not write about gay or lesbian persons. We wrote about their children.

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Water Birth—A Near-Drowning Experience

ABBREVIATIONS. CI, confidence interval; RR, relative risk.

Can delivery in water cause serious adverse outcomes? Undoubtedly, the answer is "yes." There are several reports of death attributable to drowning resulting from poorly managed water births[1] and 1 death, involving 2 experienced midwives, in which asphyxiation and water-logged lungs made resuscitation of the infant difficult.[2] The latter case led to the cessation of water births in Sweden. In their report of 4 infants with water aspiration that appears in this issue of *Pediatrics*, Nguyen et al[3] provide additional evidence that water birth does cause adverse outcomes. Their argument for causality rests on the demonstration of radiograph appearances of gross pulmonary edema and, in 1 infant, hyponatraemia.

Any woman contemplating water birth will regard the safety of her infant as of paramount importance. For some women, these case reports will be sufficient in their decision to have a nonwater birth. Others are prepared to trade off a small risk of a very serious outcome against the perceived benefits of the experience. There may also be hope of physical benefits for the infant and mother but there is no clear research evidence that immersion in water during labor reduces duration of labor, perineal tears, or use of analgesia.[4] No studies have examined the effect of water birth.

To weigh the potential "pros and cons" of water birth, women need to know how likely it is that a serious outcome will occur. The answer is uncertain, but boundaries can be drawn. A surveillance study in England and Wales found a perinatal morality rate of 1.2/1000 (5/4030; 95% confidence interval [CI]: 0.4, 2.9) for infants delivered via water birth.[5] Compared with low-risk deliveries that are nonwater births, the upper 99% confidence limit for the relative risk of perinatal death after delivery in water was 3.6/1000 ([relative risk (RR): 0.9: 99% CI: 0.2, 3.6 $\times$ 1.2] $-$ 1.2). The risk of admission to the neonatal intensive care unit for lower respiratory tract problems (2 explicitly attributed to water aspiration) was 0.4% (95% CI: 0.2, 0.6%) or 1 in 270. Unfortunately, data to determine the additional risk attributable to water birth compared with low-risk nonwater birth deliveries are not available. Other adverse outcomes included a surprising number of infants ($n = 5$) with a snapped umbilical cord, of whom 1 required a transfusion. This finding may be attributable to rapid cord traction as the infant is brought to the surface and could be remedied by lowering the water level as the infant is born. There was no evidence that the rate for hypoxic-ischemic encephalopathy differed from low-risk nonwater birth deliveries but as for mortality, the CI was wide.

Advocates of water birth cite the empowerment and autonomy over birth as one of the main advantages[6,7] but fail to give information about the potential harms of water birth. One Web site mentions safety but refers to home births rather than water births.[7] Regardless of commercial interests, practitioners have a responsibility to provide balanced information to empower women to make informed decisions about water birth. Adverse events, including death, have been caused by water birth and population-based studies cannot exclude a clinically important increased or decreased risk in mortality, much less morbidity.

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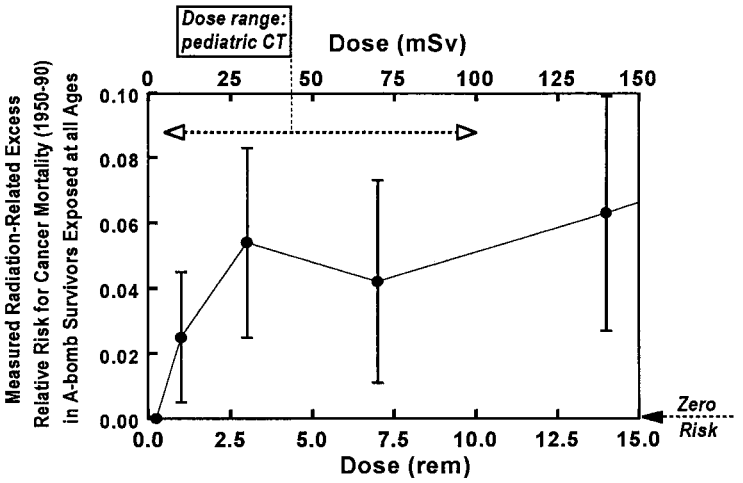

Fig 1. Relevant dose range for pediatric CT: 6 to 100 mSv (0.006–0.1 Sv). From Brenner DJ. Estimating cancer risks from pediatric CT: going from the qualitative to the quantitative. *Pediatr Radiol.* 2002;32:228–233.

