Osteomyelitis and Sepsis: Severe Complications of Fetal Monitoring

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ABSTRACT. Sophisticated modern methods of fetal monitoring during labor have improved the prognosis for high-risk infants, but the possible adverse side effects have not yet been fully documented. One infant with osteomyelitis and one with streptococcal sepsis are reported. In the future, greater attention should be paid to such potential complications and new noninvasive techniques of fetal monitoring should be developed. *Pediatrics*, 55:244, 1975, OSTEOMYELITIS, SEPSIS, FETAL MONITORING.

During the past decade, sophisticated techniques have been developed to monitor the fetus during labor, thus providing better data for maternal obstetrical management and reducing the risks to the infant. Direct monitoring of the fetal electrocardiogram is now possible, using any of several varieties of electrodes attached directly to the fetal presenting part, usually the vertex of the scalp. Although reports of maternal and fetal complications have been infrequent, the complete spectrum of adverse effects has yet to be documented. In this report, we describe the occurrence of osteomyelitis of the skull in one neonate and streptococcal sepsis in another after use of a fetal monitoring electrode in each infant.

CASE REPORTS

Case 1

D.T., a female Polynesian infant, was born at a community hospital. She was the first born of twins, delivered at 36 weeks gestation; her birthweight was 2,750 gm. A spiral-type scalp electrode was inserted into the vertex and left in place five hours until immediately before delivery. Maternal membranes were ruptured for less than 24 hours before birth. Five days after delivery, it was observed that the infant had a "large cephalohematoma" over the left parietal area surrounding the site of the monitoring electrode. The swelling enlarged slightly over the following two days; however, the infant remained well and was discharged at eight days. The infant's mother, however, was readmitted and treated for endometritis at the same hospital five days postpartum.

The infant was subsequently admitted to Los Angeles County/University of Southern California Medical Center (LAC/USC MC) at 26 days of age with a two-day history of swelling and erythema over the posterior fontanel. The parents had noticed a straw-colored fluid draining from the center of the lesion for two to three days before admission.

On admission to LAC/USC MC, the heart rate was 156/min, respirations, 52/min, and body temperature, 37.0C. The infant weighed 3,184 gm, and the head circumference was 53 cm. A raised, erythematous, nonfluctuant mass, 2.5 cm in diameter, was present adjacent to the posterior fontanel over the left parietal-occipital region of the scalp. A small amount of serous fluid drained from the central portion of the mass.

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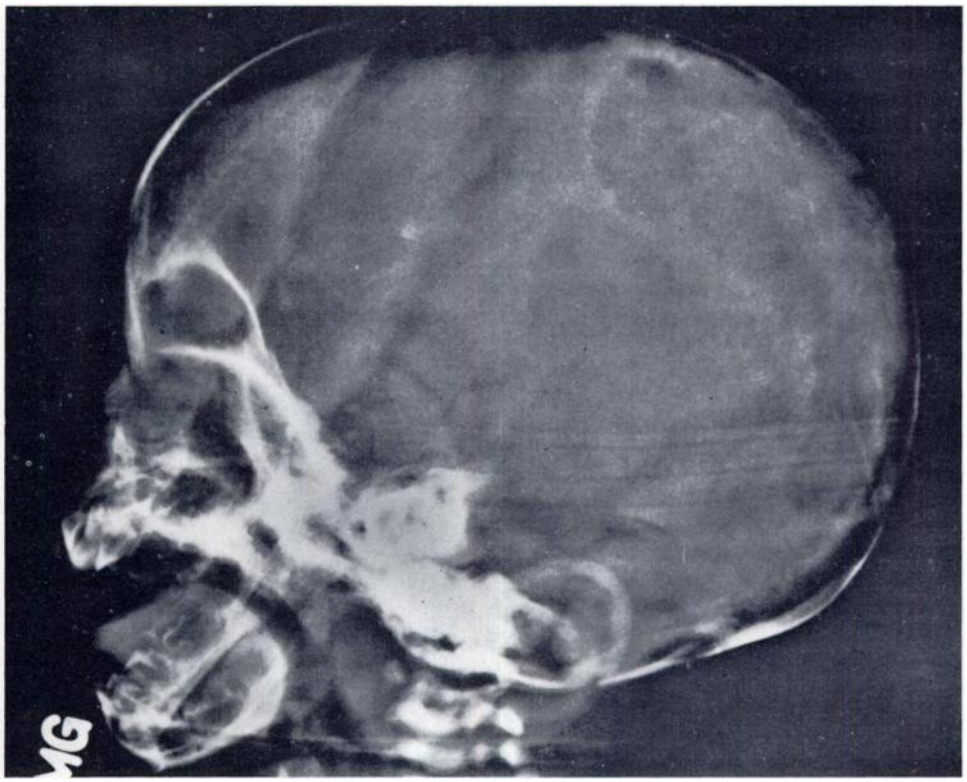

