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Scheduled Maternal Positioning with a Peanut Ball During Epidural Labour in Primiparous Women: A Narrative Review of Physiological Rationale, Randomized Evidence, and Implications for Trial Design

Parveen Nather[1], Dr. Poongodi V[2*], Dr. Seema Nahid[3], Dr. Aseen[4], Dr. Prabhavathy[5]

[1]Ph.D Scholar, Kasturba Gandhi Nursing College, Sri Balaji Vidyapeeth (Deemed to be University)
[2]Professor, Department of Obstetrics and Gynecology Nursing, Kasturba Gandhi Nursing College, Sri Balaji Vidyapeeth (Deemed to be University)
[3]Associate Consultant Anesthetist, Women's Wellness and Research Center, Hamad Medical Corporation, Doha, Qatar
[4]Medical Student, European University, Tbilisi, Georgia
[5]Professor, Department of Mental Health Nursing, Kasturba Gandhi Nursing College, Sri Balaji Vidyapeeth (Deemed to be University)
*Corresponding author: Dr. Poongodi V

ABSTRACT:

Background: Most women who choose epidural analgesia in labour obtain dependable pain relief. The block, however, can be dense or long-lasting, and it restricts how much the woman is able to move. Long periods spent lying on the back or half-sitting have been tied to slower labour, fetal malposition and more operative births, and women in their first labour bear most of this burden. The peanut ball is an elongated inflatable device that sits between the knees or legs; it was brought into practice so that women who cannot move freely could keep an open, asymmetric pelvic posture with no effort of their own. Enthusiasm for the device has run ahead of the data, and the argument has moved from whether to use the ball to how, when and how often it should be used.

Objective: To draw together the physiological basis, the randomized and quasi-randomized trials and the pooled analyses of peanut ball use, focusing on scheduled positioning protocols for primiparous women with an epidural, and to turn the gaps we identify into specific suggestions for the design of future trials.

Methods: A structured narrative review. We searched MEDLINE/PubMed, Embase, CINAHL, Scopus, the Cochrane Library, PEDro and trial registries from their start dates to October 2026, and followed citations forward and backward from key papers.

Key findings: The first trials, all from the United States, gave conflicting results. Across successive meta-analyses the picture changed from a non-significant shortening of total labour (four trials, 648 women) to a first stage about 87 minutes shorter and an 11% relative rise in vaginal birth for women with an epidural; certainty for caesarean birth is still low. Gains seem larger when the ball is combined with regular position changes set by protocol, and in primiparous women. Trials published since 2024 from Brazil, Turkey

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and India add data on pain, fatigue, satisfaction and stress; most effects are favourable, though duration findings vary. No trial has reported serious harm to mother or baby.

Conclusions: The peanut ball costs little, carries little risk and is well accepted by women, and current evidence justifies offering it once an epidural is in place. No trial has directly asked whether a fixed rotation schedule does better than ad hoc use. What is needed now are adequately powered trials in primiparous women that report the intervention in a standard way, monitor fidelity and use core outcome sets.

1. INTRODUCTION

Caesarean section is now among the commonest surgical procedures performed anywhere. Worldwide, slightly more than one birth in five is by caesarean, and current projections point to further growth over this decade [1,2]. The operation saves lives when there is a medical reason for it. Without such a reason it exposes the woman to bleeding, infection, placenta accreta spectrum in future pregnancies and a slower recovery, and it has been linked with changes in the child's immune and metabolic development [3]. India follows the same pattern. National survey figures show a sharp increase in caesarean rates over the last twenty years, with wide gaps between public and private hospitals and between states [4]. A woman's first caesarean largely decides how her later babies will be born, which is why professional bodies have made avoiding the primary caesarean in nulliparous women an explicit goal [5].

Labour dystocia is a loose term that takes in slow cervical change in the active first stage as well as failure of descent in the second stage, and it is the leading indication for primary caesarean among women having their first baby [5,6]. Over the same period, neuraxial analgesia has become the usual form of pain relief wherever anaesthetic cover exists. Women value epidurals and they work well, but they do alter the mechanics of labour [7,8]. In the Cochrane comparison of epidural and non-epidural analgesia, epidural use went with more instrumental deliveries and a longer second stage, although newer low-concentration regimens seem to have reduced some of these effects [7,9]. Some of what remains is very likely a matter of posture. Once an epidural is working, a woman tends to stay still for hours, usually half-sitting or flat on her back, and her pelvis no longer makes the small repeated movements that would normally go with each contraction [10,11].

