Suffer the Infants: A Severe Case of Pertussis in Oregon, 2012

ABSTRACT

Pertussis remains a public health concern in Oregon, especially among young infants. The disease can be severe in this age group and is associated with a high inpatient cost. This report describes an Oregon infant who was hospitalized with pertussis for 90 days, required extracorporeal oxygenation for 43 days, suffered complications including stroke, and had hospital charges totaling $1.5 million. Pertussis morbidity among young infants argues for vaccination of women during each pregnancy and of infants beginning promptly at two months of age.

Pertussis is often considered a merely persistent but ultimately self-limited nagging cough. However, afflicted infants may suffer hospitalization, serious complications, and sometimes death. We report a severe case of pertussis and review recent public health data to describe the burden of pertussis among infants in Oregon.

CASE REPORT

A 3,136-gram Hispanic girl was born at 35 weeks’ estimated gestational age via normal spontaneous vaginal delivery, was vaccinated at birth with hepatitis B vaccine, and had an uneventful postnatal course. The family subscribed to vaccination, and the baby’s siblings were current with pertussis-containing vaccines. The mother had declined tetanus, diphtheria, and acellular pertussis vaccine (Tdap) offered during pregnancy. She received it two weeks after delivery.

At 18 days of life, the baby was brought to an emergency department for a choking episode after being bottle-fed breast milk. According to the patient’s father, prior to being brought to the emergency department, the baby had...
stopped breathing and turned blue. Upon admission to the emergency department, her temperature was 97.2°F, her respiratory rate was 24 breaths per minute, and her room-air oxygen saturation was 97%. Her white blood cell count was 9,300 per microliter (μL) with 67% lymphocytes. Her chest radiograph was normal. Neither cough nor apneic episodes were noted. Her physical examination was normal. Given the history of the choking episode, the patient was admitted for observation. However, she was discharged from the hospital the following day on no medications.

At 20 days of life, the patient was reevaluated in the doctor’s office for the reported apneic episode (i.e., the apnea was that which occurred on day 18 of life). The mother mentioned a new cough for the past three days. A physical examination of the infant was again unremarkable, and she was sent home without intervention.

At 23 days of life, the mother returned to the doctor’s office with the infant. She reported that the infant had developed paroxysmal cough, perioral cyanosis, and gagging after feeding. Nasopharyngeal secretions were obtained for pertussis testing by polymerase chain reaction (PCR), and azithromycin was prescribed. The baby’s mother was also noted to have a productive, paroxysmal cough. No other ill contacts were identified.

The mother and baby were sent home, with follow-up planned for the next day at the doctor’s office. Upon their return, the doctor observed that the infant had worsened, with poor feeding, apnea, and bradycardia at 40–60 beats per minute. The infant was transferred via ambulance from the doctor’s office to a tertiary-care children’s hospital. On admission, she suffered additional episodes of apnea, with intermittent oxygen desaturations to 60%, and bradycardia.

Respiratory failure ensued during the next 24 hours, and the infant was transferred to the pediatric intensive care unit. The peripheral white blood count was 52,800 per μL with 48% lymphocytes. A chest X-ray revealed airway thickening and pulmonary ground-glass opacities (Figure 1). The infant was intubated and placed on extracorporeal membrane oxygenation (ECMO). PCR from nasopharyngeal secretions was positive for *Bordetella pertussis*.

While on ECMO, the patient developed seizures and suffered a left middle cerebral artery-territory infarction. A cranial ultrasound demonstrated significant ill-defined echogenicities in the left interior frontal, temporal, and subinsular regions, and mild ventriculomegaly.

The hospital course was complicated by pneumonia caused by *Staphylococcus aureus* and *Enterobacter cloacae*, suspected sepsis, severe pulmonary hypertension, hyperbilirubinemia (peak total bilirubin, 42.5 milligrams per deciliter), renal failure necessitating hemodialysis for 31 days, medical necrotizing enterocolitis, seizures, drug dependence (lorazepam), and bronchiolitis obliterans.

Dopamine and epinephrine were required for blood pressure support for 10 days. Milrinone was administered for inotropic support for 18 days. High-frequency oscillatory ventilation, inhaled nitric oxide, and conventional ventilation were employed for a total of 72 days, and ECMO was employed for 43 days. The patient underwent 19 bronchoscopic procedures.

