

Case Report of *Haemophilus parainfluenzae* Sepsis in a Newborn Infant Following Water Birth and a Review of Literature

Manu Kaushik, MBBS¹ Brittany Bober, BSN¹ Leonard Eisenfeld, MD¹ Naveed Hussain, MBBS, MD, DCH¹

¹Division of Neonatology, Department of Pediatrics, Connecticut Children's Medical Center and University of Connecticut School of Medicine, Farmington, Connecticut

Address for correspondence Naveed Hussain, MBBS, MD, DCH, Division of Neonatology, Department of Pediatrics, Connecticut Children's Medical Center–NICU, 263 Farmington Avenue, Farmington, CT 06030-2948 (e-mail: hussain@uchc.edu).

Am J Perinatol Rep 2015;5:e188–e192.

Abstract

Keywords

- ▶ water birth
- ▶ neonatal sepsis
- ▶ *haemophilus parainfluenzae*
- ▶ case report

Water birth has grown in popularity over the recent years. Although beneficial for mothers, there are concerns for the infants. There are previous reports of infection following water birth. The information regarding infection with *Haemophilus parainfluenzae* is limited. We report a case of a neonate with *H. parainfluenzae* bacteremia following water birth. The child was successfully treated with both antibiotic and supportive care. Previous reports of neonatal *H. parainfluenzae* infection are reviewed.

Water birth has become an increasingly popular alternative to hospital delivery as it is thought to provide maternal benefits, including less discomfort, decreased need for analgesics or anesthesia, and decreased perineal trauma.^{1,2} Immersion in water during the first stage of labor has some beneficial effects for the mother, but water immersion during the second stage of labor has not been adequately studied for safety and efficacy.^{3,4} Water birth has been deemed safe for infants in a few studies, but these have been mostly retrospective reports or studies with a small sample size.⁵ Bacterial colonization of infants does not seem to differ between normal births and water births.⁶ Despite putative physical and emotional benefits for mothers, underwater delivery has been linked to rare but serious adverse effects for newborns. These include respiratory distress and drowning from tub-water aspiration, pneumonia, sepsis, seizures, and perinatal asphyxia.^{7,8} There have been many small sample size reports but no randomized controlled trials on this subject.⁹ It is notable that there is no mention of this mode of birth in the medical, health, and newborn sections of the 2003 U.S. Standard Certificate of Live Birth.¹⁰

Case reports of water births have raised concerns that the “protective” reflex that prevents the newborn from aspirating is sometimes overridden especially in stressed or

compromised infants at birth resulting in aspiration pneumonia.^{11,12} Moreover, sepsis may occur, most commonly because of *Pseudomonas aeruginosa*,^{13,14} *Legionella pneumophila*,^{15–18} and Group B streptococcus (GBS),^{19,20} which may be found in maternal genitourinary and gastrointestinal tract and can proliferate in an aqueous environment. Cases of transmission of gastrointestinal tract-related adenovirus have been reported.²¹ Infections because of these organisms could have serious and life-threatening sequelae.

H. parainfluenzae is an organism that is known to cause chorioamnionitis²² and neonatal infection through maternal–infant transmission.^{23–27} It is present in the maternal genital tract and can thus also be transmitted from the mother to the infant during the birth process.^{28–30} *H. parainfluenzae* infection in the newborn is a relatively rare event and has never been reported in association with water birth. Given the plausible correlation of these two relatively uncommon events, we are prompted to report this association.

Case History

A 39-week gestation baby boy was born at home, underwater in a birthing tub to a 34-year-old G4 P3 mother. Limited prenatal information was available as the prenatal care was

received
April 15, 2015
accepted after revision
May 19, 2015
published online
July 14, 2015

DOI <http://dx.doi.org/10.1055/s-0035-1556068>.
ISSN 2157-7005.

Copyright © 2015 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
Tel: +1(212) 584-4662.

