Acute Otitis Media in an Extremely Preterm Infant

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Abstract

There are a limited number of documented cases of acute otitis media (AOM) in preterm infants while hospitalized in the neonatal intensive care unit (NICU). We present a case of a former 26 weeks old infant who at 29 weeks, 6 days postmenstrual age presented with acute signs and symptoms of systemic sepsis subsequently found to be secondary to AOM with purulent ear drainage. The patient received a septic evaluation, including urine, blood, and cerebrospinal fluid studies. Treatment included intravenous antibiotics with full resolution of symptoms. AOM in extreme preterm infants is multifactorial, with leading causes that include prematurity, the use of oropharyngeal and nasogastric tube placement and endotracheal intubation, eustachian tube dysfunction, and a distinct immune response. To our knowledge, there is not another published case of AOM of a preterm baby while in the NICU.

Keywords
- acute otitis media
- preterm
- NICU
- otorrhea

Acute otitis media (AOM) is one of the most common diagnoses among young children in the primary care setting.[1] Though consensus on diagnosis may vary, in 2013 the American Academy of Pediatrics released a clinical practice guideline on the management of AOM. However, this did not address populations under 6 months, particularly those in the neonatal intensive care unit (NICU).[2] Premature neonates have smaller eustachian tubes, distinct immune responses, and a decreased level of secretory immunoglobulin A (IgA). Thus, prematurity is the most common risk factor for recurrent otitis media with effusion (OME).[3]

Case Description

A premature baby girl was born at 26 weeks of gestation, weighing 790 g, to a 29-year-old, Gravida 4 Para 0030. Perinatal history was significant for maternal abdominal pain and vaginal bleeding. She was febrile with early cervical dilation one day prior to delivery. Given the concern for preterm labor in the setting of chorioamnionitis, the mother was started on ampicillin, gentamicin, given one dose of betamethasone and induced. Prenatal lab results were negative for human immunodeficiency virus, syphilis, chlamydia, gonorrhea, and hepatitis B virus. Group B *Streptococcus* was initially unknown and later positive. Maternal history was significant for sickle cell trait and herpes simplex virus (HSV) prior to pregnancy with no active lesions during pregnancy. The baby was delivered vaginally with APGAR scores of 6 and 8 at 1 and 5 minutes, respectively. She was intubated in the delivery room for poor respiratory effort and admitted to the NICU for ongoing management related to her prematurity. Maternal placental histopathology was consistent with a third trimester placenta with acute chorioamnionitis and umbilical and chorionic vessels phlebitis.

Upon NICU admission, the patient received 48 hours of ampicillin and gentamicin for suspected sepsis. Her other diagnoses included respiratory distress syndrome, slow feeding, and apnea of prematurity. She required intubation for the first 2 days of life (DOL). Total parental nutrition (TPN) and donor breast milk (DBM) began on DOL 0. Expressed

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breast milk (EBM) began on DOL 3. TPN was discontinued on DOL 11. The infant received EBM (~99.5%) and DBM (~0.5%) until DOL 30.

The patient was hemodynamically stable on bubble continuous positive airway pressure until DOL 30 when frequent and prolonged apneas led to reintubation. Due to the acute change in clinical status, a partial sepsis evaluation was initiated with the following laboratory results: complete blood count, basic metabolic panel, C-reactive protein, and blood culture. Abdominal and chest radiographs were completed and nafcillin and gentamicin were administered. Within 24 hours, bilateral purulent otorrhea was noted. On physical exam, there was left-sided erythematous pre- and postauricular rash along with postauricular desquamation. An otoscopic evaluation revealed bilateral purulent drainage, left greater than right, the tympanic membranes (TM) could not be visualized, and the external auditory canals were erythematous. Pediatric infectious disease consulted and the following additional laboratory tests were sent: cerebrospinal fluid (CSF) for HSV, culture, protein, glucose, and cell count, a urinalysis and urine culture; and periauricular swabs for anaerobic, aerobic as well as HSV. Given concerns for methicillin-resistant *Staphylococcus aureus* (MRSA), pseudomonas and antibiotics were changed to linezolid, cefepime, acyclovir, and fluconazole prophylaxis. See ►**Tables 1** and **2** for laboratory results. The aerobic ear culture grew: moderate *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, and *Enterococcus faecalis*. Blood culture was negative, HSV swabs were negative, CSF culture was negative, urine culture was negative, anaerobic culture was negative, and MRSA swabs were negative. The chest and abdominal radiographs were unremarkable. On DOL 32, she was extubated. She received a 7-day course of piperacillin/tazobactam. The drainage and desquamation resolved within one week.