FIG. 1. Osteomyelitis of the posterior parietal-occipital skull in case 1.

Laboratory findings on admission included hemoglobin of 9.8 gm/100 ml; hematocrit, 27%; white blood cell count 27,000/cu mm,[3] with a differential count of 29% polymorphonuclear cells, 5% band forms, 62% lymphocytes, 3% monocytes, and 1% eosinophils; sedimentation rate, 57 mm/min. Roentgenograms of the skull (Fig. 1) revealed a large radiolucent area with a sclerotic border encompassing most of the left parietal bone, extending from 1 to 2 cm above the posterior fontanel to immediately below the left lambdoidal suture. No organisms were seen on gram stain of the exudate from the scalp. *Staphylococcus epidermidis* was recovered on culture of local aspirates and exudate. Blood cultures were repeatedly negative.

Therapy was instituted with parenteral administration of methicillin (150 mg/kg of body weight/24 hr, intravenously) and gentamicin (5.0 mg/kg of body weight/day, intramuscularly). During the first six days of hospitalization, the infant fed well, remained afebrile, and the mass slowly reduced in size. A 2-cm area of fluctuation appeared on the sixth hospital day and drained purulent material spontaneously. Surgical incision and drainage were performed and extensive debridement was undertaken. Cultures of this material also grew S. *epidermidis*.

On the eighth hospital day, the infant developed tachypnea and tachycardia associated with hepatosplenomegaly and cardiomegaly. An electrocardiogram demonstrated low voltages and an absence of left-sided forces. Although the cause of her heart failure remained unknown, the infant was treated with digitalis and diuretics were initiated with good response. In addition, clindamycin (20 mg/kg of body weight/day, administered intravenously) was added, since an anaerobic sepsis was suspected because a gram-positive coccus was found growing from a surgical specimen under thioglycolate broth only. Gentamicin was discontinued on the 13th hospital day when all cultures had failed to reveal the presence of susceptible organisms.

The patient was taken to surgery on the 19th hospital day to debride the area of osteomyelitis and establish drainage. A craniotomy was performed and the superior posterior portion of the left parietal bone was found to be considerably softened. A small portion of the right parietal bone and apex of the occipital bone were removed along with the involved left parietal bone. Methicillin was discontinued nine days postoperatively and the patient was continued on clindamycin administered intravenously for four weeks postoperatively. *In vitro* susceptibility testing against the isolated S. *epidermidis* revealed an MIC of 0.1 μg/ml to clindamycin. She remained afebrile and her wounds progressively healed. The infant was discharged on the 47th hospital day and convalescence was uncomplicated.

Case 2

L.V., a 2,460-gm Caucasian female infant, was born at term at LAC/USC MC on June 28, 1973 to a 37-year-old chronic alcoholic mother. Membranes were ruptured for 18 hours before delivery, and no amnionitis was observed. The postnatal course was complicated by perinatal maternal fever and a possible alcoholic withdrawal syndrome in the infant associated with hypocalcemia and hypoglycemia. Neonatal asphyxia was suspected because of transient postpartum respiratory cyanosis and lethargy. However, Apgar score at five minutes was 9. The infant was observed to take

feedings poorly for a prolonged period. Because of the infant's irritability and tremulousness, she received sedation in addition to glucose and calcium administration.

At 7 days of age, a small draining scalp abscess was seen surrounding the site of the fetal monitor in the right parietal area. The abscess was incised and drained, cultures were obtained, and dicloxacillin (25 mg/kg of body weight/day) was given by mouth. On the following day, a second abscess was found immediately adjacent to the first and it too was incised. On the ninth day a β hemolytic streptococcus, nongroup A or D, was recovered from cultures of the initial abscess. Dicloxacillin was discontinued and oral administration of phenoxymethyl penicillin (50,000 units/kg of body weight/day) was initiated. The infant remained afebrile and continued to feed well; she was discharged on the 11th hospital day and continued on penicillin therapy.