ECMO was discontinued on day 68 of life, and the patient was extubated on day 96 of life. After 90 hospital days (75 days of which were in the pediatric intensive care unit), the infant was discharged home on 0.25 liters per minute of oxygen and with a feeding tube. Hospital charges totaled $1.5 million. The infant’s father missed one month of work.

At the time of discharge, an electroencephalogram showed mild, generalized slowing with left-sided attenuation, consistent with generalized encephalopathy. After discharge, the baby required physical and occupational therapy and extensive follow-up care by pediatric pulmonology and neurology. At 23 months of life, the baby has persistent language and right-sided motor deficits in the distribution of her stroke.

**OREGON SURVEILLANCE DATA**

In 2012, 910 cases of pertussis were reported in Oregon—the state’s highest case count since 1953. Incidence during 2012 was highest among infants <12 months of age (253 cases per 100,000 population). Within infancy from 2009 through 2013, the highest pertussis incidence was in infants <2 months of age (270 cases per 100,000 population) compared with infants 6–11 months of age (49 cases per 100,000 population) (Figure 2) (Unpublished data, Oregon Health Authority, 2014).

Infants suffer disproportionately severe pertussis when compared with reported cases in those aged >12 months. Of 285 infant cases reported in Oregon during February 2009–February 2013, 94 (33%) were hospitalized for a total of 805 days (median = 4 days; range: 1–128 days), and one infant died. In contrast, only 19 (1%) of the 1,462 non-infant cases were hospitalized, and none died. Fifty-nine (63%) of the 94 hospitalized infants were <2 months of age. Of the hospitalized infants, 27 (29%) were admitted to the intensive care unit for a total of 322 days (median = 3 days; range: 1–128 days), and seven (7%) required mechanical ventilation for a total of 185 days (median = 12 days; range:}
Two infants were supported with ECMO for a total of 87 days. One patient was discharged on oxygen and one with a tracheostomy (Unpublished data, Oregon Health Authority, 2014).

Two infants required ECMO during February 2009–February 2013: the case reported herein and another infant aged six weeks. That infant spent 128 days in the hospital, was mechanically ventilated for 83 days, received ECMO for 44 days, and was discharged home with a tracheostomy to be ventilated mechanically for 10 hours each night (Unpublished data, Oregon Health Authority, 2014).

**DISCUSSION**

The case of pertussis described in this article illustrates how severe the disease can be, and the accompanying epidemiological data underscore the burden—in terms of both incidence and morbidity—of pertussis among infants. Two critical cases of pertussis occur in children who are too young for diphtheria, tetanus, acellular pertussis (DTaP) vaccination, and they carry a high risk for fatality. The Centers for Disease Control and Prevention and the Advisory Committee on Immunization Practices recommend vaccination of pregnant women during each pregnancy, preferably between 27 and 36 weeks gestation, to maximize the maternal antibody response and passive antibody transfer to the infant. Although the efficacy of maternal pertussis vaccination and the optimal concentration of *B. pertussis* antibodies in newborns have not been definitely proved, higher levels of several *B. pertussis* antibodies correlate with better protection against severe pertussis.

Stroke has been infrequently described among young infants with pertussis. However, more cases...
are likely to be reported because of the extensive use of ECMO. ECMO may be the only means of sustaining life in patients with respiratory failure caused by pertussis, but the anticoagulation it requires carries a risk of cerebral hemorrhage.

The direct and indirect costs of pertussis and of the public health response are substantial. A study of hospitalized cases in four states during a four-year period found that 90% of pertussis hospitalizations occur among infants, and that such cases generate higher inpatient costs than other age groups. Costs may be even higher with routine use of modern intensive treatment modalities including ECMO.

Since 2005, the focus of Oregon’s public health response to reported cases of pertussis has been the protection of infants, who account for the preponderance of severe disease, hospitalizations, and death. Accordingly, antibiotic prophylaxis is targeted to households with infants or pregnant women. Antibiotic prophylaxis is recommended, if it can be given within 21 days of exposure, for close contacts who are infants or pregnant women, and for all household members of a case whose household includes an infant or pregnant woman.

CONCLUSION

We strongly endorse the Advisory Committee on Immunization Practice’s October 2012 recommendation regarding vaccination of pregnant women during each pregnancy to provide newborns with maternal antibody pending active immunization with DTaP beginning at 2 months of age. Several recently published studies show low Tdap coverage among pregnant women. Obstetricians and public health officials need to explore ways to boost vaccination rates among pregnant women during every pregnancy.

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REFERENCES