It was to deal with exactly this that the peanut ball came into use on labour wards. The familiar round birthing ball is something a mobile woman sits on or leans against. The peanut ball, in contrast, is pinched in at the middle like a peanut shell, so it can lie between the thighs or knees of a woman who is on her side or semi-reclined. It keeps the legs apart and the hips bent, giving a woman lying down some of the pelvic shape she would have when squatting or lunging [12,13]. It is cheap, can be reused, and involves no drug or procedure. For these reasons it spread quickly through nursing and midwifery practice, often before formal evidence was available [11,14,15].

Even so, the evidence has grown. We now have several randomized trials, at least four meta-analyses and an increasing number of trials from outside North America [16–19]. The results do not agree, and one likely reason is that "peanut ball use" describes very different things, ranging from a ball offered once and left in place to a planned sequence of positions changed every 30 to 60 minutes. The useful question is therefore no longer simply whether the ball works, but which way of using it works, for which women and with what level of fidelity. A randomized trial of scheduled peanut ball positioning in primiparous women with epidural analgesia, registered recently, addresses this question directly [20].

We had three aims in writing this review. The first was to set out the physiological and biomechanical case for positioning women during epidural labour. The second was to appraise the randomized and pooled evidence on the peanut ball, keeping trials of women with and without an epidural apart. The third was to use the shortcomings of that evidence to suggest practical design features for the next generation of trials, particularly those testing scheduled positioning in primiparous women.

2. METHODS OF THE REVIEW

We did not set out to perform a new systematic review with meta-analysis, as several recent pooled analyses are already available; our aim was an interpretive, structured narrative synthesis. We searched MEDLINE/PubMed, Embase, CINAHL, Scopus, the Cochrane Library, PEDro, ClinicalTrials.gov and the Clinical Trials Registry of India from their inception to October 2026. Search terms linked three concepts: labour (labour, labor, parturition, childbirth, intrapartum), positioning (peanut ball, birthing

ball, maternal position, posture, mobility, flexible sacrum) and analgesia (epidural, neuraxial, regional analgesia). We checked the reference lists of the trials and reviews we included and tracked later citations of the main meta-analyses.

Priority went to randomized and quasi-randomized trials of the peanut ball against any form of usual care. For context we also included systematic reviews on maternal position and mobility in epidural labour, good-quality observational research on labour physiology, and international guidelines. Screening was not limited by language, but the final synthesis draws mostly on papers in English. Where trials reported risk-of-bias assessments, or review authors graded the certainty of evidence, we report those judgements in the language of the RoB 2 tool and the GRADE approach [21,22].

3. EPIDURAL ANALGESIA AND THE MECHANICS OF LABOUR

3.1 Effects on labour duration and mode of birth

How epidural analgesia affects the course of labour has been debated for decades. Randomized comparisons are hard to interpret because women who ask for an epidural often have longer and more painful labours from the outset, so observational studies suffer from confounding by indication [10,23]. Allowing for this, the Cochrane evidence shows no rise in the overall caesarean rate with epidural use, but a longer second stage and more instrumental vaginal deliveries [7]. Low-concentration local anaesthetic regimens lessen the excess of instrumental births without removing it [9]. Data from large cohorts suggest that the effect on second-stage length may be greater than older thresholds allowed for: in nulliparous women with an epidural, the 95th percentile for second-stage duration is more than an hour longer than in women without one [24,25].

The length of labour matters, since a prolonged second stage carries its own risks. Among nulliparous women, longer second stages have been linked with more chorioamnionitis, severe perineal tears and postpartum haemorrhage, and with slight increases in certain adverse neonatal outcomes [26,27]. Rigid time limits, on the other hand, lead to caesarean sections that are not needed, and consensus guidance on preventing the primary caesarean specifically permits extra time for nulliparous women with an epidural so long as labour is progressing and mother and baby are well [5]. Any measure that shortens labour without adding risk is useful on both counts: it cuts exposure to the complications of a long labour and eases the pressure towards operative delivery. The timing of pushing is one such measure that has been studied on a large scale; in a big multicentre trial of nulliparous women with neuraxial analgesia, delaying pushing did not raise the rate of spontaneous vaginal birth and made the second stage longer [28]. Position is another measure, and it costs next to nothing.

3.2 Immobility, fetal position and rotation

The planes of the pelvis do not line up with one another, so the descending fetal head has to adapt. It normally flexes and turns from a transverse or oblique position at the inlet to an occiput anterior position at the outlet. When the occiput stays posterior, labour tends to be longer, operative birth is more likely and severe perineal injury is more common [29]. Repeated ultrasound examinations have shown that the position of the fetus changes often during labour, and that women who have an epidural are more likely than other women to deliver a baby in the occiput posterior position [30]. It is not known whether the epidural leads to malposition or whether malposition makes labour painful enough to prompt the request for an epidural; both may well be true.

