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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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