INFECTED CEPHALHEMATOMA AND NEONATAL MENINGITIS COMPLICATING OSTEOMYELITIS OF THE SKULL

—A Case Report—

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The case of a newborn infant with E. coli sepsis, meningitis and infected cephalhematoma complicating with osteomyelitis of the underlying skull is presented. The diagnosis of infected cephalhematoma and osteomyelitis of the skull were documented by clinical manifestations and skull X-rays. Treatment with proper antibiotics for three weeks did not eradicate the infections. Recovery followed only after incision and drainage in addition to antibiotic therapy for another four weeks. The rarity of a cephalhematoma becoming infected is mentioned. Recent advances in treatment of neonatal meningitis and osteomyelitis are discussed briefly. Available data confirm that one of the newer "third generation" cephalosporins can be used effectively and safely as a single drug in the treatment of neonatal Gram-negative bacillary meningitis. (Acta Paed Sin, 28: 184-188, 1987)

Key words: ***infected cephalhematoma, sepsis, neonatal meningitis, osteomyelitis***

Cephalhematoma, a subperiosteal hematoma of the skull, is a common form of neonatal injury. Though generally benign and self-limited, it may produce complications. The most frequent complications are hyperbilirubinemia, anemia, underlying skull fracture and exostosis.[1-3] Infrequently, infection may follow needle aspiration or occur spontaneously.[4-9] Osteomyelitis is the unusual complication of infected cephalhematoma.[10-12]

This report describes a newborn with sepsis, meningitis and infection of cephalhematoma complicated by osteomyelitis of the underlying parietal bone.

CASE REPORT

A five-day-old, full-term, male baby, weighing 3860 gm, was born of a healthy gravida-2, para-1, abortus-1 mother on November 19, 1985. The delivery was aided by vacuum traction. There was a 3×4 cm cephalhematoma over the right parietal area. On the fourth day of life, the baby was noted to have abdominal distention, moderate jaundice and high fever (39.3 C). A series of septic work-ups, including blood, urine and cerebrospinal fluid (CSF) cultures, were done. The CSF appeared xanthochromic with a white blood cell (WBC) count of 6,000/cmm with 84% of polymorphonuclears and 16% of lymphocytes, red blood cell (RBC) count was 700/cmm, sugar 21 mg/dl, protein 180 mg/dl and chloride 118 meq/L. The peripheral blood hemoglobin was 16.4 gm/dl, WBC was 11,300/cmm with polymorphonuclear leukocyte dominant (51%). The serum bilirubin level was 14.9 mg/dl in total with direct bilirubin of 1.2 mg/dl. The infant was placed on antibiotic therapy with ampicillin 200 mg and cefotaxime 200 mg intravenously (iv) every six

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hours soon after the septic work-ups. The blood and CSF cultures subsequently grew Escherichia coli, sensitive to both ampicillin and cefotaxime. On the fifth day of life, the baby was transferred to the Pediatrics Department, and his general condition improved; he became afebrile two days later after continuing the antibiotic therapy. On the 16th day of life, a small erythematous mass grew beside the cephalhematoma. The cephalhematoma remained the size, with little fluctuation. Repeated aspiration and culture of the erythematous mass grew no organism. In spite of the good general condition antibiotic therapy was continued.

On the 25th day of life, skull X-rays (Fig. 1) showed osteolytic change under the cephalhematoma. Infected cephalhematoma with osteomyelitis of the underlying skull was suspected. Tapping of the cephalhematoma produced sanguinous pus. Incision and drainage were done, and about 30 ml of sanguinous pus was drained. The pus culture was sterile. After incision, the baby was continuously treated with ampicillin and cefotaxime for another three weeks. The cephalhematoma subsided gradually and the incision wound healed three weeks later. Follow-up skull X-rays revealed healing of the osteomyelitis as well. The baby was discharged, with complete recovery, at eight weeks of age.

DISCUSSION

Cephalhematoma is generally a benign, subperiosteal hemorrhage. It occurs from 1.5% to 2.5% of deliveries.[3] Resorption of the hematoma usually occurs within 2-8 weeks.[3] The incidence of linear skull fracture is 18% in infants with bilateral cephalhematoma but only 5% in unilateral cephalhematoma.[13].

