

Zuckerberg San Francisco General Hospital (ZSFG) Labor Duration and Management Guideline

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Background

A third of all babies in the U.S. are born by cesarean delivery, a rate twice as high as what the World Health Organization deems appropriate for highly developed countries.¹ While cesarean delivery (CD) is a life-saving procedure in some situations, its overuse in the United States is currently contributing to undue morbidity and mortality for mothers and babies. CD are associated with a three-fold increase in severe maternal morbidities such as hemorrhage requiring hysterectomy or transfusions, uterine rupture, anesthetic complications, shock, cardiac arrest, acute renal failure, assisted ventilation, venous thromboembolism, major infection, and in-hospital wound or hematoma.² Furthermore, subsequent cesarean deliveries increase the risk of placental abnormalities in future pregnancies. By the third cesarean delivery, a woman has a 3% chance of placenta previa and there is a 40% chance that the placenta previa will be complicated by placenta accreta.² Labor dystocia is the top indication for primary cesarean deliveries.¹ However, many of the interventions used to treat labor dystocia, such as oxytocin augmentation and artificial rupture of membranes, put women at risk for other morbidities and in some cases decreased patient satisfaction. This guideline is intended to aid health care providers in identifying those at risk for labor dystocia, and provide them with a template for judicious, safe and timely management of labor dystocia and arrest.

Relevant Data

Active Phase Arrest

In the setting of active phase arrest (APA), outcomes of vaginal delivery and cesarean delivery were compared.³ Abnormal active phase was diagnosed after greater than or equal to 4cm cervical dilation with no progress for at least 2 hours in the presence of adequate uterine contractions (≥ 200 Montevideo units per 10-minute period, as measured by an intrauterine pressure catheter). A sample of 1,014 women, 355 in the vaginal delivery group, 95 in the operative vaginal delivery group, and 584 in the cesarean delivery group yielded the following results:

Neonatal Outcomes:

- No difference in rates of adverse neonatal outcomes between those who delivered vaginally and those who had a cesarean delivery

Maternal Outcomes:

Women with APA who had cesareans compared with women with APA who delivered vaginally, were at higher risk of

- Chorioamnionitis (OR 3.37 95% CI 2.21-5.15)
- Endometritis (OR 48.4, 95% CI 6.61-354)
- Postpartum hemorrhage (OR 5.18; 95% CI 3.42-7.85)
- Severe postpartum hemorrhage (OR 14.97, 95% CI 1.77-1.26)³

The researchers also studied the outcomes of 355 women with vaginal deliveries in the setting of APA compared to 12,566 women without APA. The women with APA had:

Maternal Outcomes

- Higher rate of Operative vaginal delivery (28% vs. 17%, p<0.001)
- Higher rate of chorioamnionitis (18% v. 8%, p<0.001)
- Higher rate of 3rd and 4th degree lacerations (16% vs. 9%, p<0.001)
- Higher rate of Postpartum hemorrhage (26% vs. 17%, p<0.001)

Neonatal Outcomes:

- Higher rate of shoulder dystocia (4% vs. 2%, p<0.01)
- Higher rate of 5 minute Apgar scores <7 (5% vs. 2%, p<0.001)
- No difference in sepsis, NICU admission, clavicular fracture, Erb's palsy or acidemia.³

Summary: Women who had active phase arrest had higher risks of maternal and neonatal outcomes compared to those who did not have the diagnosis. However, those who had active phase arrest and underwent a cesarean delivery had much higher risks than those who delivered vaginally. Waiting for a vaginal delivery rather than doing a cesarean decreases the risk of adverse maternal outcomes without causing any additional risk to the newborn. Number needed to treat (NNT): three women delivering vaginally rather than by cesarean would prevent one postpartum hemorrhage; 33 women delivering vaginally would prevent one blood transfusion.

Prolonged Second Stage

Nulliparous women:

Multiple investigators have found that for nulliparous women, adverse neonatal outcomes are not associated with duration of second stage.² A secondary analysis compared neonatal and maternal outcomes of 4,126 nulliparous women with second stages of labor lasting greater than 3 hours with women who delivered in under 3 hours.

Results:

There were no increases in neonatal outcomes of prolonged second stage for:

- NICU admission
- 5 minute Apgar scores<4
- umbilical cord pH<7
- intubation
- sepsis
- small increase in brachial plexus injury (OR 1.78 CI 1.08-2.78)
 - small absolute risk (3 in 1000)

Maternal outcomes

Longer 2nd stage associated with:

- higher rate chorioamnionitis (OR 1.60, CI 1.51-1.87)
- 3rd or 4th degree laceration (OR 1.88, CI 1.62-1.99)
- uterine atony (OR 1.29, CI 1.51-1.45)⁴

Multiparous women:

A retrospective cohort study of 5158 women found that for multiparous women with 3 hours or more in second stage, there were increased risks of:

Maternal Outcomes:

- 3rd and 4th degree laceration [OR 2.56; 95% CI [1.44-4.55]]
- postpartum hemorrhage [OR 2.27; 95% CI [1.66-3.11]]
- chorioamnionitis [OR 6.02; 95% CI [4.14-8.75]]

Neonatal Outcomes:

- 5-minute Apgar score of less than 7 [OR 3.63; 95% CI [1.77-7.43]]
- NICU admission [OR 2.08; 95% CI [1.15-3.77]]
- Composite of neonatal morbidity [OR 1.85; 95% CI [1.23-2.77]]
- Longer neonatal stay in the hospital [OR 1.67; 95% CI [1.11-2.51]]⁵

A population-based study including 2,156 multiparous women with prolonged second stage (defined as lasting more than 2 hours) found similar results but no difference in:

- neonatal sepsis
- trauma⁶

Chance of NSVD by lengths of second stage:

- at 3 hours: 59%
- at 4 hours: 27%
- at 5 hours: 9%⁴

According to a 2014 retrospective cohort study of 42,268 women who delivered vaginally and had normal neonatal outcomes, the 95th percentile duration of second stage labor with epidural anesthesia is more **than two hours greater** for both nullips and multips (as opposed to one hour) when compared to women in second stage labor without epidural use.⁷

Summary: In prolonged second stage for nulliparous women, there is higher risk of adverse maternal outcomes but no evidence of adverse neonatal outcomes. For multiparous women with prolonged second stage, there are increased risks for maternal and neonatal outcomes. As second stage progresses past the normal range, there is a decreasing chance of a successful vaginal delivery.

New Insight from Contemporary Data on Normal Labor Curve

Traditionally, normal ranges for the duration of the stages of labor have been based on data from Friedman's studies in the 1950's.⁸ Research from Zhang has updated our understanding of what is normal for contemporary women in terms of labor duration.⁹

Likely the most significant new understanding is that, for most women, active labor doesn't begin until six centimeters of cervical dilation, not three centimeters as thought by Friedman. According to Zhang et al, half of women are not yet active at 4-5 cm dilation. Thus they recommend using 6 cm as the start of the active phase of labor.

Another key take-away from this contemporary data is that for nulliparous women, labor accelerates at greater dilations but there is no clear inflection point as previously thought. In multiparas labor generally accelerates after 6 cm dilation.

Additionally, Zhang and colleagues highlight that using the "average" as the parameter for guiding labor management decisions is not suitable for the management of the individual patient. Rather, women should be compared to the longest normal duration that is still associated with healthy birth outcomes (also known as 95th percentile values) for the first and second stages of labor.

See Zhang's labor curve chart in **Appendix A** for median and 95th percentile durations for cervical dilation.

Labor Duration Definitions

First Stage Latent Labor: Cervical dilation of 0-6 cm⁹

Normal	<p>Difficult to define due to challenge of determining the onset of labor.</p> <ul style="list-style-type: none"> No range exists for the new latent labor definition of 0-6 cm per Zhang <ul style="list-style-type: none"> Nulliparas (data exists only for 3-6cm): Median duration of 3.9 hours; 95th percentile: 17.7 hours Multiparas (data exists only for 4-6cm) Median duration of 2.2 hours; 95th percentile: 10.7 hours⁹ Per Friedman: <20 hours in the nullipara, and <14 hours in the multipara from 0-3cm⁸
Prolonged	<ul style="list-style-type: none"> No range exists for the new latent labor definition of 0-6 cm <ul style="list-style-type: none"> Nulliparas: >18 hours from 3-6cm Multiparas: >10.7 hrs from 4-6cm⁹ Per Friedman: >20 hours in the nullipara, >14 hours in the multipara from 0-3cm⁸

First Stage Active Labor: Cervical dilation of 6-10 cm⁹

Normal	<ul style="list-style-type: none"> Nulliparas: Median duration of 2.1 hours; 95th percentile: 7 hours Multiparas: Median duration of 1.5 hours; 95th percentile: 5.1 hours⁹
Prolonged/ slow slope	<ul style="list-style-type: none"> Slow progress from 6-10cm: Presence of labor progress, but duration outside the 95th percentile range of normal (> 7 hours in a nullipara, or > 5 hours in a multipara)⁹
Arrest	<p>Absence of labor progress/progressive cervical dilation for:</p> <ul style="list-style-type: none"> 4 hours OR MORE of adequate UCs (MVUs >200) 6 hours OR MORE with Pitocin and ruptured membranes (if possible) if UCs inadequate²

Second Stage Labor: Complete dilation to birth of the neonate

Normal*	<ul style="list-style-type: none"> Nulliparas: <3 hours WITHOUT epidural, <4 hours WITH epidural Multiparas: <2 hours WITHOUT epidural, <3 hours WITH epidural¹ <p>*New data from 2014 suggests that 95% of nullips with epidurals will deliver safely within 5 hours and 19 minutes and 95% of multips will deliver safely within 5 hours.⁷</p>
Prolonged	<p>Presence of descent, but duration outside normal range.</p> <ul style="list-style-type: none"> Nulliparas: >3 hours without epidural, >4 hours with epidural Multiparas: >2 hour without epidural, >3 hours with epidural¹
Arrest	<p>No descent after good pushing efforts for:</p> <ul style="list-style-type: none"> Nulliparas: >3 hours without epidural, >4 hours with epidural Multiparas: >2 hour without epidural, >3 hours with epidural

General Considerations

Team Considerations

Concerns regarding labor progress and need for potential intervention or operative delivery due to labor dystocia should be communicated frequently and openly to all team members. Care should be taken to address timing and resource utilization with situational awareness about other patient care activities at the Birth Center.