Trials that used posture to correct an occiput posterior position have given mixed results. Hands-and-knees and side-lying positions in the first stage did not reliably increase rotation to occiput anterior [31,32], whereas a Spanish trial found some benefit for rotation from a modified Sims position in women with epidurals [33]. That single postures held for a limited time had only small effects in these trials is relevant to research on the peanut ball. If posture affects rotation, it most likely does so through pelvic positions that are held, repeated and varied over time, not through one manoeuvre, and this favours scheduled positioning over occasional positioning.

4. BIOMECHANICAL RATIONALE FOR POSITIONING AND THE PEANUT BALL

The bony pelvis is not rigid. In pregnancy the sacroiliac joints and the pubic symphysis loosen, and when a woman is not lying on her sacrum and coccyx, both can move backwards. Magnetic resonance pelvimetry has demonstrated that moving from a supine position to kneeling or squatting enlarges the sagittal outlet and the interspinous and intertuberous diameters by a measurable amount [34]. Subsequent imaging showed that these position-dependent changes occur in pregnant and non-pregnant women alike and reach several millimetres, which is clinically relevant [35]. Reviews of the biomechanics conclude

that the pelvic planes are most likely to widen in positions that combine flexion, abduction and external rotation of the hip, and in positions that leave the sacrum free to move [36].

This is the thinking behind "flexible sacrum" positions for the second stage. Meta-analyses of trials that compared these positions with lithotomy or supine positions found fewer operative deliveries and less time spent actively pushing, with perhaps a slight increase in minor perineal trauma [37]. An overview of systematic reviews of upright positions came to much the same view, while pointing out large differences between the reviews [38]. In women without an epidural, Cochrane reviews of position in the first and second stages indicate that being upright and mobile is linked with shorter labour and fewer interventions [39,40]. The World Health Organization advises that low-risk women be encouraged to move about and stay upright, and that they be supported to give birth in the position they choose, and this advice extends to women with epidural analgesia [41].

Women with an established epidural present the real challenge. Even a low-dose block dulls proprioception and weakens the legs, and staff worry about falls and monitoring, so women are often kept in bed [11,42]. Observational data show that women with an epidural spend most of their labour in a few reclining positions and seldom change position unless staff prompt them [42]. This is the gap the peanut ball is meant to fill. When it is placed between the knees or ankles of a woman lying on her side, or beneath the upper leg when she is semi-reclined, it holds the hips flexed and abducted with no muscular effort and keeps weight off the sacrum. Positions commonly used include the side-lying "open" position for the inlet and midpelvis, the semi-reclined "tuck" or "pushing" position for the outlet, and an exaggerated side-lying (Sims-type) position in which the upper leg is brought forward over the ball [12,13,15]. Switching sides at set intervals creates asymmetry, which in theory helps the head to use the oblique diameters as it turns [29,36].

Two points need to be kept in mind. First, very little of the biomechanical evidence was gathered from women actually using a peanut ball; most of it is inferred from imaging of other postures. Second, the second-stage evidence that is specific to epidural labour points somewhere unexpected. In the BUMPES trial, which enrolled more than 3,000 nulliparous women with a low-dose epidural, lying on the side during the second stage led to more spontaneous vaginal births than being upright [43]. The Cochrane review of second-stage position with epidural anaesthesia, which is largely made up of that trial, found that when only high-quality trials were analysed, upright positions appeared harmful and satisfaction was slightly lower [44]. Because peanut ball positions are reclining and not upright, these results do not weigh against the ball; they arguably support side-lying positions that keep the pelvis open. What they do show is that more movement, or a more upright posture, should not be assumed to be better for a woman with an epidural.

5. RANDOMIZED EVIDENCE IN WOMEN RECEIVING EPIDURAL ANALGESIA

The principal randomized and quasi-randomized studies of the peanut ball are listed in Table 1. They vary in the women they enrolled, when the ball was started, how many position changes were made and how often, what the control group received and which outcome was primary. These differences need to be borne in mind when reading the pooled results described later.

5.1 The early North American trials

The first trial, which set off interest in the device, took place in a teaching hospital in the south-west of the United States and recruited roughly 200 women with epidural analgesia [12]. In the intervention group, women were given a peanut ball once the epidural was in and changed position while using it; women in the control group changed position every one to two hours but had no ball. The authors reported a first stage shortened by about 90 minutes, a second stage shortened by about 23 minutes and fewer caesarean births with the peanut ball [12,45]. The trial had real weaknesses, among them an unclear account of allocation concealment and a sample that mixed nulliparous and multiparous women. Even so, it supplied the effect size used to calculate sample sizes for the trials that followed.

