blood cell (WBC) count of $19200/\mu\text{l}$ and C-reactive protein (CRP) level of 6.7 mg/dl . Bacterial culture of nasal swab, urine, stool, and venous blood samples was negative. Cerebrospinal fluid (CSF) examination by lumbar spinal tap revealed cell count of $1/\mu\text{l}$, and normal CSF glucose and protein levels. Cranial computed tomography revealed a low density subdural fluid collection in the right frontotemporal region with slight displacement of the midline structures (Fig. 1). Magnetic resonance (MR) imaging showed the lesion as hypointense



Fig. 1 Computed tomography scan showing a low density subdural fluid collection in the right frontotemporal region with slight displacement of the midline structure.

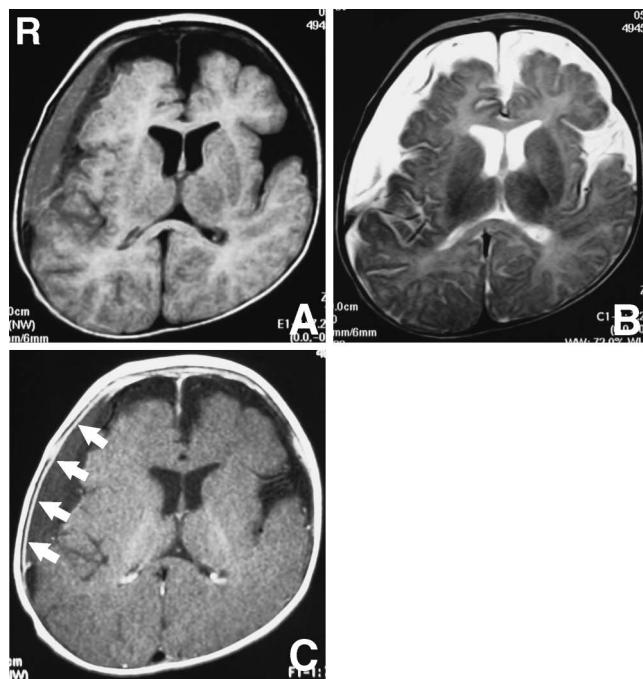
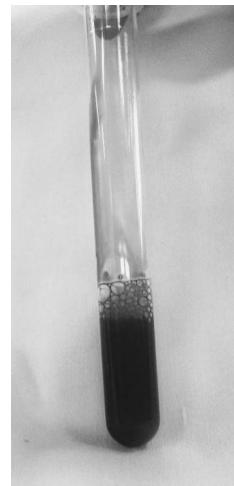


Fig. 2 Axial magnetic resonance (MR) images showing the subdural accumulation as hypointense on T₁- (A) and hyperintense on T₂-weighted (B) images with intense enhancement of the outer membrane (arrows) (C).

on T₁- and hyperintense on T₂-weighted images with intense enhancement of the outer membrane (Fig. 2). The preoperative diagnoses were isolated subdural empyema not associated with meningitis and chronic subdural hematoma concurrent with bacteremia.

Burr-hole surgery revealed the thick and expansive pinkish-red outer membrane of the hematoma, intermingled with yellowish pus material (Fig. 3). Following aspiration of the capsulated fluid, the hematoma cavity was carefully irrigated with a copious amount of physiological saline solution. Then a silastic tube was placed in the hema-

Fig. 3 Intraoperative photograph showing aspirated pinkish-red subdural hematoma intermingled with yellowish pus material.

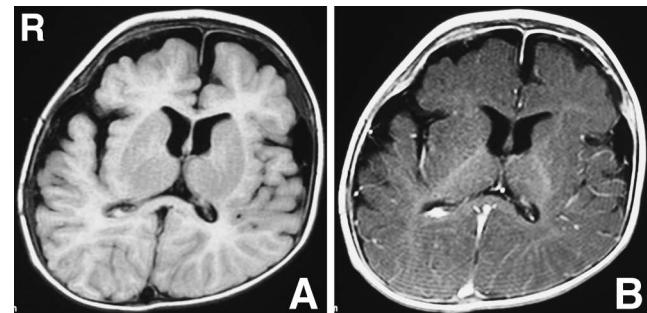


Fig. 4 Axial T₁-weighted magnetic resonance images before (A) and after (B) administration of contrast medium performed 8 weeks after completion of antibiotic therapy demonstrating complete resolution of the subdural fluid collection.

toma cavity, and withdrawn on postoperative day 3. Culture of the purulent specimen identified *E. coli* as the causative organism. Postoperatively the patient was treated with antibiotic therapy with intravenous administration of third-generation cephalosporin (ceftriaxone sodium hydrate, 125 mg/day in 2 divided doses) for 8 weeks, resulting in resolution of the fever and seizure, and normalization of the blood WBC count and CRP level. MR imaging performed following completion of antibiotic therapy revealed complete resolution of the subdural fluid accumulation (Fig. 4). The patient was discharged without neurological sequelae and has been doing well as an outpatient without remission or recurrence of infection.

Discussion

E. coli is the most common cause of bloodstream infection, but the epidemiology has not well been defined in the non-selected population. A cohort study showed that infants and the elderly were at highest risk for *E. coli* infection.⁷

Hematogenous transmissions of *E. coli* usually occur as a complication of focal infections of the urinary or gastrointestinal tracts, but occasionally also occur as primary bacteremia without a definite source. The predisposing factors were not identified in 70% of patients, which reflects the limited understanding of *E. coli* infection.³⁾ In the present case, the predisposing factors were not identified. We assumed that asymptomatic urinary tract infection or gastroenteritis was the probable origin of the *E. coli* infection, although no extracranial focal infection was identified.

