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Julie Rikkers
Philadelphia College of Osteopathic Medicine, julieri@pcom.edu

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Does Immersion in Water During Labor Decrease the Likelihood of Perineal Tears?

Julie Rikkers, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

January 23, 2013
ABSTRACT

OBJECTIVE: The objective of this review is to determine whether or not “Does water immersion in the course of labor decrease the risk of perineal injury during vaginal delivery?”


DATA SOURCES: Two Randomized, Double-Blind, Controlled trials as well as One Case Control Study which evaluated Maternal and Neonatal Outcomes during labor and delivery were found using PubMed and Cochrane Databases.

OUTCOME MEASURED: Each study looked at women who used water immersion during labor and those that did not. The outcomes measured were those regarding maternal and neonatal outcomes, including Perineal Trauma of varying degrees. Visual Inspection was the method employed by experienced clinicians evaluating the women after giving birth to determine the extent, if any, of damage to the perineum. Women were given a rating of Intact, Episiotomy, First, Second, Third, and in one study, Fourth degree tear. P-values were employed to assess clinical significance of outcomes measured.

RESULTS: All of the studies showed that immersion in water during labor does not significantly reduce the likelihood of perineal tearing.

CONCLUSION: Results of the studies measuring perineal tears in women using water immersion during labor demonstrate that water immersion during labor has no effect on the likelihood of perineal injury. The only study in which women were allowed to give birth into the water itself showed a significant decrease in the risk of vaginal trauma in women who give birth in water. Further research is warranted to determine whether actual delivery into water vs. land has a beneficial outcome for women with regard to perineal trauma and long-term sequelae.

KEYWORDS: “Water Immersion,” “Water Birth,” “Perineal Injury,” “Perineal Tear”
INTRODUCTION

Perineal injury is an almost universal complication of vaginal delivery, when the perineal body (the muscle and tissue between the vulva and the anus) stretches to accommodate delivery of the fetus. First degree perineal lacerations are defined as a tear that involves the vaginal mucosa and perineal skin. Second degree tears penetrate the fascia and musculature of the perineal body. Third degree tears continue into the anal sphincter and fourth degree tears extend further into the rectal mucosa. 40-85% of women experience some form of perineal tear while giving birth. Third and fourth degree lacerations (major tears) occur in 3-7% of deliveries. Up to 75-85% of women experience additional trauma such as labial, periurethral, clitoral or cervical trauma. Perineal trauma has a direct and serious impact on a woman’s quality of life postpartum as it can lead to urinary and/or fecal incontinence, sexual dysfunction, dysparunia and perineal pain.

Various preventative measures have been suggested in an attempt to decrease the chances of suffering perineal damage: Kegel exercises; warm compresses; perineal massage with manual lubricated stretching; “hands-off” or “hands-poised” technique during delivery; episiotomies; obstetric gel. Positioning of the woman during labor may also play a large part in the rate of injury (e.g. lateral or upright positioning versus the lithotomy position). The treatment for 2nd to 4th degree tears is suturing. Analgesics, pain relievers and stool softeners may be provided throughout the healing process. If fecal spillage into the wound occurs, antibiotics such as broad spectrum cephalosporins may be warranted.

Water immersion during labor has been shown to significantly decrease the need for epidural, spinal and/or paracervical analgesia or anesthesia. This practice is routinely offered by midwives at home births as well as in birthing centers primarily to aid in pain control during the
first two stages of labor (stage 1 includes initiation of labor contractions, cervical thinning and full cervical dilation, stage 2 involves delivery of the fetus). On the contrary, very few hospitals in the United States offer water immersion to their patients.

This paper evaluates two double-blind randomized controlled trials (RCTs) and one case-control trial comparing standard vaginal delivery versus use of immersion in water during labor as a tool to reduce the likelihood of perineal injury. Neither of the two RCTs allowed for in-water birth; water immersion during the first stage of labor only was permitted.

**OBJECTIVE**

This article posits the theory that immersion in water decreases the likelihood of perineal tears. The objective of this selective EBM review is to determine whether or not “Does Immersion in Water During Labor Decrease the Likelihood of Perineal Tears?”

**METHODS**

The literature search was for pregnancies of 37 weeks or more. The women stated the preference for vaginal delivery in the hospital. Inclusion criteria comprised original, primary research containing a minimum of two randomized controlled trials and at least one other primary study that focused on patient oriented outcomes (POEMS).

Exclusion criteria were articles in which women planned C-section delivery, continuous electronic fetal monitoring was needed and or medical or obstetric risk factors were present. Studies excluded were those published before 1996, secondary literature or “review” articles published in a medical periodical or conducted by a PCOM PA graduate as well as any content found in a previously published Cochrane systematic review or meta-analysis.