License terms



provided predominantly by a midwife and no laboratory tests were done in the final trimester of pregnancy. GBS status was unknown. There was spontaneous rupture of membranes for > 12 hours before delivery. The duration of labor in the water tub was not documented. The mother reported a rapid vaginal delivery after three pushes. She noted the infant to have a “weak cry” (difficulty getting the infant to cry) at birth, with increased respiratory rate. The Apgar scores at 1 and 5 minutes were 6 and 8, respectively. A midwife attending delivery documented respirations as “clearing” at the time of the formal physical examination. The day after birth, the parents brought the infant to the emergency room at the local children’s hospital because of mild respiratory distress, tachypnea, and poor feeding since birth. The infant was then transferred to the neonatal intensive care unit.

Clinical diagnosis at the time of admission included respiratory distress, suspected sepsis, and pneumonia. Initial chest X-ray revealed a right lower lobe infiltrate, compatible with pneumonia. The patient was placed on 100% oxygen via nasal cannula and then placed on nasal continuous positive airway pressure (CPAP). Intravenous fluids were started and blood cultures drawn. Initial complete blood count showed white blood cell count of 20,000 with significantly higher numbers of immature neutrophils. C-reactive protein was abnormally high at 11.1 mg/dL. The cerebrospinal fluid showed normal cell counts, glucose, and proteins. Cerebrospinal fluid culture did not grow any organisms.

Respiratory distress was treated by CPAP for the first day. Subsequently, he was weaned to room air for the remaining of his hospital stay. He was initially started on ampicillin, gentamicin, and acyclovir. The antibiotics were changed to ampicillin, ceftazidime, metronidazole, and tobramycin on the 4th day when the blood cultures grew Gram-negative organisms. Later, when the organism was identified as *H. parainfluenzae* that was β lactamase negative, all other antibiotics except ampicillin were discontinued and intravenous ampicillin was given for a total of 10 days. An echocardiogram was performed on the 5th day of admission and showed no evidence of endocarditis. The patient’s condition improved and was discharged home with his parents on the 12th postnatal day.

Discussion

The practice of water immersion during labor and birth has grown in popularity in industrialized countries since the 1980s.^{4,13,31} However, most of the research related to infant outcomes from water birth is observational and descriptive, and reported outcomes do not demonstrate causal associations.³² Reports have largely shown a positive effect for mothers with no major adverse effects on the infants but concerns regarding associated infection risks have not been allayed. There have been clinical guidelines on water births published by ACOG and AAP that have helped standardize the process.^{1,2,33}

Neonatal sepsis because of *Haemophilus influenzae* is well documented and has recently been increasing,³⁴ but *Haemophilus* species other than *H. influenzae* have been reported to

rarely cause human disease. *H. parainfluenzae*, *H. aphrophilus*, *H. paraphrophilus*, *H. aegyptius*, and *H. ducreyi* are among the species implicated.²⁵ Neonatal sepsis associated with *H. parainfluenzae* is extremely rare and the reported cases are shown in **Table 1**.

Serious infections because of *H. parainfluenzae* out of the neonatal period have been rarely seen with the first case reported in 1966.³⁵ *H. parainfluenzae* in adults has been shown to cause endocarditis, pharyngitis, otitis media, meningitis, brain abscesses, epiglottitis, pneumonia, conjunctivitis, dental abscess, empyema, septicemia, septic arthritis, osteomyelitis, peritonitis, hepatobiliary infections, epidural abscesses, and urinary tract and genital infections.^{36–40} However, reported pediatric infections have been limited to the upper and lower respiratory tract infections, endocarditis, meningitis, and brain abscesses in infants with long standing respiratory infections.^{37,39} Documented cases of neonatal *H. parainfluenzae* are still very rare and the 11 reported cases (including ours) are shown in **Table 1**.^{41,42} Hable et al suggested that neonatal infections may be rare because of presence of protective maternal antibodies.⁴³ An important aspect of *H. parainfluenzae* infection is that β lactamase production occurs with a frequency that may be greater than *H. influenzae*; thus, antimicrobial sensitivity is important in determining appropriate antibody treatment.⁴⁴

It has been found that the rates of maternal colonization with *H. parainfluenzae* are low. The reported rate of vaginal carriage during pregnancy is < 1%.⁴⁵ Kinney et al concluded from their study that just 0.3% of mothers had positive cultures for this bacterium in their genital tract.⁴⁶ On the basis of this information, blood borne vertical transmission of the infection from mother to infant is highly unlikely to have caused the infection in our patient although this possibility cannot be ruled out.