Subdural empyema is estimated to account for 10–20% of all childhood intracranial bacterial infections. Subdural empyema usually develops as a complication of bacterial meningitis resulting in significant morbidity and mortality, despite recent advances in neuroimaging, surgical techniques, and antibiotic therapy.^{1,2,11)} A large series found that 30 of 80 patients with infantile meningitis had concomitant subdural empyema.³⁾ The prevalent pathogens of infantile meningitis are *Streptococcus* species, *Haemophilus influenzae*, *E. coli*, and *Salmonella* species.^{3,13)} In past large series, *E. coli* was responsible for 9.7% to 27% of cases.^{3,8,13)}

Subdural hemorrhage in an infant has been considered to result from rupture of the cortical bridging veins, but recent investigation suggested a dural origin, as the intradural vessels, thin-walled and adapted for fluid resorption, may be the most likely to leak, resulting in bleeding into the dura and simultaneously forming a subdural hematoma either spontaneously or after an otherwise innocuous event.¹²⁾ Our patient had no apparent history of traumatic episodes. Therefore, we assumed that the preexisting subdural hematoma had formed after unrecognized minor head trauma, and hematogenous infection by *E. coli* had occurred via the outer membrane resulting in empyema. The significantly thickened outer membrane of the hematoma found intraoperatively may support this mechanism.

The appropriate surgical option, and correct dose and period of antibiotic administration to treat infected subdural hematoma have not been determined because of its rarity. The reported infant cases were successfully managed by burr-hole drainage and empirical administration of antibiotic agents.^{5,6,9,10)} All patients had only localized subdural infection with minimal signs of meningitis, in contrast to subdural empyema commonly associated with meningitis, which may be the reason for the more satisfactory outcome of patients with infected subdural hematoma. A thick membrane formed in the chronic subdural hematoma may act as a barrier to the dissemination of localized infection within the capsulated hematoma resulting in meningitis. In the present case, we selected burr-hole drainage as a less invasive surgery because the patient did not have any neurological deficits caused by the lesion except for persistent focal seizure in the contralateral upper extremity. Burr-hole drainage and ade-

quate subdural irrigation followed by intensive antibiotic therapy successfully resolved the infection without remission or recurrence. Experience with more cases is needed to better understand and standardize the treatment strategy for infantile infected subdural hematoma.

Pediatric subdural empyema can be successfully treated with early surgical intervention, eradication of the infectious agent, and administration of appropriate antibiotic agents. We should be aware of the possibility of infected subdural hematoma in infants who present with subdural hemorrhage with clinical symptoms of bacteremia.

References

- 1) Banerjee AD, Pandey P, Devi BI, Sampath S, Chandramouli BA: Pediatric supratentorial subdural empyemas: a retrospective analysis of 65 cases. *Pediatr Neurosurg* 45: 11–18, 2009
- 2) Bockova J, Rigamonti D: Intracranial empyema. *Pediatr Infect Dis J* 19: 735–737, 2000
- 3) Chang CJ, Chang WN, Huang LT, Huang SC, Chang YC, Hung PL, Lu CH, Chang CS, Cheng BC, Lee PY, Wang KW, Chang HW: Bacterial meningitis in infants: the epidemiology, clinical features, and prognostic factors. *Brain Dev* 26: 168–175, 2004
- 4) Greenlee JE: Subdural empyema. *Curr Treat Options Neurol* 5: 13–22, 2003
- 5) Hamada J, Ichimura H, Ushio Y: Huge subdural empyema with unusual presentation in infant—case report. *Neurol Med Chir (Tokyo)* 33: 40–43, 1993
- 6) Hoshina T, Kusuvara K, Saito M, Mizoguchi M, Morioka T, Mizuno Y, Aoki T, Hara T: Infected subdural hematoma in an infant. *Jpn J Infect Dis* 61: 412–414, 2008
- 7) Laupland KB, Gregson DB, Church DL, Ross T, Pitout JD: Incidence, risk factors and outcomes of *Escherichia coli* bloodstream infections in a large Canadian region. *Clin Microbiol Infect* 14: 1041–1047, 2008
- 8) Legrand M, Roujeau T, Meyer P, Carli P, Orliaguet G, Blanot S: Paediatric intracranial empyema: differences according to age. *Eur J Pediatr* 168: 1235–1241, 2009
- 9) Le Roux PC, Wood M, Campbell RA: Subdural empyema caused by an unusual organism following intracranial haematoma. *Childs Nerv Syst* 23: 825–827, 2007
- 10) Levy I, Sood S: *Staphylococcus aureus* dissemination to a preexisting subdural hematoma. *Pediatr Infect Dis J* 15: 1139–1140, 1996
- 11) Pattisapu JV, Parent AD: Subdural empyemas in children. *Pediatr Neurosci* 13: 251–254, 1987
- 12) Squier W, Mack J: The neuropathology of infant subdural haemorrhage. *Forensic Sci Int* 187: 6–13, 2009
- 13) Wu TJ, Chiu NC, Huang FY: Subdural empyema in children—20-year experience in a medical center. *J Microbiol Immunol Infect* 41: 62–67, 2008

Address reprint requests to: Satoshi Tsutsumi, M.D., Ph.D., Department of Neurological Surgery, Juntendo University Urayasu Hospital, 2-1-1 Tomioka, Urayasu, Chiba 279-0021, Japan.
e-mail: shotaro@juntendo-urayasu.jp