Using these criteria, two double-blind, randomized controlled trials, and one case-control trial were identified and included in this review. All of the articles selected were written in
English, published in peer-reviewed journals and were found by the author via PubMed and CINHAL. Statistics were analyzed and reported using p values, relative risk (RR), 95% confidence interval (CI), Chi-squared test, t-test and Kruskal-Wallis tests. Key words used in the search were perineal tear, injury, trauma, water birth, and water immersion.

**Table 1**: Demographics of participants in studies analyzed

<table>
<thead>
<tr>
<th>Study</th>
<th>Type</th>
<th>#Pts</th>
<th>Age</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>W/D</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>BODNER</td>
<td>Case control study</td>
<td>280</td>
<td>17 – 42 y/o; Mean age 27-28 y/o</td>
<td>Pregnant women with a gestational age &gt; 37 wks; A normal sized fetus; Reactive admission cardiotocography; Drainage of clear amniotic fluid (if membranes already ruptured); Pregnancy w/ cephalic presentation</td>
<td>Women with medical or obstetric risk factors</td>
<td>0</td>
<td>Water Birth group was enrolled and control group was chosen from a delivery database to match experimental arm demographics</td>
</tr>
<tr>
<td>ECKERT</td>
<td>RCT</td>
<td>274</td>
<td>Mean age 27.2 – 28.4 y/o</td>
<td>Pregnant women with a gestational age &gt; 37 weeks; Pregnant women who planned delivery in the hospital; Singleton pregnancy at term; No medical or obstetric complications</td>
<td>Pregnant women &lt; 37 weeks along; Planned Cesarean sections; Those who required continuous electronic fetal monitoring</td>
<td>76</td>
<td>Randomized to water immersion group or non-water immersion group</td>
</tr>
<tr>
<td>RUSH</td>
<td>RCT</td>
<td>800</td>
<td>Mean age 27.7 – 27.8</td>
<td>Pregnant women ≥ 37 weeks along who were in labor (&gt; 3cm dilated); Planned hospital delivery; No previously scheduled cesarean sections; Afebrile (&lt; 37.5° C); Used water immersion during the 1st stage of labor</td>
<td>Orders for epidural or continuous electronic fetal monitoring upon admission</td>
<td>15</td>
<td>Randomized to water immersion group or non-water immersion group</td>
</tr>
</tbody>
</table>
**OUTCOMES MEASURED**

In the 2002 Bodner study, perineal tears were assessed by an experienced obstetrician-gynecologist and categorized using traditional definitions of 1st, 2nd and 3rd degree tears. In addition, the clinician recorded any labial or vaginal trauma incurred during labor as well as the incidence of an episiotomy.

Outcomes addressed in the 2001 Eckert article were measured by visual inspection and palpation by a trained healthcare professional. A score of Intact, Grazes, Episiotomy, Extended Episiotomy, 1st, 2nd and 3rd degree tear were given to the women post-delivery.

Outcomes assessed in the 1996 Rush article were the presence and extent of damage to the perineum, and performance or not of an episiotomy. The degree of intactness or tearing of the perineum was measured by visual inspection and palpation by a trained clinician. A rating of Intact, Episiotomy, 1st, 2nd, 3rd and 4th degree laceration were assigned immediately postpartum.

**RESULTS**

The study conducted by Bodner et al. was a case-control trial in which women consented to water births and were followed through labor and delivery (n = 140). Parity-matched women with normal spontaneous vaginal delivery who delivered on land were selected from a delivery database as the control arm (n = 140). This was the only study included in this paper in which women actually gave birth in water.

A physician recorded the information during labor and delivery including length of labor, use of analgesia, use of oxytocin for induction of labor, performance of an episiotomy, perineal injury, and more. Of the 140 females who were enrolled in the experimental arm, none were excluded from the trial, and all delivered their babies under water.
The number of perineal tears sustained by women who birthed in water versus land was not statistically significant. The number of 1st degree lacerations incurred by women who gave birth in water was 29 as compared to 27 women in the control arm. Of the women who chose water birth, 8 experienced 2nd degree tears as compared to 9 women who gave birth on land. 3rd degree tears did not occur in any woman who gave birth in water, whereas one female who gave birth outside of water suffered a 3rd degree laceration. As described above, the number of perineal tears incurred in this study was virtually identical in each group. Interestingly, water birth was found to be protective with regard to the incidence of vaginal trauma, as well as need for episiotomies. According to their data, for every 14 women who have a water birth instead of a land birth, 1 woman is saved from vaginal trauma (p = 0.03, ARR = 7.0%, NNT = 14), and for every 3 women who have a water birth, 1 woman is spared an episiotomy, with an absolute risk reduction of 32.0% (p = 0.0001, ARR = 32.0%, NNT = 3).