In our reported case, underwater birth of the infant, along with the extremely low rate of maternal blood stream transmission of *H. parainfluenzae* raises the possibility that this organism may have been present in the aqueous environment around the baby during the birth process. The aqueous environment may be seeded secondary to maternal genital tract secretions or primarily as contaminants of the birthing tub or the water used. It is well known that in water births, during the bearing-down phase, gastrointestinal organisms such as *E. coli* and *Staphylococcus aureus* contaminate the water environment and *Haemophilus* species in feces may have been a potential source of the organism.⁴⁷ It is of interest that in a study by Palmer, who inoculated feces on a selective medium, *Haemophilus* species were isolated from 28% of 612 samples from patients of all ages; most isolates being *H. parainfluenzae*.⁴⁸

Despite a growing body of evidence for water birth safety, a myriad of political and cultural issues result in its limited use in the hospitals in United States compared with other developed nations.⁴⁹ It is well recognized that the water used in the water birth can be a major source of infection. Thoeni et al, analyzed 250 water samples taken from the birth pool and installed a special bacteria filter in 2002.⁶ Two water samples were obtained at every water birth, samples were cultured for

Table 1 Review of literature: newborn infants with *Haemophilus parainfluenzae* sepsis.

Case	Maternal data	Mode of delivery	Neonatal data	<i>H. parainfluenzae</i>	Outcome
1 ³⁴	33 y old, ROM for 8 days	CS at 27 wk GA	Sepsis, neutropenia, RD, mild DIC, pulmonary hypertension	In infant blood and tracheal aspirate	Survived
2 ²²	18 y old PPRM for 48 h Abdominal tenderness	NVD after 29 wk GA	1.15 kg boy, atonic and dusky, no spontaneous respirations, Apgar 2 and 2 after 1 and 5 min, chest X-ray-pneumonia, interstitial opacifications	In placental swabs, Placenta with chorioamnionitis, funisitis	Died on 15th PND
3 ³⁵	20 y old G2A1	Baby in breach CS at 32 wk GA	1.58 kg, leukopenia, weak cry, TCP, severe RD, IVH grade III, intubated, PDA, chest X-ray-low volume lungs, hypocalcemia, left-sided pneumothorax. hyponatremia	In infant's blood sample	Survived
4 ⁴⁴	Amnionitis	Term gestation MOD not specified	NS	In infant's CSF and throat culture.	Survived
5 ⁴⁴	Fever	MOD not specified	3.46 kg	In infant's blood	Survived
6 ⁴⁴	ROM for 20 h	Term gestation NS	2.84 kg	In infant's blood	Survived
7 ⁴⁴	ROM for 8 h	Term gestation	3.40 kg Chest X-ray-left lower lobe infiltrate	In maternal blood, infant's blood, scalp	Survived
8. ⁴⁴	Amnionitis ROM for 48 h	NS	0.73 kg Pneumonia, HMD	In maternal placenta, cervix culture and infant's blood	Died
9 ⁴⁴	ROM for 48 h Funisitis and chorioamnionitis	NS	1.15 kg Pneumonia, HMD	Growth in maternal placenta culture and infant's blood.	Died
10 ⁴⁴	NS	30 wk GA MOD NS	1.76 kg	In infant's gastric aspirate	Died
Current case	34 y G4P3	39 wk GA NVD (water birth)	Weak cry Tachypnea, RD, poor feeding Chest X-ray-pneumonia (right LL Infiltrate)	In infant's blood culture	Survived

Abbreviations: CS, cesarean section; CSF, cerebrospinal fluid; DIC, disseminated intravascular coagulation; HMD, hyaline membrane disease; IVH, intraventricular hemorrhage; LL, left lower; MOD, mode of delivery; NS, not specified; NVD, normal vaginal delivery; PDA, patent ductus arteriosus; PND, postnatal day; PROM, premature rupture of membranes; RD, respiratory distress; ROM, rupture of membranes; TCP, thrombocytopenia; wk GA, weeks of gestation.