Gray and Sievert - SI units
(Systéme International Units)

Absorbed Dose

Unit is the Gray (Gy)
Converting to rads
1 Gy = 100 rad
1 cGy = 1 rad

Exposed Dose - expression of radiation protection

Unit is the Sievert - Sv
Compared to rems
1 Sv = 100 rems
1 mSv = 100 mrems

Conversion 1 rad = 1 rem

Background Radiation

3 mSv = 300 mrem/year

Fig 2. Radiation dose.

we will succeed in tipping the benefit/risk scale even further in favor of the child.

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Underwater Birth: Missing the Evidence or Missing the Point?

We read with interest the case reports and discussion regarding the potential complications of underwater birth[1,2] because we have had 4 neonates admitted to the neonatal intensive care unit after underwater birth and have been concerned regarding the cause-and-effect relationship.

Our first case was a 37-week-gestation male infant (born in a hospital tub) who developed respiratory distress syndrome requiring mechanical ventilatory support. Although water inhalation was suspected, his discharge diagnosis was respiratory distress syndrome. Our second case was a male infant, (born at home in a bathtub) who developed seizures at ~8 hours of age. A serum sodium level of 128 was treated but continued to fall, at 12 hours of age the

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serum sodium was 125. His discharge diagnosis was probable water intoxication after underwater birth. Our third case, a female infant, (born underwater in a hospital tub) was diagnosed on day 2 of life with Shone's complex, manifested in this case as absence of left lung and left kidney, and a left-sided cardiac defect. A total of 3 ultrasounds had been performed during the pregnancy without diagnosing the defects. Our fourth case was an infant (born at home in a bathtub) who was admitted at 4 days of age with group B streptococcal meningitis. Although 2 of the cases suffered no obvious direct ill effects from underwater birth, the potential for harm from birthing underwater may be much greater in the case of birth defects (in this case undiagnosed) or with intrapartal group B *Streptococcus* exposure.

We conducted an extensive review of the nursing, midwifery, and medical literature (in any language), for the efficacy and validity of underwater birth and found multiple reports. Methodology ranged from retrospective reviews, anecdotal reports, summaries of mailed surveys, and individual case reports. None of the reports included true randomized, controlled trials, although some authors have called for such.

Some of the reports conclude that birthing underwater is safe for both mother and infant, others conflict with that conclusion, and still others have questionably erroneous conclusions. Alderdice et al,[3] for example, reported on 4494 women who gave birth underwater, with 12 neonatal deaths (no reported reasons for death) and 51 infants with morbidities (again, no diagnoses given). We consider the mortality rate to be above expected. Alderdice et al concluded their report by saying:

> "There is no evidence from this survey to suggest that labour and birth in water should not continue to be offered as an option in England and Wales. Questions remain, however, about the possible benefits and hazards, the conditions of clinical practice, and resource use."

If questions remain, why would one continue the practice?

Proponents of the practice have claimed that infants will not breathe or swallow during an underwater birth. We could find no conclusive evidence that an infant would not inhale or swallow the tub water during the birth as they swallow and inhale amniotic fluid in utero. We were particularly intrigued to find a photograph in a book on underwater birth showing an infant's face delivering, with the mouth wide open.[4] This photograph lends support to our theory that hyponatremia can be caused by swallowing tub water during birth.

