

Review of **2.225** underwater births in a single institution.

Does water birth increase the risk of neonatal infection?

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Abstract

Objectives: The retrospective study was performed to review the first 2.225 underwater births at our institution and to compare the outcomes of primiparae deliveries in water to those in bed and on the delivery stool.

Methods: We compared 982 primiparae deliveries in water with 424 primiparae deliveries in bed and 136 primiparae on the delivery stool. The duration of labour, shoulder dystocia, perineal trauma, arterial cord blood pH, postpartum maternal haemoglobin levels, women with previous caesarean section and rates of neonatal infection were also evaluated. In addition, bacterial cultures of water samples, obtained from the bath after filling the tub and after delivery, were performed.

Results: The duration of the first stage of labour was significantly shorter with water births than with other delivery positions (380 vs. 458 min, $P < 0.01$). The episiotomy rate for all water births was much lower than for deliveries carried out in bed or on the birthing stool (0.37% vs. 23% , and 8.4% , respectively). The rate of perineal tears was similar among methods (23%). No differences were observed in the duration of the second stage of labour (34 vs. 37 min), arterial cord blood pH, or postpartum maternal haemoglobin levels. No woman using the water birth method required analgesia. The rate of neonatal infections was not increased in water births.

Conclusions: Water birth appears to be associated with a significantly shorter first stage of labour, a lower episiotomy rate, and reduced analgesic requirements when compared with other delivery positions. If women are selected appropriately and hygiene rules are respected, water birth appears to be safe for both the mother and the neonate.

Key words: underwater birth, delivery methods, duration of birth, perineal trauma, shoulder dystocia, neonatal respiratory distress, infections

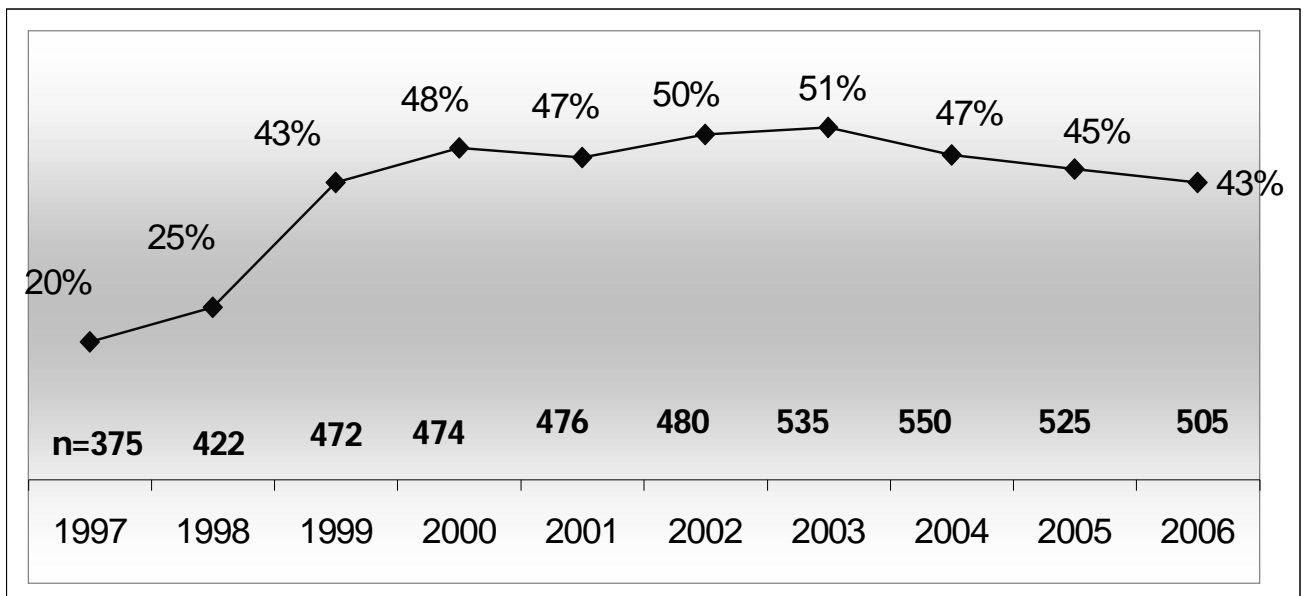
Introduction

Parturients are now considered as "partners in care" alongside obstetricians and midwives and not patients in the traditional sense (1,2). This change has shifted attention to a more natural and less medical environment in delivery units. Water birth is also a move in this direction (3,4). In 1996 our unit installed a birthing pool and a birthing stool, providing women with an alternative to conventional delivery. At any point during the delivery stage (3,5,6), women without risk factors have the choice of delivering their baby in water, in bed or on the birthing stool. The purpose of this report is to review the first 2.225 underwater births at our unit and to compare the outcomes of primiparae deliveries in water to those in bed and on the delivery stool.