Pseudomonas aeruginosa, *Escherichia coli*, *Enterococcus* species, Coliforms, and *Legionella pneumoniae*. They also compared the rates of perinatal infection in infants delivered in water with those delivered in air. Overall, 12% of one sample contained *Legionella pneumophila*, 11% *Pseudomonas aeruginosa*, 19% *Enterococcus species*, 21% Coliforms, and 10% *Escherichia coli*. This suggests the importance of disinfecting water before and after use in a water bath as a possible way of limiting infectious complications. In our case, we were unable

to obtain bacterial sample from the water in the tub used during delivery.

Training and safety of health personnel involved in water births is another matter of concern. A study of 53 Clinical Nurse Midwives in Georgia by Meyer et al revealed that only 30% of these professionals had received instruction about water birth in their midwifery training program.⁵⁰ It was shown that midwives' support for water birth was based mostly on the expected benefits to the mother with very little

attention given to the potential risks to the infant. Another aspect not given adequate attention is the increased risk of exposure to HIV and HBV of health workers involved in water births.⁵¹ Hence, education of personnel involved in water births on infection safety of the health professional, mother, and infant is of vital importance.

Our current case report along with previous reported cases of neonatal pneumonia and sepsis from other organisms associated with water births suggests that there may be a need to be more vigilant regarding the management, training, and education of midwives (and other practitioners) with a particular focus on infection control during water births.

Financial Disclosures

None.

Conflict of Interest

None.