The results of this study are significant in that they show virtually no difference in the likelihood of perineal tears in women who spent a significant amount of time in water and gave birth into water versus women who had a routine vaginal delivery on land.

### Table 2: Incidence of perineal and labial injury in water vs. non-water birth, Bodner 2002

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Water Birth</th>
<th>Control</th>
<th>p value</th>
<th>RRR</th>
<th>ARR</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>29</td>
<td>27</td>
<td>NS*</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2nd degree</td>
<td>8</td>
<td>9</td>
<td>NS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3rd degree</td>
<td>0</td>
<td>1</td>
<td>NS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Labial Trauma</td>
<td>9</td>
<td>9</td>
<td>NS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vaginal Trauma</td>
<td>7</td>
<td>17</td>
<td>0.03</td>
<td>59.0%</td>
<td>7.0%</td>
<td>14</td>
</tr>
<tr>
<td>Episiotomy</td>
<td>2</td>
<td>46</td>
<td>0.0001</td>
<td>96.0%</td>
<td>32.0%</td>
<td>3</td>
</tr>
<tr>
<td>Postpartum Hemorrhage**</td>
<td>2</td>
<td>14</td>
<td>0.002</td>
<td>86.0%</td>
<td>8.6%</td>
<td>11</td>
</tr>
</tbody>
</table>

* NS = Not Significant (p > 0.05); p value < 0.05 is considered significant
** Postpartum Hemorrhage = blood loss > 500mL
In the study conducted by Eckert et al., 274 pregnant women who were interested in having the option to bathe during labor were enrolled in the study. When a participant presented to the hospital she was randomized into an experimental (bath) group (n = 137) or a control (land) group (n = 137). Unfortunately the data collected in the Eckert et al. study was limited in several respects. Though the study was meant to be completely double-blinded, in order to assign a delivery room with or without a bath in it, staff members had to be made aware of the woman’s treatment option when she presented to the hospital for delivery. In addition, the researcher who collected the clinical data upon completion of the trial was not blinded to the treatment allocation. One major issue encountered was that 40 women (29%) in the experimental water immersion group declined to use the bath during labor, and 36 women (26%) assigned to the control group used the bath. Because intention-to-treat analysis was used, the 40 women in the experimental group who decided not to use the bath were still counted in the experimental arm as though they had used the bath. Similarly, the 36 women in the control group who ended up employing water immersion during labor were counted as though they were in the control group without access to the bath. Though this poses obvious limitations, analysis of actual treatment received was performed by researchers and the results were comparable.

Overall, the Eckert et al. trial showed no significant difference in rates of perineal injury between the two study arms. According to their data, the relative risk of 1st degree tears was 1.18, 2nd degree tears 0.74, and 3rd degree tears 2.54. The data showed a relative risk reduction in perineal tearing when using water immersion versus none of 2.0%, with an absolute risk reduction of 1.0%. According to their research, for every 100 Pts using water immersion during labor, there are 1 fewer perineal tears than would bee seen in a land birth (NNT = 100).
By and large, treatment effect of water immersion on risk of perineal tear was small as evidenced in this study; the rate of tears in both groups was comparable. However, the trial did show a relative benefit of water immersion with regard to 2nd degree tears. Their data showed that 12 women would have to engage in water immersion during labor in order for 1 woman to be protected against a 2nd degree tear (ARR = 8.0\%, NNT = 12).

Of note, Eckert et al. found that the incidence of postpartum hemorrhage was higher in the experimental arm than in the control arm. Their data showed that for every 20 women using water immersion during labor, there is 1 more incidence of postpartum hemorrhage than had they not engaged in water immersion (NNH = 20).