The mother failed to continue the medication, and the infant was readmitted two days after discharge with a 5 × 5 cm. area of cellulitis in the right parietal-occipital region. The infant was afebrile. Gram-positive cocci were noted on an aspirate of the cellulitis. Subsequent skin and blood cultures grew β-hemolytic streptococci, non-group A or D. Admission laboratory data included: hemoglobin, 16.8 gm/100 ml; white blood cell count, 35,000 with 75% polymorphonuclear cells, 6% bands, 17% lymphocytes, and 2% monocytes. Intravenous administration of methicillin (250 mg/kg of body weight/day) was begun. On the third hospital day, a wide incision and drainage were performed. The baby improved progressively and was discharged on the fifth hospital day on orally administered ampicillin (125 mg/kg of body weight/day). The family failed to appear for scheduled appointments.

DISCUSSION

Monitoring techniques have led to improved survival for high-risk infants.[1,2] Reports of fetal complications of monitoring have been confined to episodes of hemorrhage, localized septic and sterile abscess formation, and abrasions and lacerations of the scalp site. Early electrodes were hand-crafted products of research laboratories, although recently a silver-silver chloride, two-prong, clip-type of electrode has become available commercially. In several large studies, the clip device has been associated with a low incidence of complications. Cordero and Hon[3] reported only seven scalp abscesses among 2,003 fetuses monitored with the clip electrode, including one instance of use that resulted in a septic episode caused by *Klebsiella*. The onset of each of these abscesses was within the first eight days of life. Scanlon and Walkley[4] have reported a case of significant fetal bleeding resulting from a scalp arterial laceration from an implanted monitoring electrode of this same type.

Recently Hon and his colleagues[5] have developed a spiral, stainless steel electrode. An expectation of greater use of this device is probable because of the advantages of its smaller size, ease of application, greater reliability, and commercial availability. No serious complications have been reported from this particular electrode. However, Paul and Hon[6] reported two abscesses among 600 monitored infants. The etiologic agent responsible in these two instances was not mentioned.

In our first case, osteomyelitis of the skull resulted from entry or indeed may have conceivably been the cause of a cephalohematoma by a monitoring spiral electrode. It is also possible that the electrode may have been directly associated with an abscess and the diagnosis of cephalohematoma was in error. Although S. *epidermidis* is an infrequent cause of osteomyelitis, it is the probable cause in this case. A second case also seems clearly to relate the acquisition of a pathogen and ensuing sepsis to fetal monitoring.

Because scalp abscesses frequently appear after several days and the usual follow-up period for newborn infants may be brief, it is possible that the real incidence of these infections may be unknown. Both the infants reviewed were seen with their infectious complications after the time of usual discharge for term neonates. The frequent documentation of "sterile" abscesses suggests that many episodes may resolve spontaneously. Alternatively, these infections may involve organisms of low pathogenicity or anaerobic organisms. Infection incidence may also vary according to the perinatal and general infection rate within the hospital. In addition, little information is currently available on the relationship between various implantation techniques and subsequent complications.

Our own experience has suggested that the incidence of abscesses after scalp monitoring is relatively infrequent. From January 1 through December 31, 1973, 3,329 infants (32% of all deliveries) were monitored at LAC/USC Medical Center.[7] During this same time period, two infants were admitted to the Pediatric Pavilion (including the second case reported here) with scalp abscesses despite the lack of an active surveillance system to detect other cases. Few prospective studies have been developed to define the risk of infections in infants after fetal monitoring. It is hoped that in the future greater attention will be given to the potential hazards of the present types of monitoring devices as well as developing noninvasive techniques.

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THE LIMITS OF MEDICAL CARE

Overpopulation makes more people dependent on limited resources. Affluence compels each person to use more energy. Faulty technology degrades energy in an inefficient way.

Honesty requires that we each recognize the need to limit procreation, consumption and waste, but equally we must radically reduce our expectations that machines will do our work for us or that therapists can make us learned or healthy.

IVAN ILLICK
Tools for Conviviality
(New York: Harper & Row, 1973)