Bacterial infection of a cephalhematoma is rare. It should be suspected whenever there is rapid enlargement of the mass several days after birth, cutaneous erythema over the lesion or otherwise unexplained fever and leukocytosis. The first reported case consistent with such an infection in a newborn with cephalohematoma, was described by Underwood[14] in 1818. Infection of a cephalhematoma may occur in a septic newborn infant or secondarily to contamination during attempted needle aspiration of the lesion.[4,5] Sjovall[6] described three cases of infected cephalhematoma; two of them were associated with overlying skin infection and one followed needle aspiration. Jacobson *et al*,[7] Gordon and Aronow,[8] Chiu and Lee[9] have reported spontaneous infection of cephalhematoma. Infected cephalhematoma and/or osteomyelitis of the skull have also been documented with the use of fetal scalp monitors.[15] Most cases of infected cephalhematoma were associated with septicemia and meningitis; the most

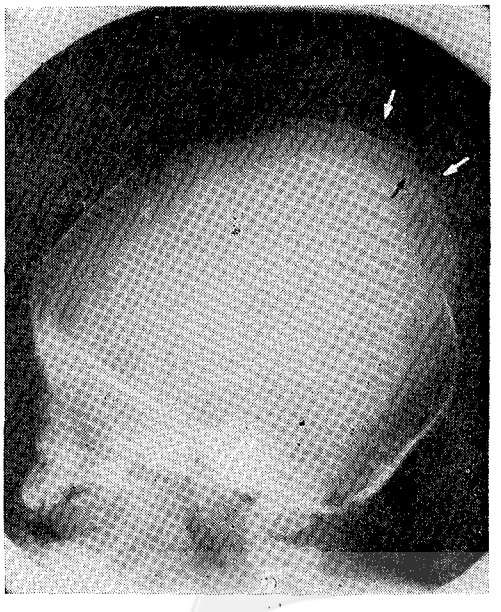

Fig. 1. Right lateral view of skull at 25 days of age shows osteolytic change (black arrow) under the cephalhematoma (arrows),

frequent infected organism was Escherichia coli.[5,8,10] In these cases the cephalhematoma were presumably seeded by an organism during the initial bacteremia. An infected cephalhematoma may be complicated by osteomyelitis of the underlying skull or by meningitis either associated with sepsis or secondary to intracranial extension through an adjacent skull fracture or a cranial suture.[10-12,15,16]

In the present case, he might have bacteremia initially and then induced meningitis and seeded the bacteria into the cephalhematoma. There was no underlying skull fracture, therefore osteomyelitis might have been caused by direct invasion of the infected cephalhematoma. The diagnosis of osteomyelitis cat be confirmed by skull X-rays. Although aspiration and incision of cephalhematoma may induce risk of infection,[6,14] diagnostic aspiration with aseptic techniques is certainly indicated in cases suspicious of infected cephalhematoma.[12] Adequate incision and drainage with appropriate antibiotic therapy are mandatory if infected cephalhematoma is present.[11,12]

Antimicrobial therapy for neonatal meningitis needs to be directed specifically towards the organism causing disease. Selection of appropriate antibiotic therapy is based in part on the achievable cerebrospinal fluid levels of these drugs in relation to the susceptibility of the organisms causing disease.[17,18] Traditionally, ampicillin and an aminoglycoside such as gentamicin are recommended for initial empiric treatment of neonatal meningitis because E. Coli and Group B streptococci are the most common causes of meningitis in this age group.[17-22] In Taiwan, though Chiu[23] and Kao[24] had reported the increasing incidence of Group B streptococcal meningitis in the newborn, Gram-negative enteric bacilli (E. Coli, Salmonella etc) are still the most frequent causative agents of neonatal meningitis.[25,26] In contrast to the combinations of ampicillin and an aminoglycoside, the third generation cephalosporins have held promise in the treatment of enteric Gram-negative bacillary meningitis.[18,20,26,27] Because they are highly bactericidal and penetrate well to the blood-brain barrier.[18,20,27] Cefotaxime is preferred to other third-generation cephalosporins for use in neonates both because it has been used more extensively[27-29] and because it is not excreted in the bile.[30] Thus, either cefotaxime or the conventional regimen of ampicillin and an aminoglycoside are satisfactory for treatment of enteric Gram-negative bacillary meningitis. If facilities are not available for determining aminoglycoside concentration, or if the patient has abnormal renal function, cefotaxime is preferred.[18] The dosage of third generation cephalosporins recommended is 100 mg/kg/day in 2 doses for infants less than 7 days old, increasing to 150-200 mg/kg/day in 3 to 4 doses for infants of 7 to 28 days of age.[18,31] The duration of antimicrobial therapy is based on the causative agent, the clinical response, and the development of complications. In general a minimum of ten days therapy is required for meningitis caused by H. influenzae or S. pneumoniae, 14 to 21 days for that caused by Group B streptococci or L. monocytogenes, and 21 days for disease caused by Gram-negative enteric bacilli.[18] Patients with meningococcal meningitis can usually be successfully treated for 7 to 10 days.[18]