If we are to feel confident regarding the safety of underwater birth for the neonate, we must be confident that a sufficient number of cases have been scientifically scrutinized in a rigorous fashion and that these cases demonstrate a reasonably low probability of harm as compared with the current standard of birth above water. Furthermore, if there is possible case report evidence of harm without demonstrable improvement in outcomes, we must question the rationale for continuing the practice of offering underwater birth. We found case reports of infants with pneumonias,[1,5] hyponatremic seizures,[6] *Pseudomonas* infections,[7,8] and multiple freshwater drownings attributed to underwater birth.[2,9] Have these reports been missed by others or simply ignored? Of importance, none of the reports we reviewed made any claim of underwater birth being better for the infant.

After reviewing the literature, we stop to ponder: what evidence of harm would be enough to convince us to stop the practice? Should the report of a single drowning be enough? Apparently, it was not. At this point, we are convinced there is no evidence to support any benefit of underwater birth for the neonate, and plenty of evidence to suggest harm. With the potential for drowning, hyponatremic seizure activity, infection, and pneumonia, is it ethical to call for randomized, controlled trials?

We believe in evidence-based health care. Although it is perhaps still possible to practice evidence-less care that is safe, we believe in this case the care is evidence-blind. We are left to wonder why it is that pediatric providers have ignored the reports that are present, and have not advocated with our obstetric colleagues for the discontinuation of the practice.

Editor's Note: I've always considered underwater birth a bad joke, useless, and a fad, which was so idiotic it would go away. It hasn't! It should!

—Jerold F. Lucey, MD, Editor

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The risks of underwater birth

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KEY WORDS
Water birth
Complication

Objective: We performed a retrospective review of the literature on the complications that could be associated potentially with water birth.

Study design: We performed an extensive review of the medical literature using the Pub Med search engine, which is available through the National Library of Medicine. We also examined the Cochrane review on immersion in pregnancy, labor and birth.

Results: Our review revealed 74 articles regarding water births. We found 16 citations that described complications that were associated with underwater birth. Possible complications that were associated with water birth included fresh water drowning, neonatal hyponatremia, neonatal waterborne infectious disease, cord rupture with neonatal hemorrhage, hypoxic ischemic encephalopathy, and death. Our systematic review did not identify an adequately controlled trial of delivery underwater (second stage of labor underwater) compared with delivery in air.

Conclusion: Water birth may be associated with potential complications that are not seen with land-based birth. The rates of these complications are likely to be low but are not well defined.

In 1805, the *Annales de la Societe de Medicine Pratique de Montepellier* was the first medical journal to report an underwater birth that occurred in France.[1] The woman was reported to be exhausted after 48 hours of labor. After being placed in a tub of water, she was revived and was able to give birth to a healthy infant. Since that event, water birth has been promoted as a natural and safe method of pain relief and relaxation during labor.[2,3]

It has been estimated that >150,000 water births occurred globally from 1985 to 1999.[4] Given the lack of a registry, verifiable numbers are not available. There are, however, numerous reported series of patients who have undergone water births that, when added up, number into the thousands of deliveries.[4,5] Most of these accounts are retrospective and uncontrolled and represent reports of individual or institutional experiences.

In the United States, the actual number of water births is unknown, and literature regarding this procedure is scarce. Rosenthal's[6] report of his personal experiences of water births in California from 1985 through 1990 and the information that at least 143 hospitals in the United States, as of 2001, are providing water births as an option[4] suggest that water births are becoming more popular in the United States. The mystique of water birth, the serenity of delivering in a warm pool of water with lights dimmed, and the sense of empowerment and autonomy are emphasized by proponents.[2]

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However, adverse events, including death, have been associated with underwater births.[7,8] Over a 16-month period, our institution cared for several neonates who had been transferred because of possible complications as the result of water birth.[9] We therefore undertook a critical review of the literature regarding complications that could be attributed potentially to this type of delivery.

Methods

We conducted a PubMed (National Library of Medicine) literature search of articles from 1965 to 2003 (all languages included) that encompassed the nursing, midwifery, and medical journals. Keywords included "birth in water," "underwater delivery," "birth underwater," "tub births," "water births," and "pool birth."