In California, a trial recruited women booked for elective induction at 39 weeks or later who intended to have an epidural [46]. The peanut ball was positioned within 30 minutes of the epidural being sited, and women were turned from side to side every 30 minutes. The overall effect on the length of the first stage was small, but it was significantly larger in primiparous than in multiparous women, and the time spent pushing did not change in either group. Among women given oxytocin, the ball shortened the first stage by about three hours in primiparous women but lengthened it a little in multiparous women [45,46]. Subgroup results like these can only generate hypotheses. The difference by parity does make biological sense, however: a

primiparous pelvis and its soft tissues have never accommodated a term baby, so the effect of position on rotation and descent may be greater.

A smaller trial in Philadelphia randomized 86 women. It found no significant difference in how fast the cervix dilated (0.98 versus 0.79 cm/h) or in the length of active labour (315 versus 387 minutes), and no difference in caesarean birth or occiput posterior presentation [47]. The point estimates leaned in favour of the peanut ball, and the trial did not have enough power to detect differences of the size it saw. An unpublished North Carolina trial likewise found a shorter first stage with the ball that did not reach statistical significance [18]. A registered trial of nulliparous women at a hospital in Ohio compared the ball with the usual wedges and pillows and used operative birth as its primary outcome [48].

Quasi-experimental and quality-improvement work offers a further angle. In a nurse-led programme that paired the peanut ball with position changes, it was how often women changed position, not ball use on its own, that was linked to shorter first and second stages [49]. At the level of a whole service, a bundle designed to lower caesarean rates in nulliparous women, which included standard labour support and the peanut ball, raised use of the ball from 16% to 45% of labours, and caesarean births fell over the same period [45,50]. Since many elements changed at once, the part played by the ball cannot be isolated. The result does, however, support the view that the ball is effective as one part of a positioning routine and not as a device used on its own.

5.2 Pilot and feasibility work

An Australian pilot trial protocol was designed to find out whether it was feasible to randomize women with epidurals to the peanut ball. It measured how willing women were to be randomized, how many dropped out and why use of the ball was stopped [15]. Outcomes of this sort seldom appear in the peanut ball literature, yet they bear directly on trials of scheduled positioning, where keeping to the schedule is the very mechanism by which the intervention is supposed to work. Qualitative interviews with midwives by the same team found that the ball was well received, but that practical issues such as choosing the right size, staffing levels and the woman's comfort decided how consistently it was used.

Table 1. Design features and principal results of randomized and quasi-randomized trials of the peanut ball

Study, country	Population and design	Intervention protocol	Main findings
Tussey et al., 2015, USA [12]	~200 women with epidural, mixed parity; RCT	Ball introduced after epidural, with position changes; controls turned every 1-2 h	Shorter first stage (~90 min) and second stage (~23 min); fewer caesarean births
Roth et al., 2016, USA [46]	Planned epidural with elective induction at ≥39 wk; RCT	Ball placed within 30 min of epidural; turned side to side every 30 min	First-stage reduction larger in primiparous than multiparous women; no change in pushing time
Mercier and Kwan, 2018, USA [47]	86 women with epidural; RCT	Peanut ball in active labour compared with no ball	Dilation rate, labour length, caesarean and OP position did not differ significantly
Hickey and Savage, 2019, USA [49]	Women with epidural; quasi-experimental, nurse-led	Peanut ball combined with position changes	More frequent position changes associated with shorter first and second stages
Fraga et al., 2024, Brazil [51]	100 women with no analgesia; RCT	Ball positions chosen by fetal station, plus pelvic mobility	Active phase shorter by ~82 min and total labour by ~89 min; greater satisfaction
Alan Dikmen et al., 2025, Turkey [52]	90 women; RCT	Peanut ball positions in the first stage	Less pain and fatigue; more positive perception of childbirth

Study, country	Population and design	Intervention protocol	Main findings
Çankaya et al., 2025, Turkey [53]	Primiparous women; RCT, single-blind	Timed cycles of side-lying ball positions starting at 4-5 cm	Better recall of labour and higher birth satisfaction; Apgar scores similar
Kamath et al., 2024-2026, India [54,55]	768 low-risk primigravidae without epidural; block-randomized RCT	Ball positions starting at 3-4 cm dilatation	Less pain and stress; better birth experience and satisfaction
Hoyladi and Yıldırım Varişoğlu, 2026, Turkey [56]	102 women; RCT	Five ball positions starting at 6 cm	Active-labour length, pain and comfort unaffected

RCT, randomized controlled trial; OP, occiput posterior. Effect sizes are approximate, as given in the original reports or as extracted in pooled analyses.