References

- Liu Y, Liu Y, Huang X, et al. A comparison of maternal and neonatal outcomes between water immersion during labor and conventional labor and delivery. *BMC Pregnancy Childbirth* 2014;14:160
- Mollamahmutoglu L, Moraloglu O, Ozyer S, et al. The effects of immersion in water on labor, birth and newborn and comparison with epidural analgesia and conventional vaginal delivery. *J Turk Ger Gynecol Assoc* 2012;13(1):45–49
- American Academy of Pediatrics Committee on Fetus and Newborn; American College of Obstetricians and Gynecologists Committee on Obstetric Practice. Immersion in water during labor and delivery. *Pediatrics* 2014;133(4):758–761
- Cluett ER, Burns E. Immersion in water in labour and birth. *Cochrane Database Syst Rev* 2009;(2):CD000111
- Demirel G, Moraloglu O, Celik IH, et al. The effects of water birth on neonatal outcomes: a five-year result of a referral tertiary centre. *Eur Rev Med Pharmacol Sci* 2013;17(10):1395–1398
- Thoeni A, Zech N, Moroder L, Ploner F. Review of 1600 water births. Does water birth increase the risk of neonatal infection? *J Matern Fetal Neonatal Med* 2005;17(5):357–361
- Fehervary P, Lauinger-Lörsch E, Hof H, Melchert F, Bauer L, Zieger W. Water birth: microbiological colonisation of the newborn, neonatal and maternal infection rate in comparison to conventional bed deliveries. *Arch Gynecol Obstet* 2004;270(1):6–9
- Pinette MG, Wax J, Wilson E. The risks of underwater birth. *Am J Obstet Gynecol* 2004;190(5):1211–1215
- Davies MW. Water births and the research required to assess the benefits versus the harms. *J Paediatr Child Health* 2012;48(9):726–729
- Osterman MJ, Martin JA, Mathews TJ, Hamilton BE. Expanded data from the new birth certificate, 2008. *National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics*. National Vital Statistics System 2011;59:1–28
- Johnson P. Birth under water—to breathe or not to breathe. *Br J Obstet Gynaecol* 1996;103(3):202–208
- Thach BT. Maturation of cough and other reflexes that protect the fetal and neonatal airway. *Pulm Pharmacol Ther* 2007;20(4):365–370
- Rawal J, Shah A, Stirk F, Mehtar S. Water birth and infection in babies. *BMJ* 1994;309(6953):511
- Thöni A, Mussner K, Ploner F. Water birthing: retrospective review of 2625 water births. Contamination of birth pool water and risk of microbial cross-infection [in Italian]. *Minerva Ginecol* 2010;62(3):203–211
- Elyse F, Kay S, Heidi T, Diana C. Fatal Legionellosis after Water Birth, Texas, USA, 2014. *Emerg Infect Dis J* 2015;21(1):130–132
- Franzin L, Cabodi D, Scolfaro C, Gioannini P. Microbiological investigations on a nosocomial case of *Legionella pneumophila* pneumonia associated with water birth and review of neonatal cases. *Infect Med* 2004;12(1):69–75
- Nagai T, Sobajima H, Iwasa M, et al. Neonatal sudden death due to *Legionella pneumonia* associated with water birth in a domestic spa bath. *J Clin Microbiol* 2003;41(5):2227–2229
- Phin N, Cresswell T, Parry-Ford F; Incident Control Team. Case of Legionnaires disease in a neonate following a home birth in a heated birthing pool, England, June 2014. *Euro Surveill* 2014;19(29):19
- Zanetti-Dällenbach R, Lapaire O, Maertens A, Frei R, Holzgreve W, Hösli I. Water birth: is the water an additional reservoir for group B streptococcus? *Arch Gynecol Obstet* 2006;273(4):236–238
- Plumb J, Holwell D, Burton R, Steer P. Water birth for women with GBS: a pipe dream? *Pract Midwife* 2007;10(4):25–28
- Soileau SL, Schneider E, Erdman DD, Lu X, Ryan WD, McAdams RM. Case report: severe disseminated adenovirus infection in a neonate following water birth delivery. *J Med Virol* 2013;85(4):667–669
- Arias JW, Saldana LR, Conklin R. Chorioamnionitis due to *Haemophilus parainfluenzae*. *Tex Med* 1981;77(7):47–48
- Govind B, Veerarahavan B, Anandan S, Thomas N. *Haemophilus parainfluenzae*: report of an unusual cause of neonatal sepsis and a literature review. *J Infect Dev Ctries* 2012;6(10):748–750
- Rele M, Giles M, Daley AJ. Invasive *Haemophilus parainfluenzae* maternal-infant infections: an Australasian perspective and case report. *Aust N Z J Obstet Gynaecol* 2006;46(3):258–260
- Chen RV, Bradley JS. *Haemophilus parainfluenzae* sepsis in a very low birth weight premature infant: a case report and review of the literature. *J Perinatol* 1999;19(4):315–317
- García E, Andreu A, Bartolomé RM. Maternal-fetal vertical transmission of *Haemophilus influenzae* and *Haemophilus parainfluenzae* [in Spanish]. *Enferm Infec Microbiol Clin* 1997;15(2):65–69
- Hunkert F, Handrick W, Spencker FB, Hüchel D. [Neonatal infections caused by *Haemophilus influenzae* and *Haemophilus parainfluenzae*]. *Zentralbl Gynakol* 1988;110(13):816–820
- Tashjian JH, Coulam CB, Washington JA II. Vaginal flora in asymptomatic women. *Mayo Clin Proc* 1976;51(9):557–561
- Quentin R, Musser JM, Mellouet M, Sizaret PY, Selander RK, Goudeau A. Typing of urogenital, maternal, and neonatal isolates of *Haemophilus influenzae* and *Haemophilus parainfluenzae* in correlation with clinical source of isolation and evidence for a genital specificity of *H. influenzae* biotype IV. *J Clin Microbiol* 1989;27(10):2286–2294
- Harper JJ, Tilse MH. Biotypes of *Haemophilus influenzae* that are associated with noninvasive infections. *J Clin Microbiol* 1991;29(11):2539–2542
- Odent M. Birth under water. *Lancet* 1983;2(8365-66):1476–1477
- Hershckowitz S, Elisha MB, Fleisher-Sheffer V, Barak M, Kudinsky R, Weintraub Z. A cluster of early neonatal sepsis and pneumonia caused by nontypable *Haemophilus influenzae*. *Pediatr Infect Dis J* 2004;23(11):1061–1062
- Committee on Obstetric Practice; American Academy of Pediatrics. ACOG Committee Opinion no. 594: Immersion in water during labor and delivery. *Obstet Gynecol* 2014;123(4):912–915
- Vergnano S, Menson E, Kennea N, et al. Neonatal infections in England: the NeonIN surveillance network. *Arch Dis Child Fetal Neonatal Ed* 2011;96(1):F9–F14
- Gullekson EH, Dumoff M. *Haemophilus parainfluenzae* meningitis in a newborn. *JAMA* 1966;198(11):1221

