



RANDOMIZED CONTROLLED TRIAL OF

Use of the Peanut Ball During Labor

Abstract

Purpose: The purpose of this study was to evaluate the efficacy of peanut ball use on duration of first stage labor and pushing time in women who were scheduled for elective induction of labor at ≥ 39 weeks gestation and planning an epidural.

Study Design and Methods: In this randomized controlled trial, women having labor induction and planning a labor epidural were assigned (1:1) to one of two groups: one group used a peanut ball and one group did not. Outcome variables were time spent in first stage labor and time spent pushing. Factors included group assignment (peanut ball, no peanut ball), parity (primiparous, multiparous), and race. Age and maximum oxytocin dose served as covariates.

Results: Among women having elective induction with epidural analgesia, use of a peanut ball reduced first stage labor duration for primiparous patients significantly more than multiparous patients, $p = 0.018$. There was no significant difference in the reduction of length of first stage labor for multiparous women, $p = 0.057$ with use of the peanut ball. Peanut ball use did not alter length of pushing time for either group, $p > 0.05$.

Clinical Implications: Use of peanut balls may reduce total labor time to a greater degree in primiparous patients than multiparous patients having elective induction at ≥ 39 weeks with epidural analgesia.

Keywords: Epidural analgesia; First stage labor; Obstetric labor; Second stage labor.

Cheryl Roth, PhD, WHNP-BC, RNC-OB, RNFA,
Sarah A. Dent, MSN, RNC-OB,
Sheryl E. Parfitt, MSN, RNC-OB,
Sandra L. Hering, MSN, RNC-OB, CPHIMS,
and R. Curtis Bay, PhD

Use of peanut balls for laboring women has become common in hospitals in the United States. Many nurses believe that the peanut ball can help to decrease labor duration and maternal pushing time, and may even decrease risk of cesarean birth (Tulley, 2015). Potential uses include enabling optimal positioning and opening the pelvis, as a nonpharmacologic comfort measure for squatting or rocking, and facilitation of fetal rotation and descent in second stage labor (Zwelling, 2010). The labor and birth nurses at the large community hospital where this study was completed frequently use peanut balls for these purposes.

Birthing balls of various shapes have been used during labor and birth since the late 1990s (Zwelling, 2010), but no large studies have evaluated their effectiveness in reducing duration of first or second stage labor. A systematic review of four RCTs with 220 women and meta-analysis by Makvandi, Latifnejad Roudsari, Sadeghi, and Karimi (2015) found a significant improvement in labor pain with use of the labor ball ($p = .0000005$). Tian, Kao, Lin, Chang, and Gau (2013) found a significant difference in labor

Use of peanut balls for laboring patients has become common in many hospitals in the United States.

pain and childbirth satisfaction when birth balls were used during pregnancy and subsequent labor in an RCT of 74 women. An RCT of 58 women without epidurals who used the birth ball found a decrease in labor pain, but not a decrease in labor duration (Delgado-García, Orts-Cortés, Poveda-Bernabeu, & Caballero-Pérez, 2012). No studies were noted that found a decrease in duration of labor or maternal pushing time.

Peanut balls are large, plastic exercise balls shaped like a peanut (Figure 1). They come in different sizes and can be inflated in different amounts to accommodate smaller or larger patients. Peanut balls are a specific type of birthing ball shaped so that they can be placed between the legs of women in labor, although they can be used in a variety of ways. Women may find them comfortable to sit on during labor or for rocking back and forth or bouncing during contractions. When placed between women's legs while in the lateral position, they are thought to facilitate opening of the pelvis (Figure 2). Women who have a labor epidural and a fetus in the occiput posterior position may be supported in the hands and knees position with the peanut ball to facilitate rotation of the fetus to an occiput anterior position. Use of the ball in opening the pelvis may aid in appropriate alignment of the fetus for birth (Zwelling, Johnson, & Allen, 2006). Maternal pushing efforts can also be facilitated using the peanut ball. If the peanut ball is shown to shorten labor, this would prove to be a beneficial outcome.

There is a focus in healthcare on providing value and quality services at a minimal cost. The peanut ball is inexpensive, nonpharmacologic, noninvasive, and reusable. Average cost to order online is \$13.00 to \$40.00. Using this low-cost option may reduce the time women are in labor and potentially decrease departmental expenditures such as nurse staffing.

A literature search prior to initiation of this study found no research-based articles on peanut balls in particular. However, since the completion of the study in November 2014,



Figure 1.

one research article has been published describing a project that associated use of peanut balls with a significant decrease in length of labor and cesarean rate (Tussey et al., 2015).