On DOL 46 (postmenstrual age [PMA]: 32 weeks and 5 days), all respiratory support was discontinued and on DOL 76 with PMA of 36 weeks and 6 days, she was discharged home. Prior to discharge, the infant passed the hearing test bilaterally (evoked otoacoustic emissions and auditory brainstem response). Due to extreme prematurity, the patient had a head ultrasound and brain magnetic resonance imaging which were unremarkable.

Table 1 Laboratory results

Test	DOL 30	DOL 32
WBC (k/μL)	19.6	11.4
Hb (g/dL)	8.6	10.6
Platelet (k/μL)	526	465
Absolute neutrophil count (cells/μL)	7,056	4,104
I/T ratio	0	0
C-reactive protein (mg/dL)	<0.5	1.5
HSV serum	Negative	
BMP and urinalysis	Unremarkable	

Abbreviations: BMP, basic metabolic panel; CSF, cerebrospinal fluid; DOL, day of life; Hb, hemoglobin; HSV, herpes simplex virus; I/T ratio, immature/total neutrophil count; WBC, white blood cell count.

Table 2 CSF studies on DOL 30

Test	Result
Appearance	Clear
Color	Colorless
RBC count	10
WBC count	3
Glucose	57
Total protein	116
CSF herpes simplex PCR	Not detected

Abbreviations: CSF, cerebrospinal fluid; DOL, day of life; RBC, red blood cell count; PCR, polymerase chain reaction; WBC, white blood cell count.

Discussion

The etiology of the increased incidence of AOM in premature infants is multifactorial. A study conducted on 86 preterm babies reported that the rate of AOM is inversely related to the gestational age, and with every additional week of gestational age, the odds ratio of AOM decreases by 0.7.[4] The study also determined that the frequency of finding abnormal ear exams in preterm babies is 72.9%.[5] This in large part is influenced by intrinsic factors related to anatomical differences with prematurity, such as smaller and straight eustachian tubes and lower level of immunoglobins specifically secretory IgA.[3] Extrinsic factors that affect AOM incidence include mode of delivery, cesarean more than vaginal, endotracheal intubation, and feeding tube insertion, which cause increased pressure inside the eustachian tube, further contributing to dysfunction.[6] Additionally, proinflammatory mediators activated secondary to maternal chorioamnionitis may lead to eustachian tube dysfunction with babies often presenting with OME.[7] Maternal chorioamnionitis, even when not histopathologically significant, has been shown to be a significant factor in the development of OME in the first 3 years of life.[7] Protective factors such as breast milk, which is rich in secretory IgA, are shown to lower the incidence of AOM.[3]

Neonates rarely have specific signs and symptoms of AOM. Fortunately, ampicillin and gentamicin are commonly used for neonatal sepsis and provide adequate antibiotic coverage for AOM. Otitis media in infants can be difficult to diagnose as the TM is more horizontal in shape; thus, a review article on OM in neonates concluded that OM is defined as erythema/inflammation of TM and/or absent or minimal mobility of TM.[5,8] Inflammation of the ear mucosa can lead to watery, serosanguinous, or purulent discharge. The infant in this case had purulent bilateral ear discharge along with some episodes of apnea and bradycardia.

The most common pathogens isolated in AOM are gram-positive bacilli: *S. pneumoniae* and *S. pyogenes*, followed by gram-negative bacilli, nontypeable *Haemophilus influenzae, Moraxella catarrhalis,* which make up 10.5% of the cases.[9] A study published in 2005 reported that enteric bacteria such

as *Klebsiella pneumoniae* is the pathogenic organism responsible for AOM in 6% of the cases in infants less than 3 months of age.[10] *Klebsiella pneumoniae* and *Enterococcus faecalis* were the isolated organisms in this patient, both of which are not common pathogenic organisms of AOM. *S. epidermidis* was also isolated from the culture that is likely an organism from skin flora.

Antibiotic management was based on common pathogenic organisms known to cause AOM, the neonatal risk factors, as well as the physical exam. Ampicillin was chosen for gram-positive coverage, cefepime for gram-negative coverage, and CSF penetration and acyclovir for HSV prophylaxis. HSV was a concern given the infant had postauricular erythematous rash and maternal history of previous HSV.

When available, treatment is targeted to the sensitivities of the culture. Most literature suggests ampicillin with or without clavulanic acid and a third-generation cephalosporin.[8,11] Literature showed debating data regarding hearing loss associated with recurrent otitis media. A case–control study done on preterm infants demonstrated that cases with tympanometry abnormality had a depressed hearing threshold.[12]

Conclusion

AOM should be considered on the list of differential diagnosis for preterm infants who present with signs and symptoms of presumed sepsis. In addition to the routine evaluation, an otoscopic exam should be utilized to rule out AOM.

Conflict of Interest
None declared.

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