Materials and Methods

Our primary-level hospital performs an average of 530 deliveries per year (Fig.1). Most are low-risk deliveries; high-risk pregnancies are transferred to the regional perinatal centre. Between February 1997 and October 2007, a total of 2.225 babies were born in water at our unit. The proportion of underwater deliveries increased steadily during this period (Fig.1). About 65% of women in labour entered the water at least once. Abnormal fetal heart rate tracing, intra-uterine dystrophy, multiple pregnancy, and breech presentation were exclusion criteria for entering the pool (3%) or indications for vacating it (4%) (5). A fetal heart rate recording over a period of about 20 min was first obtained prior to entering the water, and then at regular intervals once the mother was in the water. If considered necessary, the fetal heart rate was recorded continuously with a wireless induction system, providing the mother with more freedom of movement in the pool.

Figure 1: **Number (n) and frequency (%) of water births in the period from 1997 to 2006**



We also reviewed the number of alternative delivery positions used by primiparae since 1997, and compared the duration of delivery, incidence of perineal trauma, neonatal arterial cord blood pH, base excess, number of

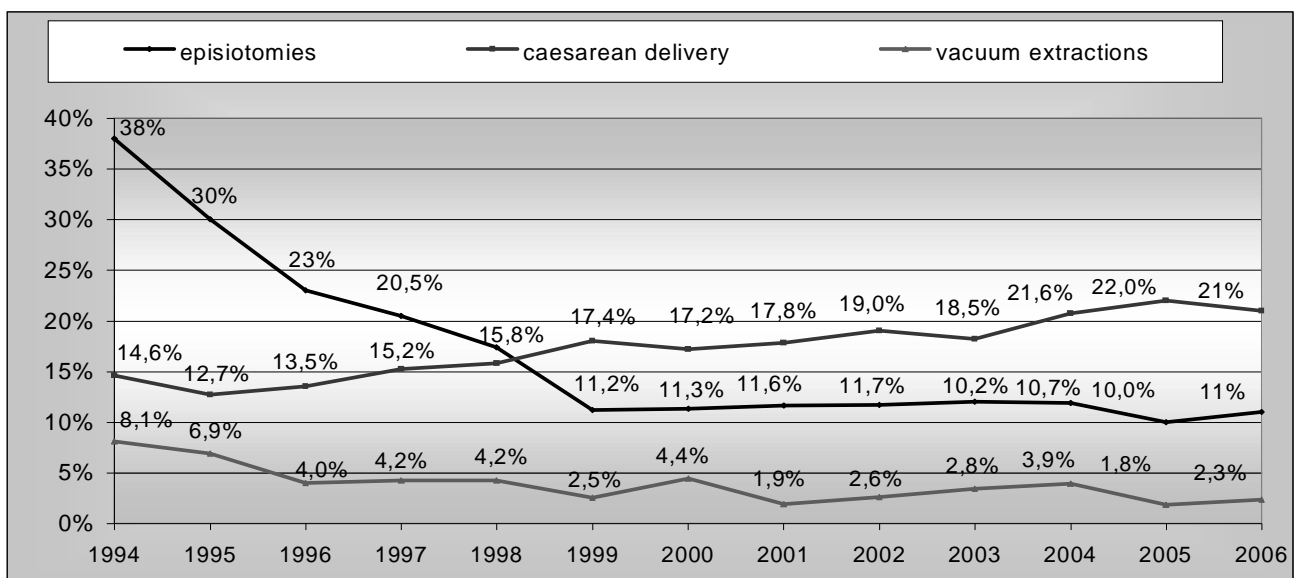
newborns with metabolic acidosis and respiratory distress, analgesic requirements, shoulder dystocia, women with previous caesarean section, and postpartum haemoglobin values. Multiparae were not evaluated (4). In addition, we analysed water samples taken from the pool. We also compared the rates of perinatal infection in infants delivered in water with those delivered in bed.

Statistical analyses were carried out with the Mann-Whitney-U test for parametric data and the Chi-square and Fisher-exact tests for nonparametric data. P levels of <0.05 were considered statistically significant.