There are multiple articles in the literature that encourage complementary therapies during labor. Maternal movement and position changes during labor may increase labor progress and maternal circulation, as well as enhancing fetal movement through the pelvis and thus decreasing time spent in the second stage of labor (Zwelling et al., 2006). Mobility in labor also may increase the fetus's ability to engage and rotate into the pelvis and descend (Zwelling, 2010). Maternal positions that facilitate movement of the pelvis should be encouraged during labor, even if a woman is confined to

bed, as in the case of epidural usage (Romano & Lothian, 2008). Lack of maternal position changes in labor can contribute to dystocia and increase risk for cesarean birth due to failure to progress or descend (Zwelling).

Epidural anesthesia is an intervention during labor that affects healthcare value. Epidurals provide the most effective pain relief (American College of Obstetricians and Gynecologists [ACOG], 2006) and are used by 61% of women in the United States during labor and birth (Osterman & Martin, 2011). In the study facility, more than 90% of women choose epidural anesthesia for pain relief. The American College of Obstetrics and Gynecologists recommends epidural anesthesia be available to all women based on consistent scientific evidence that shows regional anesthesia provides a superior level of pain relief during labor when compared to systemic drugs.

Epidurals can have unintended side effects. Although most patients can turn side to side, they are unable to stand or walk. This limited movement may contribute to longer labor duration and an inability to position the woman for optimal progress. Epidurals may prolong first

and second stages of labor, increase operative vaginal birth via vacuum or forceps (ACOG, 2006), and contribute to malposition of the fetal head (Ponkey, Cohen, Heffner, & Lieberman, 2003). Lieberman, Davidson, Lee-Parritz, and Shearer (2005) found an increase in occipital posterior (OP) presentation at birth in women receiving epidural versus no epidural (12.9% vs. 3.3%). Fetal malposition, particularly the OP position, has been associated with increased risk of cesarean birth (Lieberman & O'Donoghue, 2002), induction of labor, oxytocin augmentation, and longer duration of labor (Fitzpatrick, McQuillan, & O'Herlihy, 2001).

Women are often placed in a lateral position when laboring with epidurals. This position reduces compression of the inferior vena cava from the weight of the uterus and increases maternal-fetal circulation and fetal oxygenation. Side lying positions also decrease maternal hypotension, the most common side effect of regional anesthesia (ACOG, 2006). Downe, Gerrett,

and Renfrew (2004), found a reduced risk of operative vaginal birth for women in the side lying position versus the sitting position for women with epidurals.

Pregnant women naturally develop a spinal lordosis (Fenwick & Simkin, 1987). The weight of the uterus pulls the abdomen forward creating a Spinal S Curve. The laboring woman should be positioned with her back curled forward creating a C Curve (Zwelling, 2010). The C Curve better aligns the uterus with the pelvis and the baby's presenting part with the pelvic inlet. When the laboring patient is in the C Curve position, the sacrum and coccyx are free to move back, thus increasing the anterior-posterior diameter of the pelvis (Zwelling). This larger space allows the baby to descend through the pelvis more easily.

To facilitate the C Curve in a side-lying patient with an epidural, the upper leg should be elevated as far away from the lower leg as possible, which can be enabled with the use of the peanut ball. This causes an increase in the transverse diameter of the pelvis outlet (Zwelling).

*The
peanut ball can
optimize patient
positioning.*

Figure 2.



Study Design and Methods

This RCT was conducted in a large Magnet designated community hospital to test the utility of the peanut ball during labor. The research question was: does use of the peanut ball during labor in women having an elective induction of labor and epidural analgesia decrease duration of first stage labor and pushing time?