Results

Review of the literature regarding underwater delivery revealed a variety of reports. Studies ranged from anecdotal reports, case series, retrospective reviews, and mailed surveys. Our review revealed 74 articles on the topic of water birth, which included 16 articles that detailed complications that could be associated with this procedure.

Review of the medical literature in regards to underwater births failed to demonstrate any benefit to the neonate. Although several studies suggest some benefit in terms of pain management in mothers who undergo parturition in a tub of water, the Cochrane database finds no clear research evidence that immersion in water reduces the risk of perineal tears, duration of labor, or use of analgesia.[10] Moreover, there appear to be cases of possible harm as a result of underwater birth (Table).

The Cochrane Data Base of Systematic Reviews identified 3 randomized controlled trials under the heading of immersion in water in pregnancy, labor, and birth.[10] Two of these trials contained a small number of participants (<50 women), although the third trial reported a >40% drop out rate in the study group.[11-13] Perhaps most importantly, none of the trials compared underwater birth with delivery in air (second-stage labor). Finally, the main outcome was pain relief in 2 of the 3 trials, although it was not stated in the third.

Comment

Physiologically, there may be a benefit to the land-based experience of giving birth. Scientific evidence suggests that intrathoracic pressure of 200 cm of water occurs by the vaginal squeeze.[14,15] The process of squeezing the fetus through the birth canal may act in the same manner as the old-fashioned wringer that was used to remove excess water from wet clothes. In the absence of normal labor and delivery, cesarean-delivered infants without labor have delayed lung fluid clearance[16] and nearly 5 times the risk of transient tachypnea of the newborn infant.[17] There may be a benefit of clearing the lungs of fluid in preparation for land-based air breathing. It is clear that neonatal lung expansion and aeration depend on the removal of fetal lung fluid. The act of delivering underwater may negate the advantage of squeezing the water out of the lungs, especially if the fetus takes a breath while still submerged.

Some investigators have suggested that neonates will not breathe underwater; therefore, there is no substantial risk of drowning. There appears to be little evidence to back this assertion. Clearly, neonates swallow and breathe sterile amniotic fluid in utero while receiving oxygen from the uteroplacental circulation. Interestingly, a book that features underwater birth shows a newborn infant being delivered with an open mouth.[18] This photograph suggests that underwater birth may result in the swallowing of free water that may lead to reported cases of hyponatremia, which sometimes is complicated by seizures.[9,19]

A surveillance study by Gilbert and Tookey[20] suggests that the relative risk of underwater birth in terms of death and admission to a neonatal intensive care unit is small. Gilbert and Tookey report 15 cases of respiratory tract problems that are attributed directly to water aspiration. Grade 2 to 3 ischemic encephalopathy was reported in 5 cases. The surveillance study also reported 5 cases of cord avulsion (1 in 270 water births), which was thought to be the result of rapid cord traction as the infant was brought to the surface. One of the 5 neonates required a transfusion. In this report, the perinatal mortality rate was 1.2 per 1000 births, as compared with 0.8 per 1000 births in a similar low-risk group. The authors of the study correctly point out that the perinatal mortality rate for infants who are delivered in water was not increased statistically. The confidence limits, however, were wide (0.4-2.9). In a separate letter to the editor, Gilbert[21] stated that the additional risk that is attributable to underwater births has not yet been determined because of insufficient data. Gilbert stated that water birth "undoubtedly" causes serious adverse outcomes and that the "population-based studies cannot exclude a clinically important increased or decreased risk in mortality, much less morbidity."