Table 3: Water immersion and its effects on perineal injury during labor, Eckert 2001

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Water Immersion</th>
<th>Control</th>
<th>RR (CI 95%)</th>
<th>RRR</th>
<th>ARR</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td>53</td>
<td>54</td>
<td>1.00 (0.75-1.33)</td>
<td>2.0%</td>
<td>0.7%</td>
<td>142</td>
</tr>
<tr>
<td>2nd degree</td>
<td>32</td>
<td>43</td>
<td>0.74 (0.50-1.10)</td>
<td>25.0%</td>
<td>8.0%</td>
<td>12</td>
</tr>
<tr>
<td>All Tears</td>
<td>63</td>
<td>67</td>
<td>0.94</td>
<td>2.0%</td>
<td>1.0%</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3A: Water immersion and its effects on perineal injury during labor and postpartum hemorrhage, Eckert 2001

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Water Immersion</th>
<th>Control</th>
<th>RR (CI 95%)</th>
<th>RRI</th>
<th>ARI</th>
<th>NNH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grazes</td>
<td>30</td>
<td>27</td>
<td>1.11 (0.70-1.77)</td>
<td>11.0%</td>
<td>2.0%</td>
<td>50</td>
</tr>
<tr>
<td>1st degree</td>
<td>26</td>
<td>22</td>
<td>1.18 (0.71-1.98)</td>
<td>18.0%</td>
<td>3.0%</td>
<td>33</td>
</tr>
<tr>
<td>3rd degree</td>
<td>5</td>
<td>2</td>
<td>2.54 (0.50-12.85)</td>
<td>150%</td>
<td>2.0%</td>
<td>50</td>
</tr>
<tr>
<td>Episiotomy</td>
<td>35</td>
<td>32</td>
<td>1.09 (0.72-1.66)</td>
<td>9.0%</td>
<td>2.0%</td>
<td>50</td>
</tr>
<tr>
<td>Extended Episiotomy</td>
<td>3</td>
<td>2</td>
<td>1.50 (0.25-8.84)</td>
<td>1.0%</td>
<td>1.0%</td>
<td>100</td>
</tr>
<tr>
<td>Postpartum Hemorrhage*</td>
<td>19</td>
<td>12</td>
<td>1.58 (0.80-3.13)</td>
<td>58.0%</td>
<td>5.0%</td>
<td>20</td>
</tr>
</tbody>
</table>

*Postpartum Hemorrhage = blood loss ≥ 600mL

Rush et al. conducted a study in which 800 women consented to participate in a randomized controlled trial wherein half of the participants were offered a tub during labor and the other half did not have access to a tub. In the final analysis, after selection, 393 women
were included in the experimental arm (water immersion), and 392 women made up the control arm (no water immersion). Of the 393 who were given access to a tub throughout labor, only 210 (54%) used the water immersion during labor. Nevertheless, the remaining 183 women (46%) in the experimental arm were counted in the study and considered experimental subjects with intention-to-treat rationale. After the trial, during data analysis, it was found that 13 subjects (5 tub, 8 controls) had not had their temperature taken upon admission, and 28 women (10 tub, 8 controls) did not fit all of the eligibility requirements. Those 41 women (15 tub, 16 controls) were still included in the data analysis in their respective groups given the intention-to-treat study design. The results of the study are therefore limited in that the number of women who used water immersion during labor (n = 210) was significantly less than those who did not use it (n = 575). It was shown that 73% of the women using water immersion only used the tub once throughout labor, as opposed to soaking multiple times. In addition, the mean amount of time spent in the water was 54 minutes, which is an arguably short amount of time as compared to the entirety of labor and delivery when studying its use in preventing maternal injury.

According to data collected in this study, the prevention effect of water immersion against perineal tears was not shown to be statistically significant. However, the study demonstrated that there was a statistically significant increase in the likelihood of accomplishing delivery with an intact perineum in women using water immersion (p = 0.019). According to the data, for every 13 patients using water immersion, 1 more woman would have an intact perineum after childbirth than had she birthed without use of immersion (ARR = 8.0%, NNT = 13). There was a minimal reduction in risk of 1st degree tears found in the water immersion group (ARR = 4.0%, NNT = 23), but the results were not statistically significant (p = 0.345). Although the number of women with an intact perineum was significantly greater in the tub group (n = 129 vs.
n = 99), all in all the results of this study showed no statistical difference in the likelihood of perineal tears between the experimental and control arms.

Worth noting, Rush et al. showed a relative protective affect of water immersion on the necessity of forceps and/or vacuum extraction used during delivery (p = 0.011). Their study found that for every 18 women using water immersion, there would be 1 fewer births requiring forceps and/or vacuum extraction.