6. EVIDENCE FROM WOMEN WITHOUT EPIDURAL ANALGESIA AND BROADER OUTCOMES

A later group of trials, mostly from Brazil, Turkey and India, has studied the peanut ball in women without neuraxial analgesia, and has widened the outcomes to take in pain, fatigue, experience of childbirth and stress. Their findings cannot be applied directly to epidural labour, but they shed light on mechanism and on what structured protocols can achieve.

A Brazilian physiotherapy trial enrolled 100 women in active labour who had no analgesia. The protocol paired the peanut ball with positions selected according to the station of the fetal head, along with pelvic mobility exercises. Active labour was about 82 minutes shorter and total labour about 89 minutes shorter, and women were more satisfied with their birth [51]. In this protocol each position was chosen to suit the pelvic plane in which the fetus lay (inlet, midpelvis or outlet), making it the clearest example so far of a structured schedule grounded in physiology. The same group had previously found that active pelvic movements on a round Swiss ball shortened labour and reduced pain, fatigue and anxiety [57], in line with earlier work showing that birthing ball exercises lessen pain and improve self-efficacy [58–61].

In Turkey, trials found that the peanut ball lowered perceived pain and fatigue and gave women a better perception of childbirth [52], and that primiparous women who used it remembered their labour more positively and were more satisfied with the birth [53]. Another Turkish trial, with 102 women, found no effect on the length of active labour, on pain or on comfort [56]. A trial among women with a high body mass index, in whom immobility and malposition are frequent, has also been published recently [62]. In India, a large block-randomized trial at a tertiary centre enrolled 768 low-risk primigravid women; positioning with the peanut ball from 3 to 4 cm of dilatation was associated with less pain and lower maternal stress [55,63] and with a better birth experience and greater satisfaction [54]. As far as we know, this is the largest peanut ball trial to date and the first from India. Because it enrolled primigravidae and measured biological markers of stress, it is relevant here, even though the women in it did not have epidurals.

Read together, these studies indicate that protocols built around frequent, deliberate position changes give more consistent benefit than simply handing the woman a ball. They also show that women appreciate the experience, which is important now that the woman's experience is regarded as a core outcome of intrapartum care [41,64]. Qualitative syntheses suggest that non-pharmacological methods help women feel in control and involved, even when they are also using drugs for pain relief [65].

7. WHAT THE META-ANALYSES SHOW

Peanut ball trials have been combined in four meta-analyses, and the conclusions have changed over time (Table 2). The earliest, from 2019, pooled four randomized trials with 648 women, most of them nulliparous and all with an epidural [16]. Total labour was roughly 79 minutes shorter with the ball, but the confidence interval was wide and included zero (mean difference −79.1 minutes; 95% CI −204.9 to 46.7). The estimate for total duration came from just one trial, and the tendency towards more spontaneous vaginal births was not statistically significant [16].

A review in 2021 that took in both randomized and quasi-randomized trials, in women with and without epidurals, combined six studies with 645 participants. It too found no significant difference in caesarean rate (risk ratio 0.82) or in length of the first stage, and judged the certainty of evidence to be low [18]. Its authors asked for larger trials of better design.

Delgado and colleagues, in their 2022 review, limited inclusion to women with epidural analgesia and, with an updated search, included four studies and 818 women [17]. They found high-certainty evidence of a first stage about 87 minutes shorter with the peanut ball (mean difference −87.42 minutes; 95% CI −94.49 to −80.34), and moderate-certainty evidence of an 11% higher chance of vaginal birth (risk ratio 1.11; 95% CI 1.02 to 1.22) [13,17]. The effect on caesarean birth was not significant (risk ratio 0.75; 95% CI 0.57 to 1.00; low certainty), and the finding of a second stage some 22 minutes shorter came from one trial only [45]. Since the individual trials disagreed, the very tight confidence interval for the first stage should be read with care; it may owe more to the weight of a single large trial and to fixed-effect assumptions than to genuine precision.

The latest update, from 2025, covered randomized and quasi-experimental studies in women with and without an epidural [19]. Among women with an epidural the first stage was about 53 minutes shorter, and the authors concluded that in this group the peanut ball shortens the first stage and reduces caesarean rates, although once again the duration estimate for epidural labour rested on only a few trials [19]. A clinical-inquiry summary written for family physicians graded the evidence for a shorter first stage as strong and observed that the benefit may be greater in primiparous women [45]. A broader meta-analysis of mobility and position change in low-dose epidural labour, not confined to the peanut ball, found no significant effect on mode of birth or labour length and no harm, and advised that women who wish to move should be helped to do so [66]. In a randomized trial in which a physiotherapist led women through a planned series of posture changes in the passive second stage, compared with lying supine, there were more spontaneous births, fewer caesarean and instrumental births and a shorter second stage [67].