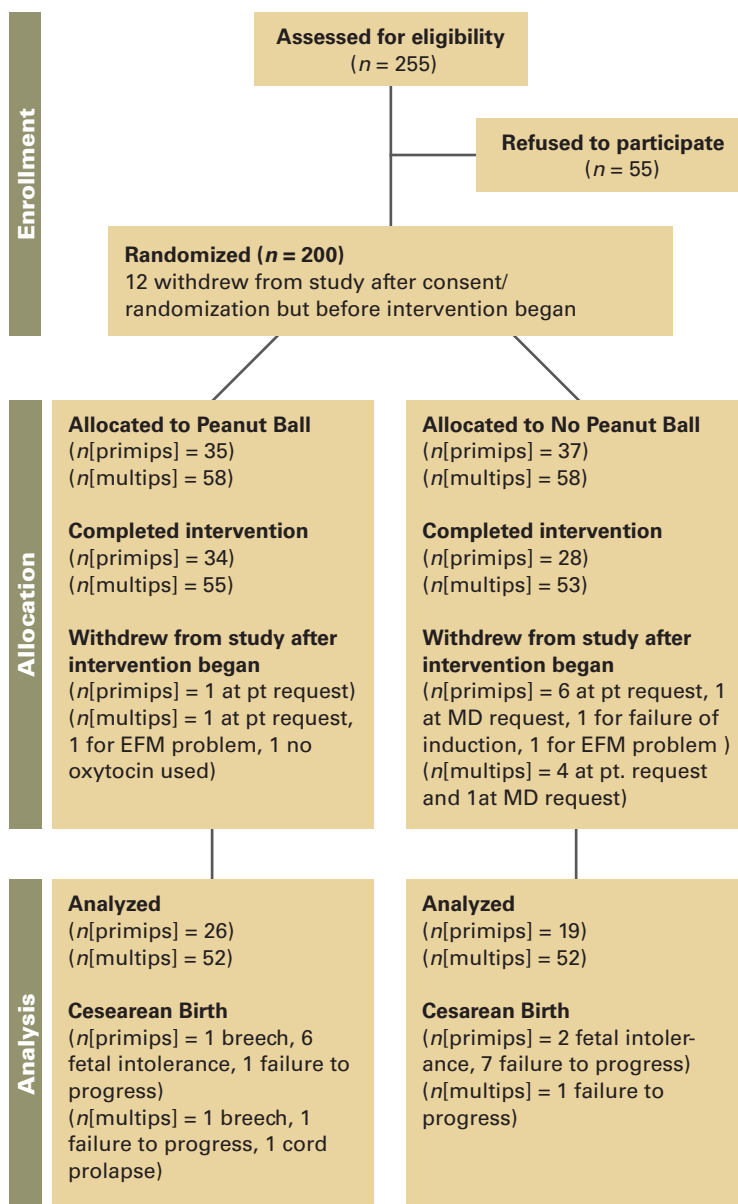
Women were eligible for inclusion in this study if they were at least 18 years of age, were scheduled for an elective labor induction at or beyond 39 weeks gestation, and chose an epidural for pain management. There were no specific exclusion criteria except those implied by the inclusion criteria.

A sequential randomization list was generated using IBM SPSS Statistics version 21. Individual, opaque envelopes with group assignment codes were prepared, sealed, and placed in a dedicated cabinet. When an eligible patient presented for induction of labor, the study was explained to her. If she agreed to enroll in the study, the next ordered envelope was selected and she was assigned to the peanut ball (PB) group, or no peanut ball (No PB) group. Women assigned to the intervention group (PB) had the peanut ball placed between their knees within 30 minutes after epidural placement, with rotation of lateral positions every 30 minutes or as indicated by patient/fetal status. Women in the control group (No PB) did not use the peanut ball and nurses were instructed to use a maximum of one pillow between the knees.

Demographic data collected included: Age, parity (primiparous or multiparous), and race. Clinical data included: Time of onset of labor (defined as contractions q 3-5 minutes or change of dilation, effacement or station, as determined by labor nurse and confirmed by record review), time of complete dilation (end of first stage), time pushing began, time of birth (end of second stage), method of birth, and maximum oxytocin dose. The primary endpoint was the length of first stage of labor (10 cm/complete dilation) and the secondary endpoint was the length of pushing time (ending at birth). Many women used passive fetal descent during second stage labor; however, that time frame was not included in the analysis.

An a-priori power analysis determined that a sample size of 143 in each study group would achieve a power of 80%, $p < .05$, two-tailed, assuming a difference between treatment groups (effect size) of .33 standard deviations. Assuming the average duration of labor is approximately 8 hours, and that this variable is somewhat normally distributed, the standard deviation for this distribution would be 1.3 hours. Therefore, an ef-

Figure 3 Participant Flow Peanut Ball versus No Peanut Ball Randomized Control Trial



fect size of .33 standard deviations would be equivalent to 43 minutes. In the absence of a strict definition of what might be a “meaningful” clinical difference, this effect size was adopted because it would be, clearly, clinically meaningful, and allow the study to proceed in consideration of the time and resources required. In order to allow for attrition, a sample size of 200 (N = 200) for each group was chosen. The plan was for the study to continue until either the sample size was achieved or 1 year had passed, at which time the need to continue data collection would be reviewed. The average number of elective inductions per month at the participating hospital ranged from 60 to 100, so it was expected that the targeted enrollment would be

reached within the 1-year time frame. The study was approved by the hospital's Institutional Review Board.

