and childhood. Much has been written on the nutritional aspects of ID and the ways to prevent this problem. Little information, however, is available regarding parents' compliance in providing iron-containing medications to their infants.

In this study we showed that only 27% (mean) of parents buy the drug to comply with the official recommendations of iron therapy to infants. Kruske et al[6] reported 12% compliance in iron administration to anemic children. The compliance rate of adolescents taking their prescribed medication for ID was higher (67%).[7] Reasons for noncompliance with ID treatment include the following: inadequate program support, insufficient service delivery, and patient factors (misunderstanding instructions, side effects, frustration about length of treatment, and fear of side effects related to the medication).[8] It may be speculated that compliance of preventive treatment for a long period is even worse than that of therapy for an actual disease.

Because most infants in this area of Israel do not breastfeed and not all milk substitutions are sufficiently iron-fortified, it is the role of iron supplementation to combat ID and ID anemia.

It is interesting that the low-income parents purchased the drug more often than higher-income parents. There was an inverse correlation between the socioeconomic status and the percentage of parents who bought the medication.

We are aware of the differences among the populations of various countries in mentality, education, culture, and civil obedience. Our results are valid only to the involved populations. Two reasons may explain the differences in compliance between the 2 socioeconomic groups: 1) higher-income parents tend to supplement their infants with iron-fortified "alternative" medications, and 2) low socioeconomic groups tend to obey the authorities more readily compared with wealthy citizens.

In conclusion, a meticulous and intensive public campaign is needed to augment awareness of the importance of iron supplementation for infants' well-being.

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Water Birth—A Near-Drowning Experience

ABBREVIATION. CPAP, continuous positive airway pressure.

The practice of offering the pregnant woman immersion in water for part or all of labor is popular in some obstetric centers. There is little information on outcome in terms of perinatal morbidity and mortality. We present 4 neonatal patients who were transferred to our unit in the last 18 months after delivery underwater at other hospitals.

CASE REPORTS

Case 1

A male weighing 4155 g was born at term after an uneventful pregnancy. Delivery occurred accidentally in a water bath that was being used during labor for maternal analgesia. Apgar scores were recorded as 9 and 10 at 1 and 5 minutes, respectively. At 5 hours of age, the neonate was recognized to be in respiratory distress with oxygen saturation of 60%, requiring 100% oxygen via headbox. He was transferred to our unit and intubated and ventilated on arrival. No risk factors for sepsis were identified. Radiograph of the chest at 9 hours of age demonstrated bilateral interstitial and alveolar edema with bilateral pleural effusions. History of the water birth was not initially disclosed. Irritability and hypertonicity were diagnosed as mild hypoxic ischemic encephalopathy. Echocardiography demonstrated no structural cardiac abnormality. The neonate remained ventilated for 3 days. The patient was stable in air by the third day of life, after gradual weaning from oxygen. The infant completed 5 days of antibiotics; cultures of blood remained negative.

The infant was readmitted on the ninth day of life with seizures. Investigations including ultrasonography, computerized tomography, and electroencephalogram were normal. No additional seizures occurred, and the child's development over the first year of life has been appropriate for age.

Case 2

After an uneventful pregnancy, a male weighing 4675 g was born by planned water birth at term. Apgar scores were 7 and 10 at 1 and 5 minutes, respectively. At 6 hours of age, the neonate was

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recognized as tachypneic by the mother and required oxygen. The infant was transferred to our neonatal unit and commenced on nasal continuous positive airway pressure (CPAP) and antibiotics. No risk factors for sepsis were identified. Radiographs of the chest demonstrated marked alveolar and interstitial edema and pleural effusions. History of water birth was not forthcoming until the mother was questioned directly. The infant's clinical status improved dramatically. He was in air, breathing spontaneously with no respiratory support by 24 hours of age. The infant completed 5 days of treatment with antibiotics. All cultures of blood were negative.

Case 3

A male was born at term weighing 4355 g. Water birth had been planned to provide analgesia for a mother who had had spinal fusion. The infant was vigorous at birth with a good heart rate; however, he collapsed at 5 minutes of age with marked respiratory distress. Apgar scores were recorded as 7 and 2 at 1 and 5 minutes of age, respectively. A provisional diagnosis of water aspiration was made, the neonate was transferred to our unit, and commenced on nasal CPAP. Radiograph of the chest revealed pulmonary edema, with the alveolar component more obvious in the right lung. Intravenous antibiotics were commenced. The clinical course was that of rapid improvement over 24 hours. The infant weaned to air and respiratory support was discontinued. The infant completed 5 days of treatment with antibiotics. All cultures of blood were negative.

Case 4

After an uneventful pregnancy a female was born at term weighing 3860 g. At the request of the mother, labor and delivery occurred in a water bath. Apgar scores were 8 and 8 at 1 and 5 minutes, respectively. The infant developed respiratory distress at 10 minutes of age and required 60% oxygen via headbox. She was transferred to our neonatal unit and commenced on nasal CPAP and antibiotics. Radiographs of the chest showed gross bilateral interstitial and alveolar edema. The oxygen requirement increased shortly after arrival to 100%. The neonate did not require intubation and ventilation. Dramatic clinical improvement over the subsequent 24 hours enabled her to be weaned to air and all respiratory support was discontinued. All cultures of blood were negative and the infant was discharged from the hospital on the third day of life.