Three conclusions can be drawn. The clearest and most consistent benefit is a shorter first stage in women with an epidural; effects on the second stage and on caesarean birth are plausible but not established. The pooled estimates depend on few trials, mostly single-centre studies from the United States with mixed parity, differing co-interventions and an unclear risk of bias. And no review could test the dose, timing or schedule of positioning as a modifier of effect, because trials did not report these details in a consistent way.

Table 2. Meta-analyses of the peanut ball in labour

Review	Scope	Principal pooled findings
Grenvik et al., 2019 [16]	4 RCTs; 648 women, all with epidural	Total labour 79 min shorter but not significant (MD −79.1; 95% CI −204.9 to 46.7); trend towards more spontaneous vaginal birth, not significant
Ahmadpour et al., 2021 [18]	6 RCTs/quasi-RCTs; 645 women with or without epidural	Caesarean (RR 0.82) and first-stage length not significantly different; low certainty
Delgado et al., 2022 [17]	4 studies; 818 women, all with epidural	First stage 87 min shorter (high certainty); vaginal birth RR 1.11 (95% CI 1.02-1.22; moderate certainty); caesarean RR 0.75 (95% CI 0.57-1.00; low certainty)
Makvandi et al., 2025 [19]	RCTs and quasi-experimental studies; women with or without epidural	First stage ~53 min shorter in women with epidural; fewer caesareans in this group

MD, mean difference; RR, risk ratio; CI, confidence interval.

8. SCHEDULED VERSUS AD HOC POSITIONING

By "scheduled positioning" we mean a protocol in which the woman changes position at set intervals and in a set order, whether or not she or the staff would otherwise have initiated the change. In practice, most trials with positive results used some kind

of schedule. Women in the Californian trial were turned every 30 minutes [46]; in the clinical-inquiry summary, women using the ball changed position every 30 minutes to two hours [45]; and the Brazilian protocol chose positions according to fetal station [51]. The trial with the most neutral findings gave no comparably detailed account of a fixed turning schedule [47]. The quasi-experimental finding that shorter labour was predicted by how often position changed, and not by ball use itself [49], points the same way.

A schedule could matter for good physiological reasons. Hours of pressure on one side of the pelvis in a single lateral position may assist descent in one plane while doing little for rotation, which relies on alternating asymmetric forces [29,36]. Turning the woman regularly also spreads the epidural block more evenly; the block tends to collect on the lower side and may become one-sided or patchy if she lies on one side too long, and anaesthetists often recommend hourly turning for this reason alone. Scheduled turns also give midwives a built-in chance to check comfort, bladder filling, fetal heart rate and maternal blood pressure.

There are drawbacks. A strict schedule may be uncomfortable, may wake a woman who has fallen asleep and may be hard to keep up on a busy ward. Continuous support during labour is effective in its own right [68], and in an open-label trial it can be hard to tell the effect of the ball apart from the effect of the extra attention a schedule brings. To the woman this hardly matters; to anyone interpreting the trial it matters a great deal.

No trial so far has compared a scheduled protocol with ad hoc use of the peanut ball, so the question remains open. Trials now comparing scheduled positioning with usual care will answer a pragmatic question (is a structured programme better than what is done now?) and not an explanatory one (is the schedule itself what makes the difference?). Table 3 lists the elements a scheduled protocol ought to define, based on the protocols of published trials.

Table 3. Components to be defined in a scheduled peanut ball positioning protocol

Element	Considerations drawn from published protocols
Eligibility and timing of start	Begin soon after the epidural is working, usually within 30 minutes [46,48]; state the cervical dilatation at entry
Ball size	Choose according to maternal height (usually 40, 50 or 60 cm); note the size used
Positions	Side-lying with ball between knees or ankles, semi-reclined (tuck) position, exaggerated side-lying; select by fetal station and position when assessed [15,51]
Interval and sequence	Set rotation, usually every 30-60 minutes, changing sides [45,46]
Duration	Continue until full dilatation; state whether the ball is used in the passive second stage [67]
Monitoring and safety	Check fetal heart rate and maternal blood pressure at each turn; staff-assisted repositioning; check height and symmetry of block
Stopping rules	Discomfort or refusal by the woman, non-reassuring fetal status, need for urgent delivery
Fidelity record	Timed record of each planned and completed change of position

The table draws on features reported in published trials. It is offered as an aid to trial design and is not a validated clinical protocol.