**Table 4**: Incidence of Perineal injury in women participating in vs. those not participating in water immersion during labor, Rush 1996

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Water Immersion</th>
<th>Control</th>
<th>p value</th>
<th>RRR</th>
<th>ARR</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td>129</td>
<td>99</td>
<td>0.019</td>
<td>30.0%*</td>
<td>8.0%*</td>
<td>13*</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; degree</td>
<td>59</td>
<td>76</td>
<td>NS (0.345)</td>
<td>23.0%</td>
<td>4.0%</td>
<td>23</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; degree</td>
<td>58</td>
<td>56</td>
<td>NS (0.839)</td>
<td>n/a‡</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; degree</td>
<td>4</td>
<td>4</td>
<td>NS (1.00)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; degree</td>
<td>2</td>
<td>0</td>
<td>NS (0.211)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Episiotomy</td>
<td>135</td>
<td>147</td>
<td>NS (0.157)</td>
<td>8.0%</td>
<td>3.0%</td>
<td>33</td>
</tr>
<tr>
<td>Forceps +/- or Vacuum</td>
<td>65</td>
<td>86</td>
<td>0.055†</td>
<td>25.0%</td>
<td>6.0%</td>
<td>18</td>
</tr>
</tbody>
</table>

* RRR = 257.0%, ARR = 44.0%, NNT = 2 when we count the actual number of women who used water immersion (n = 210) and those who did not (n = 575) in our analysis

# NS = Not Significant (p > 0.05); p value < 0.05 is considered significant

‡ n/a = not applicable (numbers are either so low or high as to not be statistically significant)

† p = 0.011 when 41 ineligibles were withdrawn from analysis

**DISCUSSION**

Immersion in water has been proven to significantly decrease the need for analgesia and instrumentation (forceps, vacuum) used on women in active labor.\(^{1,7,9}\) It has not yet however been studied as a potential prophylactic treatment option for protection of the perineum during vaginal delivery. This study was conducted to answer that query.

Delivery in water (water birth) has been offered most commonly by nurse midwives throughout the years and is associated with decreased morbidity as compared to traditional
hospital delivery (especially those with any medical interventions).\textsuperscript{7,10} It has been proposed that water birth may increase the elasticity of the birth canal and perineum thereby reducing the risk of perineal injury; other potential benefits are the decreased need for analgesia and synthetic medications used for induction of labor as well as allowing for maternal relaxation throughout the birthing process.\textsuperscript{7}

It is difficult to conduct a randomized controlled trial requiring women to birth in water as few women in the United States are educated about birthing in water, and there is fear and ignorance about its safety. For this reason, none of the randomized controlled trials reviewed in this paper deal with birthing into water itself, which has been known to significantly decrease the risk of vaginal injury, lower the rate of episiotomies, increase the likelihood of an intact perineum and limit the incidence of perineal tears.\textsuperscript{7}

Although Eckert et al. found an increase in the rate of postpartum hemorrhage in females using water immersion during the first stage of labor, Bodner et al. found a surprisingly lower rate of significant postpartum hemorrhage in women who used water immersion during the first and second stages of labor.\textsuperscript{1,7} Further studies are therefore needed to assess the role of water immersion in this possible negative outcome.

Though there are obvious limitations to conducting a RCT dealing with water birth, it would greatly benefit the scientific community and women the world over to have a study that could truly study the potential benefits of water birth for both mother and fetus, and specifically to discover the potential benefits with regard to perineal trauma.

**CONCLUSION**

The three trials studied in this review illustrate that immersion in water during the first two stages of labor is not effective in preventing perineal tears. The potential benefits of
immersion in water during labor are relaxation and its analgesic properties. It may also increase elasticity of the birth canal and the perineum, which in turn may decrease the incidence of episiotomies performed, as seen in these study subjects.

All pregnant women should be educated about the options available to them for childbirth, including which options decrease negative outcomes and sequelae. With regard to limiting risk of perineal injury, the techniques used successfully up to now are warm compresses, perineal massage, obstetric gel, and lateral or upright positioning. As seen in the Bodner et al. study, birthing in water is correlated with an increase in the likelihood of an intact perineum and a significant decrease in the risk of vaginal trauma. However, at present, there are no reliable RCTs in the medical literature about the statistical difference between water and land birth in relation to perineal tears. Ways to create a viable RCT to study this further are the following:

Making accurate, engaging educational materials available to pregnant women as well as having one-on-one patient-provider consults about birthing options – enumerating the risks and benefits of water and routine hospital births. Advertising at birthing centers, hospitals, and retail establishments selling pregnancy-related goods as well as via the Internet would be crucial. Equally critical would be to have a website for the study allowing women access to information about land vs. water birth as well as enabling them to enroll in the study online. Ideally, a nationwide collaboration of practitioners would be involved in, or help promote the study to their patients (if not endorsing, at least making their patients aware of the study, much as they would other educational resources). A centralized database could be used to house data and allow for ease of communication. The key in a study of this nature is to have very high numbers of candidates at the outset, which allows for the reality of withdrawals, ensuring a meaningful number of participants at the conclusion of the study.
REFERENCES