The importance of early recognition and treatment of osteomyelitis of the skull is that it can prevent intracranial complications. These include epidural abscess, meningitis, thrombo-phlebitis of the dural sinus and brain abscess.[8,10,12] Antimicrobial therapy of neonatal musculoskeletal infection caused

by staphylococci or coliform organism is continued for a minimum of three weeks.[32,33] The use of oral antibiotics as a substitute for parenteral therapy during the second and third weeks of therapy is unwise because of the difficultly in assuring complete compliance on the part of the parents and the lack of experience with this route of administration in neonate.[34] Initially, this case had received antibiotic therapy for three weeks for treatment of E. coli meningitis. After documentation of infected cephalhematoma complicated with osteomyelitis of the skull, another four weeks of antibiotics therapy, followed by incision and drainage was continued. This resulted in the complete recovery from the disease.

REFERENCES

1. Rausen AR, Diamond LK. Enclosed hemorrhage and neonatal jaundice. Am J Dis Child 1961; **101**: 164-69.
2. Kendall N, Wolœshin H. Cephalhematoma associated with fracture of the skull. J Pediatr 1952; **41**: 125-32.
3. Schaffer AJ, Avery ME, Taeusch HW. Diseases of the newborn. 5th ed. Philadelphia: WB Saunders Co., 1984; pp. 662-64.
4. Burry VF, Hellerstein S. Septicemia and Subperiosteal cephalhematoma. J Pediatr 1966; **69**: 1133-35.
5. Lee YH, Berg RB. Cephalhematoma infected with bacteroids. Am J Dis Child 1971; **121**: 77-8.
6. Sjovall A. Le cephalhematoma des nouveau-nes. Acta Obstet Gynec Scand 1936; **15**: 443-74.
7. Jacobson M, Lander HB, Spiegel IJ. Spontaneous infection of cephalhematoma with recovery. J Pediatr 1960; **56**: 513-15.
8. Gordon HS, Aronow J. E. coli meningitis in a 5-day-old infant. JAMA 1955; **159**: 1288-89.
9. Chiu FY, Lee CY. Spontaneous infection of cephalhematoma: A report of 4 cases. Acta Paed Sin 1972; **13**: 12-7.
10. Levy HL, O'Connor JF, Ingall D. Bacteremia, infected cephalhematoma, and osteomyelitis of the skull in a newborn. Am J Dis Child 1967; **114**: 649-51.
11. Ellis SS, Montgomery JR, Wagner M, Hill RM. Osteomyelitis complicating neonatal cephalhematoma. Am J Dis Child 1974; **127**: 100-02.
12. Mohon RT, Mehalic TF, Grimes CK, *et al.* Infected cephalhematoma and neonatal osteomyelitis of the skull. Pediatr Infect Dis 1986; **5**: 253-56.
13. Zelson C, Lee SJ, Pearl M. The incidence of skull fractures underlying cephalhematoma in newborn infants. J Pediatr 1974; **85**: 371-73.
14. Underwood M. Treatise on the diseases of children. 6th ed. London, Philadelphia: James Webster, 1818; pp. 66-7.
15. Overtuff GD, Balfour G. Osteomyelitis and sepsis: Complications of fetal monitoring. Pediatrics 1975; **55**: 244-47.
16. Cohen SM, Miller BW, Orris HW. Meningitis complicating cephalhematoma. J Pediatr 1947; **30**: 327-29.
17. Schaffer AJ, Avery ME, Taeusch HW. Diseases of the newborn. 6th ed. Philadelphia: WB Saunders Co., 1984; pp. 735-38.
18. Klein JO, Feigin RD, McCracken GH. Report of the task force on diagnosis and management of meningitis. Pedatrics 1986; **78**(5) (Suppl): 959-82.
19. Schlech WF III, Ward JI, Band J, *et al.* Bacterial meningitis in the United States, 1978 through 1981: The National Bacterial Meningitis Surveillance Study. JAMA 1985; **253**: 1749-54.
20. Yogev R. Advance in diagnosis and treatment of childhood meningitis. Pediatr Infect Dis 1985; **4**: 321-25.
21. Epidemiology. Neonatal septicemia and meningitis (News and Notes). Br Med J 1978; **1**: 55.
22. Mulder CJJ, Van Alphen L, Zanen HC. Neonatal meningitis caused by Escherichia coli in the Netherlands. J Infect Dis 1984; **150**: 935-40.
23. 邱世昌、江滄鎮、陳澄旗、黃富源、沈淵瑤、楊定一。1975～1984 10年間兒童細菌性腦膜炎感染型態的改變—流行病學及微生物學之分析。中兒醫誌 1985; **26**(4): 363 (摘要)。
24. 高信安、黃富源、徐世達。新生兒 B 羣鏈球菌感染症。中兒醫誌 1986; **27**(3): 240-45.
25. 李月瑛、李明鎮、林凱信、黃焜璋。小兒化膿性腦膜炎—66例的臨床觀察及流行病學。中兒醫誌 1984; **25**(3): 353 (摘要)。
26. 李慶雲、許靜瑛、黃焜璋、陳森輝。第三代