DISCUSSION

Water birth is promoted as an improved, safe method of delivery.[1,2] Despite the increased popularity in water births during the past decade, there is a paucity of reliable scientific evidence about the benefits and hazards associated with this form of birthing, as emphasized in reports by Zimmermann et al[3] and the more recent Cochrane database.[4] Advocates of water births argue that delivery is less painful, with fewer injuries to the birth canal, provision of more maternal autonomy, and a gentler experience for the infant.[2,5,6] Despite these proposed benefits, there are no proven clinical benefits.[4–7]

Potential adverse risks are a restriction of alternative analgesia, increased perineal trauma, lack of control of blood loss, increased risk of infection, decreased fetal monitoring, ineffective contractions and risk of water embolus.[3,5,7] To the infant there is a potential risk of aspiration and hypoxia, increased infection, and delay in intervention in the setting of fetal distress.[3,8,9] Published studies have suggested that the risk of perinatal mortality for those delivered in water is similar to the risk for neonates born by normal vaginal delivery to women at low risk of adverse outcomes.[1,10] The degree of risk of water aspiration, hypoxia, and infection is less well established.[3,8,9] Gilbert and Tookey[10] reviewed 4032 water deliveries. No deaths were attributable to delivery in water. Thirty-five neonates were admitted for special care within 48 hours of delivery; 15 had lower respiratory tract problems such as pneumonia, transient tachypnea of the newborn, and suspected aspiration. Grade 2 or 3 hypoxic ischemic encephalopathy or perinatal asphyxia was reported in 5 children.[10]

Geissbuhler and Eberhard[1] analyzed 7508 births and showed no statistically significant difference in infection rates between infants born in water and those born in a labor and delivery room. No case of aspiration was reported and no neonate drowned or died after birth as a consequence of a water birth. Odent,[2] in a letter to the editor of the *Lancet*, described his experience with 100 water births. He did not observe any case of water aspiration.

Despite the literature reporting low morbidity from water birthing, we have cared for 4 neonates who had aspiration of water and subsequent pulmonary edema over an 18-month period. In 2 of the 4 cases, no information was forthcoming at time of transfer that the infants were born in water, there was no history of how long the infants were submerged in water or whether they were witnessed to gasp. It has been postulated that primitive reflexes prevent the neonate from gasping until cold exposure; however, in animal studies it has been demonstrated that these can be overridden.[10] One of the 4 infants demonstrated hyponatremia, consistent with water intoxication. Radiographic findings could have alerted staff to consider near drowning as in all cases the chest radiographs demonstrated gross pulmonary edema, out of proportion to that seen with transient tachypnea of the newborn (Fig 1). The other cause of pulmonary edema in neonates is congestive heart failure, but no congenital cardiac disease was

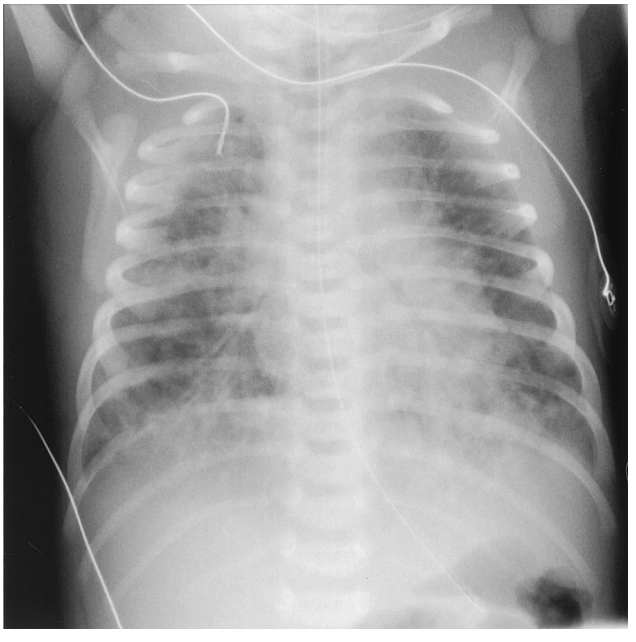

Fig 1. Case 1, Frontal chest radiograph demonstrates severe pulmonary edema in this neonate delivered in water bath.

identified in any of the above cases. No congenital cardiac disease was identified in any of the above cases. All 4 initial radiographs postdelivery showed features typical of fresh-water near drowning in children.[11] Near-drowning pulmonary edema manifests as Kerley lines, peribronchial cuffing, and perihilar alveolar areas of airspace consolidation. With increasing severity of water aspiration the radiologic appearances become nonspecific.[12,13] None of the infants had passed meconium before delivery and the chest radiograph appearances are extremely atypical for meconium aspiration syndrome.

All 4 infants presented in moderate to severe respiratory distress; however, with clinical support, improvement occurred over a 24-hour period. There were no organisms on cultures of blood to suggest that infection was a contributing factor, nor were there any risk factors for sepsis before delivery.

Our experience highlights the concern for potential near drowning at water birthing and adds to the sparse literature on adverse outcomes. These cases emphasize the need for more evidence on safety of water birth before it is offered routinely. It is recommended that water births be prospectively audited in institutions undertaking this obstetrics practice.

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FOLLOW THE MONEY

"The saga of neonatology is emblematic of how a market-driven health care system with inadequate public planning produces too much of a good thing."

Grumbach K. Specialists, technology and newborns—too much of a good thing. *N Engl J Med.* 2002; 346:1574–1575

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