Cases of near-drowning that have been reported with water births raise the issue of impaired fetal lung fluid removal. Bypassing normal physiologic condition could also lead to increased transient tachypnea. The retention of water as a drowning experience with water birth has been reported.[7,8,20,22] Rosser[8] reports 2 home births with likely drowning, which resulted in the death of 1 neonate

Table Complications associated with underwater birth

	Respiratory (n)	Cord avulsion (n)	Waterborne infection (n)	Fetal tachycardia/ hyperthermia (n)	Hypoxic ischemic encephalopathy (n)	Hyponatremia (n)	Unexpected anomalous fetus (n)
Gilbert and Tookey[20]	Wet lung (9)	5			5*	1	
	Aspiration (4)						
	Drowning (1)						
Rosenthal[6]	Wet lung (8)	4 (1 transfused, 2 anemic)					
	Meconium aspiration (1)						
Nguyen et al[22]	Near drowning (4)						
Wilson et al[9]	Water aspiration (1)		Streptococcus meningitis (1)			1	1
Rosser[8]	Drowning (2)						
Zimmerman et al[7]	Drowning (1)						
de Graaf et al[34]		1 (anemic transfused)					
Parker and Boles[29]			Pseudomonas sepsis/otitis (1)				
Rawal et al[27]			Pseudomonas sepsis (1)				
Vochem et al[28]			Pseudomonas (1)				
Franzin et al[30]			Legionella pneumonia (1)				
Nagai et al[31]			Legionella pneumonia and death (1)				
Hagadorn et al[32]			Burkholderia picketti: pneumonia (1)				
Rosevear et al[24]					2		
Barry[19]						1†	
Deans and Steer[25]				5			
TOTAL	31	10	7	5	7	3	1

* Avulsed cord, 1; shoulder dystocia, 1; drowning, 1.
† With seizure.

and severe brain damage in a second neonate who was left under water for 25 minutes. The newborn infant death occurred while under the care of experienced midwives. The neonate was observed to make respiratory efforts on its way to the surface. The infant was born in distress and was not able to be resuscitated, because it was impossible to ventilate presumably because of the water-logged lungs that were identified clearly at autopsy. Recently, Nguyen et al[22] reported a series of 4 cases of near-drowning with moderate-to-severe respiratory distress after underwater deliveries. All 4 cases demonstrated classic radiographic features that are consistent with fresh water drowning. Although decidedly uncommon, these case reports of respiratory complication that was associated with water birth are of concern.

Hyponatremia at birth as a function of swallowing free water in the tub seems likely to be a result of a water birth. In cases of fresh water drowning, fluid can be absorbed quickly through the lungs into the circulation, which results in intravascular dilution and fluid overload. As a result, it has been suggested that salt should be added to the pool to make the solution more isotonic, which most probably would prevent dilution and hyponatremia.[19,23]

Hypoxic ischemic encephalopathy has been reported in neonates who were delivered underwater. Rosevear et al[24] reported a case of asphyxia and a case of encephalopathy in 2 women who labored 7 hours in the birthing pool. Both left the pool a few minutes before delivery and technically would not have been considered an underwater birth. They suggest that hyperthermia possibly played a role in the diversion of maternal circulation to the skin, to reduce maternal core temperature. Decreased utero placental perfusion combined with increased fetal metabolic rate as the result of hyperthermia may worsen fetal oxygenation. No obvious cause of the in utero hypoxia was apparent. Table I includes several other cases of hypoxic ischemic encephalopathy, which can be seen in normal deliveries. However, 5 of the 8 deliveries were associated with other complications that most likely were attributed to water birth, such as cord avulsions and drowning. Given that hypoxic ischemic encephalopathy occurs in land births, these suppositions represent interesting conjecture. Rosevear et al[24] also make the point that patients who leave the pool for possible complications will not be included in the population of patients who experience an underwater birth.

Deans and Steer[25] reported on a small series of 112 patients who underwent hospital pool delivery, with 54% of the patients leaving the pool before birth. Five women left because of persistent fetal tachycardia, presumably because of elevated maternal core temperatures. The fetal tachycardias resolved on leaving the pool, and the outcomes were good. Other women left the pool for fetal bradycardias (2 women), heart rate decelerations (3 women) and meconium (3 women), alternative analgesia (33 women), and poor progress (12 women). The labor pool seems likely responsible for the fetal tachycardia. Because most data sets do not include the outcomes of pregnancies that started in the pool but eventually delivered in the air, the potential contribution of an attempted underwater delivery in any poor outcomes that are associated with fetal distress or delayed diagnosis of fetal distress is unclear.