- 36 Chunn CJ, Jones SR, McCutchan JA, Young EJ, Gilbert DN. *Haemophilus parainfluenzae* infective endocarditis. *Medicine (Baltimore)* 1977;56(2):99–113
- 37 Bachman DS. *Haemophilus meningitis: comparison of H. influenzae and H. parainfluenzae*. *Pediatrics* 1975;55(4):526–530
- 38 Oill PA, Chow AW, Guze LB. Adult bacteremic *Haemophilus parainfluenzae* infections. Seven reports of cases and a review of the literature. *Arch Intern Med* 1979;139(9):985–988
- 39 Black CT, Kupferschmid JP, West KW, Grosfeld JL. *Haemophilus parainfluenzae* infections in children, with the report of a unique case. *Rev Infect Dis* 1988;10(2):342–346
- 40 O'Bryan TA, Whitener CJ, Katzman M, Appelbaum PC. Hepatobiliary infections caused by *Haemophilus* species. *Clin Infect Dis* 1992;15(4):716–719
- 41 Nakamura KT, Beal DW, Koontz FP, Bell EF. Fulminant neonatal septicemia due to *Haemophilus parainfluenzae*. *Am J Clin Pathol* 1984;81(3):388–389
- 42 Zinner SH, McCormack WM, Lee YH, Zuckerstatter MH, Daly AK. Puerperal bacteremia and neonatal sepsis due to *Haemophilus parainfluenzae*: report of a case with antibody titers. *Pediatrics* 1972;49(4):612–614
- 43 Hable KA, Logan GB, Washington JA II. Three *Haemophilus* species. Pathogenic activity. *Am J Dis Child* 1971;121(1):35–37
- 44 Scheifele DW, Fussell SJ. Frequency of ampicillin-resistant *Haemophilus parainfluenzae* in children. *J Infect Dis* 1981;143(3):495–498
- 45 Wallace RJ Jr, Baker CJ, Quinones FJ, Hollis DG, Weaver RE, Wiss K. Nontypable *Haemophilus influenzae* (biotype 4) as a neonatal, maternal, and genital pathogen. *Rev Infect Dis* 1983;5(1):123–136
- 46 Kinney JS, Johnson K, Papasian C, Hall RT, Kurth CG, Jackson MA. Early onset *Haemophilus influenzae* sepsis in the newborn infant. *Pediatr Infect Dis J* 1993;12(9):739–743
- 47 Thoni A, Zech N, Moroder L, Ploner F. Water contamination and infection rate after water births [in German]. *Gynakol Geburtshilfliche Rundsch* 2007;47(1):33–38
- 48 Palmer GG. *Haemophili* in faeces. *J Med Microbiol* 1981;14(1):147–150
- 49 Nutter E, Meyer S, Shaw-Battista J, Marowitz A. Waterbirth: an integrative analysis of peer-reviewed literature. *J Midwifery Womens Health* 2014;59(3):286–319
- 50 Meyer SL, Weible CM, Woeber K. Perceptions and practice of waterbirth: a survey of Georgia midwives. *J Midwifery Womens Health* 2010;55(1):55–59
- 51 Colombo C, Pei P, Jost J. [Water births and the exposure to HIV]. *Pflege* 2000;13(3):152–159