Independent-samples *t*-tests and chi-square or Fisher's exact tests were used to compare groups on demographic and clinical characteristics at baseline. Generalized linear models were used to test the two hypotheses. Sequential Bonferroni tests were used for follow-up pairwise comparisons. Age of the patient and maximum oxytocin dose, as well as race, were tested as potentially confounding variables. Parity (primiparous vs. multiparous), and race were entered as factors, along with group assignment (PB vs. No PB). Descriptive data are reported as mean (standard deviation) or count (%), as appropriate. Outcomes from the inferential tests are reported as geometric means and geometric 95% confidence intervals because outcome data were logged to accommodate the skew of the data, and then exponentiated. Analyses were conducted using IBM SPSS Statistics version 22.

Results

One year after the beginning of the study, 110 patients had been enrolled. The decision was made to continue the study until 200 patients were enrolled. An unanticipated number

of potential participants declined to enroll in the study because they wanted to have the peanut ball available for use during labor, even though an investigator explained that its efficacy had not been formally evaluated. Thirty-nine patients did not complete the study because they chose to discontinue, their physician chose to remove them from the study, or they had emergent birth for urgent situations such as prolapsed cord or category II or III fetal heart rate tracing.

Seventeen primiparous patients and four multiparous patients enrolled in the study (12.4%) gave birth via Cesarean, and the research team decided to exclude them from the analysis because 17 of the 21 did not reach complete dilation. At close of the study, complete data were available

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for 149 patients, 78 (52.3%) in the PB group and 71 (47.7%) in the No PB group. A participant flow (CONSORT) diagram is provided in Figure 3. Summary demographic and clinical data for the groups are provided in Table 1.

The initial generalized linear models predicting duration of first stage labor and duration of maternal pushing efforts included group (PB, no PB), parity (primiparous, multiparous), and race (Caucasian, other) as factors, along with age and maximum oxytocin dose as covariates. The analyses were full factorial, including all interaction terms for the factors.

In the analysis predicting duration of first stage labor, it was determined that age ($p = 0.571$) and race ($p = 0.311$) were not associated with the outcome, so they were excluded from the model. Maximum oxytocin level was highly predictive of duration ($p < 0.001$), and improved the precision of the model estimates, so was retained. In the final model (Table 2), a significant interaction was identified for the group \times parity term, $p = 0.018$. The main effect of group was not significant ($p = 0.057$), but the main effect of parity was, $p < 0.001$, primiparous women taking longer to deliver than multiparous. Maximum oxytocin dose

Table 1. Demographic and Clinical Data for the Peanut Ball and No Peanut Ball Groups

Variable	PB (<i>n</i> = 78)	No PB (<i>n</i> = 71)	<i>p</i> -value
Age, mean (SD)	30.6 (4.3)	31.1 (4.5)	0.507
Race, <i>n</i> (%)			0.084
Caucasian	64 (82.1)	49 (69.0)	
Other	14 (17.9)	22 (31.0)	
Primiparous, <i>n</i> (%)	26 (33.3)	19 (26.8)	0.475
Highest Oxytocin [mU], mean (SD)	13.0 (6.6)	11.2 (6.0)	0.091

Note: PB = Peanut Ball; No PB = No Peanut Ball.

Table 2. Parameter Estimates for Final Model Predicting Duration of First Stage Labor by Treatment Group and Parity, Controlling for Highest Oxytocin Level

Parameter	95% Wald Confidence Interval					<i>p</i> -value
	B	Std. Error	Lower	Upper	Wald Chi-Square	
(Intercept)	5.102	.116	4.876	5.329	1946.11	<.001
Group ¹	-.331	.1741	-.672	.010	3.612	.057
Parity ²	-.741	.1511	-1.037	-.445	24.06	<.001
Group \times Parity	.479	.206	.075	.883	5.41	.018
Highest oxytocin	.027	.008	.012	.042	12.32	.001

Note: Criterion = Duration of first stage labor (logged).

¹No Peanut Ball = 0, Peanut Ball = 1.

²Primiparous = 0, Multiparous = 1.

was also significantly, positively associated with duration of first stage labor ($p < 0.001$). Geometric group means and geometric 95% CIs (adjusted for highest oxytocin level) for duration of first stage labor are provided in Table 3.

