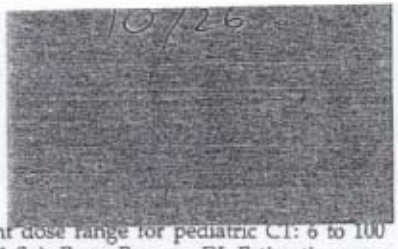
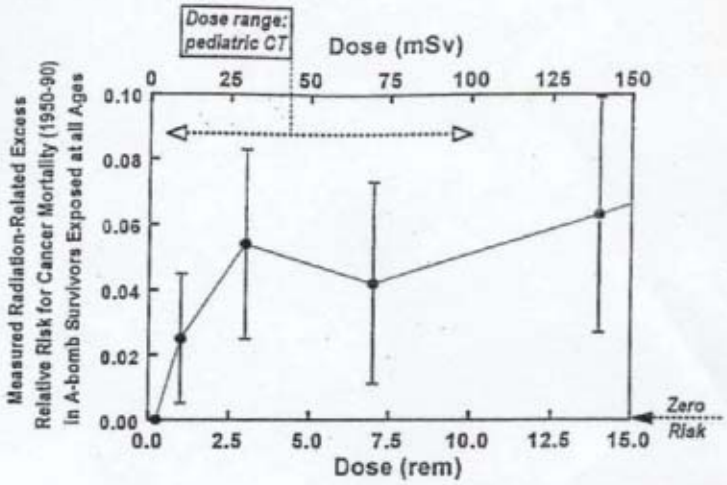


Fig 1. Relevant dose range for pediatric CT: 6 to 100 mSv (0.006–0.1 Sv). From Brenner DJ. Estimating cancer risks from pediatric CT: going from the qualitative to the quantitative. *Pediatr Radiol.* 2002;32:228–233.



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!

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