There are a number of reports of neonatal infections that are thought to be potentially due to underwater births.[26-32] In particular, neonatal pseudomonas sepsis has been identified in mothers who undergo water birth, with the identical strain being isolated within the tub in some cases.[28,29] The culturing of pseudomonas from both the tub and the neonate suggests a potential link. Reports of very unusual waterborne bacteria, such as legionella, that caused neonatal infections that were discovered after water birth likewise suggest the birthing tub as a potential source. These water-borne infections, when acquired in a hospital setting, may be at an increased risk for more virulent and more difficult to treat organisms.

Conclusions regarding the safety of underwater births are confusing. Alderice et al[33] published a survey of water births in England and Wales that revealed a relatively high mortality rate of 12 neonatal deaths in 8255 women who gave birth underwater and a relatively high morbidity rate of 51 neonates. They concluded, ''There is no evidence from this survey to suggest that labour and birth in water should not continue to be offered as an option in England and in Wales. Questions remain, however, about the possible benefits and hazards, the condition of clinical practice and resource use.''

There is a lack of evidence to suggest a benefit of underwater birth and mounting evidence to suggest occasional poor outcomes that might be attributable to the procedure. The reports of hyponatremic seizures, drowning, waterborne infections, the potential of delivering an unexpectedly compromised fetus in a difficult to resuscitate environment, potential for fetal hemorrhage from snapped umbilical cords, risk of delayed delivery in cases of fetal asphyxia, risk of shoulder dystocia, and injury to health care workers moving patients in and out of the tub are complications that may be possibly attributed to underwater births.

Some proponents of water birth make a case that the perceived unproven benefit of water birth in terms of labor duration, pain control, and perineal tears outweighs the small potential risk. Women who contemplate water birth, as all women about to give birth, regard the well-being of their newborn child to be the most important consideration. To make an informed decision, these women must know the likelihood of a significant adverse outcome that is attributable to water birth. However, the additional attributable risk of water birth is uncertain because of a lack of data. Although Gilbert and Tookey[20] surveillance study suggests that delivery in water does not increase perinatal complications substantially overall, the additional attributable risk for specific harms (such as water aspiration, drowning and aspiration, hyponatremia, neonatal infections and even death) are not known. The confidence limits on mortality rates alone was wide (0.4-2.9 per 1000 births). We would agree with the conclusions of the Cochrane database that there is a need for a large collaborative, randomized controlled study of underwater birth to determine the possible harmful effects on the fetus and/or newborn infant. To make an informed decision, women who are considering water birth should be given balanced information that includes the potential harms of the procedure.

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Underwater Births

ABBREVIATIONS. CI, confidence interval; RCT, randomized, controlled trial; OR, odds ratio.

Throughout human existence, women have typically given birth to their offspring on land. Over the last 25 years, however, underwater birth has become more popular in certain parts of the world despite a paucity of data demonstrating that it is either beneficial or safe.[1–22] Underwater birth occurs either intentionally or accidentally after water immersion for labor, a procedure promoted primarily as a means of decreasing maternal discomfort. A review of the available literature indicates that the risks of underwater birth to the newborn seem to outweigh the benefits, and caution is urged before widespread implementation.