In the analysis of duration of pushing, age ($p = 0.205$), race ($p = 0.320$), and maximum oxytocin dose ($p = 0.221$) were not significant, so were excluded from the model. In the final model (Table 4), the interaction term for group x parity ($p = 0.308$) and the main effect of group ($p = 0.150$) were not significantly predictive of duration of pushing. Only the main effect of parity achieved significance, $p < 0.001$. Primiparous women spent more time (mean \pm SD) in this phase of labor (51.2 minutes \pm 44.3) than multiparous women (7.3 minutes \pm 15.7).

Clinical Nursing Implications

Labor nurses can use this information in this study to educate women about physiologic birthing positions. Although our results do not support the use of a peanut ball to reduce time spent in labor for all patients, they do demonstrate that their use may reduce first stage labor time to a greater degree in primiparous than multiparous patients. Multiparous labors are shorter duration on the whole, and consequently, any benefit in reduction of labor time may not be reflected as easily. Routine practice of the nurses in the study is passive fetal descent in second stage labor, so use of the peanut ball may not have had a significant impact on pushing duration in this context. To encourage fetal rotation, nurses at the study hospital often use the peanut ball for laboring women with a fetus in the occiput transverse or OT positions. They commonly place the woman in the fully lateral position (fire-hydrant position) or hands and knees position with support of the peanut ball. We did not address this in our study but it warrants future research.

Limitations of the study include sample size, especially for primiparous patients and possible bias by the nurses involved. Although this hospital strives to meet the Association of Women's Health, Obstetric and Neonatal Nurses Staffing Guidelines (2010), nurses may have had more than one patient in labor or on oxytocin during labor.

Conclusion

Our study suggests that the peanut ball may be a promising adjunctive tool in shortening first stage labor for primiparous patients having an elective induction of labor after

Table 3. Geometric Means and Geometric 95% Confidence Intervals for Duration of First Stage Labor by Treatment Group and Parity

Group	Parity	Geometric Mean (95% CI)
No PB*	Primiparous	414.01 (321.44 to 533.20)
	Multiparous	197.29 (169.14 to 230.17)
PB*	Primiparous	297.38 (236.68 to 373.61)
	Multiparous	228.81 (196.17 to 266.88)

PB = Peanut Ball; No PB = No Peanut Ball

Note: Means adjusted for maximum dose of oxytocin.

Note: p -value for interaction = .018.

Table 4. Parameter Estimates for Final Model Predicting Duration of First Stage Labor by Treatment Group and Parity, Controlling for Highest Oxytocin Level

Parameter	95% Wald Confidence Interval					p -value
	B	Std. Error	Lower	Upper	Wald Chi-Square	
(Intercept)	2.025	.137	1.757	2.293	219.66	<.001
Group ¹	.428	.297	-.155	1.011	2.07	.150
Parity ²	-1.730	.264	-2.248	-1.212	42.90	<.001
Group x Parity	-.361	.355	-1.056	.334	1.04	.308

Note: Criterion = Duration of second stage labor (logged).

¹No Peanut Ball = 0, Peanut Ball = 1.

²Primiparous = 0, Multiparous = 1.

39 weeks gestation with epidural analgesia. No decrease in first stage labor duration was shown for multiparous patients and no significant decrease in pushing time was shown for either primiparous or multiparous patients. ❖

Cheryl Roth is a Nurse Practitioner, HonorHealth Scottsdale Shea Medical Center, Scottsdale, AZ. The author can be reached via e-mail at cheryl.roth@honorhealth.com

Sarah A. Dent is a Clinical Director, HonorHealth Scottsdale Shea Medical Center, Scottsdale, AZ.

Sheryl E. Parfitt is a Clinical Educator, HonorHealth Scottsdale Shea Medical Center, Scottsdale, AZ.

Sandra L. Hering is an Informatics Support Specialist, HonorHealth Scottsdale Shea Medical Center, Scottsdale, AZ.

R. Curtis Bay, is a Professor, Biostatistics, Department of Interdisciplinary Health Sciences, A. T. Still University, Mesa, AZ.

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Suggested Clinical Nursing Implications

- Peanut balls are a nonpharmacologic, noninvasive, cost-effective tool for the use of laboring women.
- Peanut balls should be considered for primiparous women having elective labor induction and epidural analgesia.
- Peanut balls may not decrease labor time for multiparous women or pushing time for primiparous or multiparous patients having elective inductions with epidural analgesia.
- Further study with larger sample is needed to determine whether use of the peanut ball decreases cesarean birth.

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