9. WHY PRIMIPAROUS WOMEN ARE THE KEY POPULATION

Several strands of evidence suggest that primiparous women stand to gain most. Their labours are longer in both the first and second stages [6], they use epidurals more often, and they are at greater risk of caesarean section for dystocia [5]. The lengthening of the second stage with epidural analgesia seems to be largest in nulliparous women [24,25]. The single peanut ball trial that examined parity found the benefit was mainly in primiparous women [46], and the clinical-inquiry summary reached the same

view [45]. Lastly, avoiding a first caesarean has knock-on benefits, since a woman who has had one caesarean is much more likely to have another [3,5].

A practical argument also applies. When trials enrol only primiparous women, the sample is more uniform and fewer participants are needed to detect a given effect. Trials that mix parities water down any effect confined to first-time mothers and are liable to give the inconsistent results seen in the current literature [16,18].

10. SAFETY AND NEONATAL OUTCOMES

Neither the randomized trials nor the meta-analyses have reported serious harm from the peanut ball [13,17,45]. The possible risks are largely practical: discomfort in the hips or pelvic girdle if the ball is too big, pressure areas, disruption of continuous fetal monitoring when the woman moves, and, in theory, a fall if a woman with weak legs tries to reposition the ball on her own. Choosing the right size (usually 40, 50 or 60 cm, according to the woman's height), cleaning the ball between women and supervising position changes deal with most of these concerns [15,63].

Reporting of neonatal outcomes has been patchy. Most trials recorded Apgar scores and admission to the neonatal unit, and none found a difference [16,53]. In low-risk women these events are uncommon, so the trials could only rule out large harms. The Apgar score is widely used but gives only a rough picture of the baby's condition [69]; where possible, future trials should look at umbilical cord blood gases, resuscitation at birth and composite neonatal morbidity. Maternal outcomes other than duration and mode of birth, including perineal trauma, postpartum haemorrhage, fever and urinary retention, are also seldom reported.

11. METHODOLOGICAL GAPS AND RECOMMENDATIONS FOR FUTURE TRIALS

The weaknesses of the present evidence are typical of research on nursing and midwifery interventions, but they are now what stands in the way of firm recommendations. We set out the main gaps and possible solutions below, and summarize them in Table 4.

11.1 Defining and reporting the intervention

Few published trials explain, in enough detail to repeat the work, when the ball was started, which positions were used, how often they were changed, who oversaw the changes and how adherence was recorded. If trials were reported according to the TIDieR checklist and the CONSORT extension for non-pharmacological treatments, pooled analyses could explore dose-response relationships [70,71]. The revised CONSORT 2025 statement also stresses making protocols available, sharing data and reporting harms [72]. As a minimum, trials should state the interval between epidural insertion and first use of the ball, the size of ball, the order and spacing of positions, the total time spent with the ball and the proportion of planned position changes that were actually made.

11.2 Control group and co-interventions

What counts as usual care varies a great deal from one hospital to another. In some trials, women in the control group were themselves turned every one to two hours [12]; in others it is not clear whether they were positioned at all. Since positioning is the likely mechanism, a control group that is turned regularly without a ball would test the device itself, whereas a usual-care control tests the whole package. Either design is valid, but the choice needs to be stated. Oxytocin augmentation, the epidural regimen (including programmed intermittent bolus or continuous infusion, and the degree of motor block), the timing of pushing and the provision of continuous labour support should be standardized or at the very least recorded, because each of these can affect the length of labour on its own [9,28,68].

11.3 Blinding and measurement

It is impossible to blind women or midwives to a peanut ball. Outcomes based on duration are especially open to bias, since the recorded times of full dilatation and of the start of the active phase depend on when examinations happen. Trials can limit this by using objective end points such as time and mode of birth, by defining the onset of the active phase with current criteria [6], by setting the timing of vaginal examinations in the protocol, and by having outcomes extracted from records by assessors unaware of group allocation. Decisions on mode of birth should follow criteria for labour arrest agreed in advance, to reduce performance bias [5].

11.4 Choice of primary outcome and sample size

Most trials have used the length of the first stage as the primary outcome because it needs a smaller sample. What women and clinicians care about most, however, is how the baby is born. To show a fall in caesarean birth among primiparous women with an epidural from, for example, 25% to 18%, a trial would need several hundred women in each arm, a number realistic only in large or multicentre studies. One approach is to make spontaneous vaginal birth the primary outcome, with a pre-specified secondary time-to-event analysis of labour duration that treats caesarean birth as a competing event. Statistical analysis plans should be made public beforehand. They should state how duration will be handled for women delivered by caesarean before full dilatation and how skewed duration data will be analysed, for instance by reporting medians and using quantile regression or survival methods in addition to mean differences.