Although there is no suggested benefit of underwater birth to the newborn, morbidities identified in clinical reports have raised concerns that this mode of delivery may not be safe. In 1983, Odent[1] reported his experience with 100 consecutive deliveries. All mothers used water immersion during labor, but only a limited and unspecified number of births occurred under water. Two infants required positive-pressure support, but little additional data were provided. In 1995, Alderdice et al[2] performed a retrospective survey of 4494 underwater deliveries by midwives in England and Wales. They reported 12 stillbirths or neonatal deaths, 51 cases of neonatal morbidity (respiratory or infectious), 33 serious maternal complications (postpartum hemorrhage, perineal trauma), and 7 cases of back injuries among staff members. In a subsequent survey of 4032 underwater births in England and Wales,[3] the perinatal mortality rate was 1.2 per 1000 live births (95% confidence interval [CI]: 0.4–2.9) and the rate of admission to a special care nursery was 8.4 per 1000 live births (95% CI: 5.8–11.8). The author of this survey suggested that these rates may be higher than expected for a term, low-risk, vaginally delivered population.[4] In 1996, a retrospective review of ~19 000 underwater births from around the world[5] noted that underwater birth (after water immersion for labor) was associated with a decrease in instrumented or operative delivery, a reduction in the need for pain medication, and no increased morbidity or mortality in the neonates. However, these data were largely anecdotal and compared with historical controls. A prospective observational study compared underwater birth with births using Maia-birthing stools and beds.[6] Although underwater birth was associated with a decreased need for episiotomies and pain medication as well as higher Apgar scores and less cord blood acidosis in newborns, the birthing method was determined by maternal preference, and potential confounding variables were not analyzed. Over the last several years, numerous case reports have associated underwater birth with respiratory distress,[3,7,8] hyponatremia,[8] infections,[3,8–11] hypoxic ischemic encephalopathy,[3,7] ruptured umbilical cords,[3] seizures,[7,8] tachycardia and fever[12] (related to water temperature of the bath), and near drownings[3,7] in newborns or fetuses.

There is only 1 report of a randomized, controlled trial (RCT) of underwater birth, but it has not been published in a peer-reviewed journal.[13] This study showed no difference in the number of neonates admitted to a NICU; however, it was not sufficiently powered to evaluate important morbidities (n = 120). There have been 6 published RCTs of water immersion during labor[14–19] (only 1 in the United States[16]). A Cochrane systematic review[20] of 3 of theses trials,[14–16] involving 988 mothers, found no benefits for pain relief, the course of labor, or perineal trauma for the mother and no differences in neonatal outcomes. The authors concluded that there were insufficient data to evaluate water immersion for labor. Subsequently, an RCT of water immersion for labor of 274 Australian women also found no benefit for pain relief, the length of labor, perineal trauma, or mode of delivery.[17] However, more neonates born to mothers who labored underwater required oxygen or positive-pressure ventilation in the delivery room compared with the control group (49% vs 35%; relative risk: 1.41; 95% CI: 1.06–1.89). A Swedish study of 1237 women found no benefit or harm to mothers or infants after water immersion for labor.[18] Cluett et al,[19] from England, reported the results of an RCT in 99 women, comparing water immersion versus augmentation (amniotomy and oxytocin) for the subset of patients with labor dystocia. There were no differences between groups in the use of epidural analgesia, operative delivery, or duration of labor. Although women in the water-immersion group were less likely to receive augmentation than the routine-care group (relative risk: 0.74; 95% CI: 0.59–0.88) and generally had lower pain scores, 12% of neonates born to mothers who labored underwater were admitted to the NICU, compared with none in the augmentation group (P = .013). A second Cochrane systematic review of water immersion for labor by the same authors as the first was published recently.[21] This report included the previously mentioned studies but also relied on unpublished data, personal communications, and data not published in peer-reviewed journals. The authors concluded that water immersion resulted in a reduction in the use of analgesia/anesthesia for mothers (odds ratio [OR]: 0.87; 95% CI: 0.71–0.99), but differences in vaginal operative deliveries (OR: 0.83; 95% CI: 0.66–1.05) and cesarean sections (OR: 1.33; 95% CI 0.92–1.91) did not reach statistical significance. The differences in the incidence of low Apgar scores (OR: 1.57; 95% CI: 0.63–4.01), admissions to a NICU (OR: 1.05; 95% CI: 0.68–1.61), and neonatal infections

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(OR: 2.01; 95% CI: 0.50–8.07) also did not reach statistical significance.

The safety and efficacy of underwater birth for the newborn has not been established. There is no convincing evidence of benefit to the neonate but some concern for serious harm. Therefore, underwater birth should be considered an experimental procedure that should not be performed except within the context of an appropriately designed RCT after informed parental consent.

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