cephalosporin 對新生兒腦膜炎之療效。中兒醫誌 1984; 25(3): 353 (摘要)。
27. Naqvi SH, Maxwell MA, Dunkle LM. Cefotaxime therapy of neonatal gram-negative bacillary meningitis. Pediatr Infect Dis 1985; 4: 499-502.
28. Begue P, Floret D, Mallet E, *et al.* Pharmacokinetics and clinical evaluation of cefotaxime in children suffering from purulent meningitis. J Antimicrob Chemother 1984; 14 (Suppl): 161-65.
29. Lecour H, Sera A, Miranda AM. Treatment of 160 cases of acute bacterial meningitis with cefotaxime. J Antimicrob Chemother 1984; 14(Suppl): 195-202.
30. Sunukawa K, Akita H, Iwata S, *et al.* The influence of cefotaxime on intestinal flora and bleeding diathesis in infants and neonates, compared with other β-lactams. J Antimicrob Chemother 1984; 14(Suppl): 317-24.
31. McCracken GH, Threlkeld NE, Thomas ML. Pharmacokinetics of cefotaxime in newborn infants. Antimicrob Agents Chemother 1982; 21: 683-84.
32. Fox L, Sprunt K. Neonatal osteomyelitis. Pediatrics 1978; 62: 535-42.
33. Waldvogel FA, Vasey H. Osteomyelitis: the past decade. N Engl J Med 1980; 303: 360-70.
34. Schaff AJ, Avery ME, Taeusch HW. Diseases of the newborn. 5th ed. Philadelphia: WB Saunders Co., 1984; pp. 741-42.

頭顱血腫感染和新生兒腦膜炎併發顱骨骨髓炎

一病例報告

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本文報告1例由大腸桿菌引起的新生兒敗血症和腦膜炎及頭顱血腫感染併發顱骨骨髓炎。在本病例中頭顱血腫感染症併發顱骨骨髓炎可由臨床症狀及頭部 X-光變化得到證明。單用抗生素治療並不能根絕頭顱血腫感染症，適當的切開引流術加上正確的抗生素治療可達完全治癒。文內並就少見的頭顱血腫感染予以討論；並對新生兒腦膜炎及骨髓炎的最新治療方法，依文獻做扼要的回顧。由臨床使用報告顯示，第三代 Cephalosporins 抗生素可單獨安全有效地應用於治療由格蘭氏陰性腸內菌引起之新生兒腦膜炎。