11.5 Fidelity and adherence

A trial of scheduled positioning succeeds or fails on whether the schedule is actually followed. Fidelity needs to be measured and not taken for granted, for example by recording each position change and its time on a structured chart and working out what proportion of planned changes took place. Per-protocol and complier-average causal effect analyses, specified in advance alongside the intention-to-treat analysis, can show whether closer adherence gives larger effects. The reasons for stopping the protocol, such as discomfort, changes in fetal heart rate or the woman's own decision, should be documented [15].

11.6 Outcomes that matter to women

Satisfaction, sense of control and experience of childbirth should be assessed with validated tools and not with single questions [64,65]. The improvements in experience seen in recent trials [51,53,54] may turn out to matter as much as any change in duration, and they are relevant to policy because the WHO framework regards a positive childbirth experience as a goal in itself [41].

11.7 Generalizability

Nearly every trial in epidural labour has been carried out in a high-income country. Staffing on labour wards, epidural regimens, oxytocin protocols and thresholds for caesarean section are very different in South Asia, the Middle East and sub-Saharan Africa. Trials in these regions, such as the ongoing trial of scheduled positioning in Qatar [20] and the Indian work in women without epidurals [55], will show whether the benefits carry over. Trial registration, published protocols and data sharing would make a future individual participant data meta-analysis possible, and this is the only practical way to study whether effects differ by parity, induction, body mass index and density of the epidural block.

Table 4. Gaps in the existing evidence and suggested responses in trial design

Gap	Suggested response in future trials
Intervention poorly described	Report using TIDieR and CONSORT-NPT; publish the positioning schedule [70,71]
Mixed parity dilutes effects	Enrol only primiparous women or stratify randomization by parity [46]
Unblinded duration outcomes	Set examination timing by protocol; blinded outcome extraction; objective primary outcome
Small, single-centre samples	Power for mode of birth; recruit across several centres; register in advance
Adherence not measured	Fidelity logs; per-protocol and complier-average analyses
Heterogeneous control care	Describe usual care; consider an active control turned without a ball
Neonatal and maternal safety under-reported	Cord gases, resuscitation, NICU admission, perineal trauma, PPH, fever
Experience outcomes inconsistent	Validated tools for childbirth experience and satisfaction [64]

NICU, neonatal intensive care unit; PPH, postpartum haemorrhage.

12. IMPLICATIONS FOR PRACTICE

Uncertainty remains, but there is a sensible basis for practice. The peanut ball is cheap, has not been shown to cause serious harm, seems to shorten the first stage in women with an epidural, may make vaginal birth more likely and is liked by women [13,17,45]. Safety bundles from professional bodies aimed at reducing primary caesarean birth already list aids such as the peanut ball to help fetal rotation and descent in women with an epidural [45,50]. A reasonable approach is to offer the ball shortly after the epidural is placed, to use it as part of a planned routine of position changes about every 30 to 60 minutes, to select positions according to the station and position of the fetal head, and to record what was done.

Success depends on midwives and nurses. Brief hands-on training in sizing, positions and how to combine turning with fetal and maternal monitoring is probably more important than the ball itself. Where workloads are heavy and staff are few, a positioning chart at the bedside may help, and turns can be timed to coincide with routine observations. Women should be told why the ball is being used and should feel free to refuse it or to pause the schedule. In India and similar settings, where epidural use is growing in urban and private hospitals and caesarean rates stay high [4], the peanut ball is an inexpensive addition to current efforts to support physiological labour, as long as it is introduced together with, and not in place of, continuous labour support and careful intrapartum monitoring [41,68].

13. CONCLUSIONS

The peanut ball is a simple device resting on a sound biomechanical principle: a woman who cannot move freely because of an epidural can still be helped to keep her pelvis open and to change its shape as labour goes on. Pooled randomized evidence now points to a clinically worthwhile shortening of the first stage and a probable increase in vaginal birth in women with an epidural, without serious harm. The likeliest reason why individual trials disagree is that the ball has been used in different ways, and the clearest benefits have come from trials that combined it with regular, structured position changes, and from primiparous women. Whether the schedule itself is what produces the benefit has not yet been tested. Well-designed trials in primiparous women, with clear reporting of the intervention, measured fidelity, objective and woman-centred outcomes and pre-registered analysis plans, would answer this question and could move the peanut ball from a promising nursing aid to an evidence-based part of intrapartum care.

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