Results

Of the 2.225 water births at our institution during the period, 982 were from first pregnancies. The mean duration of the dilatation period was 380 min in the 966 primiparae who delivered in water compared with 458 min for the 424 primiparae who delivered in bed (P<0.01). This reduction appeared to be due to a shorter second phase. The duration of the third phase of labour was also similar (34 vs. 37 min). The comparison between the primiparae who delivered in water to those who delivered in bed showed a reduced delivery time especially in the dilatation period, while the third phase did not show any significant time difference (Table 1). The episiotomy rate was significantly lower in the 2225 water births compared to the deliveries in the bed or stool group. The indications for episiotomy at our institution are restrictive (7). The low episiotomy rate was not accompanied by a higher rate of perineal tears (5), and in 57% of the primiparae who delivered in water (562 of 982), the perineum remained intact (compared to 36% and 48% in the bed and stool groups, respectively). Over the past few years, the incidence of episiotomies overall at our institution has decreased to between 10.0% and 11.7% (Fig. 2).

Figure 2: **Frequency of episiotomies, vacuum extractions (related to spontaneous deliveries) and caesarean deliveries recorded over 12 years from 1994 to 2006**



In primiparae, the episiotomy rate at our hospital decreased from 30% in 1997 to 15.0% in 2006. The indications for episiotomies in primiparae (Table 1) were the administration of oxytocin due to a prolonged time of expulsion (66%) and an abnormal CTG (34%). According to figures taken from international

literature, the percentage of grade III lacerations is between 0.4 and 6% (8,9) whereas the rates in **primiparae** at our unit were 1.0% in water births and 1.7% in stool births (Table 1) (5). No cervical tears were recorded in the group of water births, despite an increased number of tears around the clitoris and the labia minora (23, 8%).

Three cases of shoulder dystocia were registered in the group of water births (0,14%). The first case was a para 3 with a 4660-g infant; the second was a para 2 with vacuum extraction, and the third was a primipara with a 3650-g infant. In all three cases, the dystocia was resolved within three or four contractions by the Wood/Barnum manoeuvre (9) in the pool. Nevertheless, during this manoeuvre in the third case, the baby's clavicle was fractured. The arterial cord blood pH was within normal range and no functional deficit was noted.

Neonatal parameters, including arterial cord blood pH, base excess, and birth weight (mean 3255g) were not significantly different among the groups (Table 1). In the neonatal group of water births from the 982 primiparae, 1.90% had arterial cord blood pH <7.10 and 1.56% had a base excess rate >12 mmol/L. Two newborns in this group needed a paediatric follow-up as they had clinical symptoms or radiological signs of aspiration pneumonia. The cord arterial blood pH was <7.10 and the Base Excess was >12 mmol/L.

The APGAR values were 7/8/9.

Table 1: Primiparae: Comparison of duration of labour, arterial cord blood pH, base excess value, perineal trauma, and haemoglobin value in the first postpartal day.

	Water (n = 982)	Bed (n = 424)	Stool (n = 136)	P-value
First phase (min)	380 (120 - 960)*	458 (130 - 1020)*	**	<0.01
Expulsion (min)	34 (10 - 85)	37 (10 - 90)	35 (10 - 80)	n.s.
Cord blood pH	7.27 (7.01 - 7.47)	7.26 (7.03-7.46)	7.24 (7.06-7.45)	n.s.
Base Excess mmol/L	-5.35 (-0.6 -- 12.7)	-6.09 (-0.2 - 13.8)	-6.82	n.s.
Episiotomy rate (n)	0.71% (7)	22.8 % (97)	8.4% (12)	<0.01.
Grade I lacerations (n)	23.1% (227)	22.4 % (95)	23% (33)	n.s.
Grade II lacerations (n)	11.0 % (109)	11.8% (47)	13% (18)	n.s.
Grade III lacerations	1.1% (11)	1.17 % (5)	2.1% (3)	n.s.
Hb (g/dl, (postp. day)	10.9 (6.5 - 14.6)	10.1 (7.6-13%)	10.23 g/dl	n.s.

* Results are expressed as mean values (range)

**Not evaluated. This procedure is not carried out on the stool

n.s. Not significant

Women who gave birth in water required no analgesia, due to the relaxing and analgesic effect of the water and the attenuation of labour. Moreover, we seldom used oxytocic drugs to augment labour in the pool, as there was concern that infection could occur via intravenous lines.

A total of 86 women who had previously given birth by caesarean section, delivered in water. The microbiological composition of the water in the tub was determined for 300 births both before and after delivery. The bacteriologic samples taken after filling the tub but before the women entered the water showed high levels of contamination with *Legionella pneumophila* and *Pseudomonas aeruginosa*. The bacteriologic samples taken after birth showed high levels of contamination with *coliforms* and *E. coli*. Staphylococcus aureus and yeasts were found less frequently. It should be noted that the high levels of contamination in the pool water after delivery did not translate into increased neonatal infections. Overall, 1.13% of neonates born in water showed signs of infection such as tachypnoea and a suspect colour of the skin compared to 2.03% (in the bed and stool groups).

Discussion

Primipares who delivered in water had a shorter first stage of labour compared to those in the bed or stool group, whereas only a slight difference was noted during the second stage of labour. This acceleration of the dilatation period could be attributed to the relaxation and greater muscular elasticity of the pelvic floor in water. Further factors that possibly influence the shorter dilatation period are the semi-erect position (10) and the greater freedom of movement gained in water. In our experience and that of others (11), women who enter the pool at a dilatation of 3-5 cm should not stay in the water for longer than 120 min, due to the fact that extended immersion causes a reduction in uterine activity, particularly in primiparous women. We found that uterine activity increases if the woman leaves the pool for a duration of approximately 30 min. She can then re-enter the pool again at a greater dilatation.

Our policy towards episiotomies has become increasingly restrictive. The overall episiotomy rate in 2006 at our unit was 15.0% in vaginally delivering primiparae and 2.7% in multiparae. Various authors (12) question the advantages of performing an episiotomy. Routine episiotomy does not protect the pelvic floor. As the relaxing effects of giving birth in water result in a greater muscular elasticity of the pelvic floor, we have come to the conclusion that performing an episiotomy is not justified. Episiotomy performed in the semi-upright position is furthermore difficult and does not appear to be advantageous. To avoid an increase in perineal trauma, the obstetrician encourages the woman not to push actively as recommended by the more conventional delivery methods. It is also very important for the midwife to control the delivery of the fetal head, as to avoid the baby being born during one single contraction. It has also been demonstrated that during the time interval between the expulsion of the fetal head and that of the body, there is no significant fall in the pH value. The fall is approximately 0.04/min (13). This result shows that it is possible to patiently wait for a slower expulsion of the fetal head if there are no signs of intra-uterine acidosis.

The 2225 women delivering in water required no analgesia; the relaxing and analgesic effect of the water was sufficient. Only 4.9% of the women who started labour in water later requested peridural anaesthesia. Our hospital recorded an overall epidural anaesthesia rate of 5.9% during the nine-year study period.

With few exceptions, all 2225 babies born in water were in good clinical condition. Paediatricians at our hospital confirmed that, provided the mother had a normal pregnancy and labour, water birth was not detrimental to babies and did not affect the adaptation of the newborn to extra-uterine life. Also the three

newborns presenting with metabolic acidosis and respiratory distress were discharged home without complications on day 5 post-partum after a period on oxygen in the incubator and a four-day antibiotic treatment. As long as the selection criteria are followed (5,6), aspiration pneumonia does not occur. This result is due to the protective reflex (diving reflex) that is maximally functional in the last few weeks of uterine life. Before an underwater birth takes place, it is important that the water in the pool is of drinking water standard and the water pipes are free of micro-organisms. The water samples taken in the first few years after installing the birthing pool in our unit showed repeatedly increased levels of *L. pneumophila* and *P. aeruginosa*, with evidence of an increased concentration of these organisms in the shower hose in particular as a result of the hospital's contaminated plumbing system. This prompted us to install a bacterial filter in 2002, resulting in a notable reduction in the contamination (5). It is evident that faeces are discharged into the tub during the bearing down phase and contaminate the water with various organisms. Although a high level of faecal bacteria was established in the water after delivery, babies born in water did not experience an increased rate of infection or aspiration pneumonia (14,15).

Giving the current evidence, criticism about water birth no longer appears justified. For example, the concern that a newborn may aspirate water is unsubstantiated in regard to neonatal physiology and the respiratory adaptation to intra-uterine life (16). Intra-uterine acidosis is the only factor that alters or diminishes the protective mechanisms of the foetus, particularly the diving reflex, which prevents the newborn from inhaling water and is controlled by primitive cerebral structures. The diving reflex reaches its maximum efficiency in newborns at term and disappears four months post birth. The diving reflex is inhibited only when the facial receptors of the newborn encounter air for the first time (6,11,16).

In conclusion, our data indicate that water birth is a safe alternative to conventional deliveries (bed or stool) for selected women with low-risk pregnancies. Water birth appears to be associated with a shorter duration of delivery, reduced maternal analgesia requirements, a significantly reduced episiotomy rate, and a better subjective perception of the delivery, while the neonatal infection rate is not increased.

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