Risk Factors for Dystocia Before and During Labor

Based on ACOG Practice Bulletin Number 49¹⁰, except where it is noted otherwise.

Risk Factors prior to labor	Risk factors during labor
Nulliparity Obesity Postterm pregnancy Fetal weight > 4 kg Advanced maternal age Diabetes Hypertension Infertility treatment Previous perinatal death Amniotic fluid abnormalities Premature rupture of membranes Sleep deprivation ¹¹	Induction of labor Epidural Chorioamnionitis Persistent occiput posterior position Cephalopelvic disproportion Dehydration ¹²

Risk factors specific to second stage:

Short maternal height (<5 ft)

Risk factors specific to second stage:

Longer first stage of labor
High station at complete cervical dilatation (higher than +2 station at complete)

The P's of Labor Progress

The 7 P's of Labor Progress:

Remember to consider ALL of these areas when evaluating labor dystocia.

- **Powers:** contractions, pushing
- **Passage:** pelvic dimensions/shape
- **Passenger:** position, attitude, size
- **Position & Movement (maternal)**
- **Psyche:** coping
- **Partner/ support:** supportive partner, family, doula
- **Provider:** your own beliefs, attitudes, practices, state of mind

Etiologies and risk factors for dysfunctional labor

Table adapted from Simpkin and Ancheta's Labor Progress Handbook, Third Edition.¹³

Etiology	Description	Comments
Cervical dystocia	Posterior unripe cervix at labor onset; scarred, fibrous cervix or "rigid os"; "tense cervix" or thick lower uterine segment	Unripe cervix may prolong latent phase. Surgical scarring, damage from disease, or structural abnormality may increase cervical resistance
Emotional dystocia	Maternal distress or fear, exhaustion, severe pain	Increased catecholamine production may inhibit contractions
Fetal dystocia	Malposition, asynclitism, large or deflexed head, lack of engagement	Pendulous abdomen, size and shape of pelvis or fetal head may predispose fetus to malposition
Iatrogenic dystocia	Misdiagnosis of labor or second stage, elective induction (nulliparous), inappropriate oxytocin use, maternal immobility, drugs, dehydration, disturbance	Misdiagnosis or unneeded interventions or restrictions can slow or interfere with labor progress
Pelvic dystocia	Malformation, pelvic shape other than gynecoid, small dimensions	Maternal movement and upright positions increase pelvic dimensions
Uterine dystocia	Inadequate or inefficient contractions	May be secondary to fear, fasting, dehydration, supine position, cephalopelvic disproportion, lactic acidosis in myometrium, or structural abnormalities

Management Guidelines

First Stage: Latent Labor 0-6 cm

Definition of Latent labor: The point at which the woman perceives regular uterine contractions up to the beginning of active phase.

Difficult to define due to challenge of determining the onset of labor.

- No range exists for the new latent labor definition of 0-6 cm per Zhang
 - Nulliparas (data exists only for 3-6cm): Median duration of 3.9 hours; 95th percentile: 17.7 hours
 - Multiparas (data exists only for 4-6cm) Median duration of 2.2 hours; 95th percentile: 10.7 hours⁹
- Per Friedman: <20 hours in the nullipara, and <14 hours in the multipara from 0-3cm⁸

Management:

Management is based on maternal coping, membrane status, fetal status, parity, and infectious disease risk.

For ALL patients:

- Involve patient and family in care plan and shared decision making.
- Encourage continuous labor support. Continuous labor support has been shown to shorten labor and promote physiologic birth. (See **Appendix B: Continuous Labor Support**)
- Delay hospital admission until active phase:
 - Recommended admission criteria: admit at **4-5 cm** IF exams have revealed cervical change of > 0.5 cm/hr over time **OR** at **6 cm** regardless of preceding rate of cervical change.¹⁴
 - If sending home, counsel re: early labor management at home, coping strategies, danger signs, and when to return to the hospital. Women sent home in early labor reported that they would have felt more reassured if they had received detailed specific written instructions and a follow up phone call.¹⁵
- Rest
- Encourage nutrition/hydration
- Encourage upright positions (standing, walking, kneeling, sitting) (See **Appendix C: Upright Positioning During Labor**)
- Water immersion: One hour of immersion in water was associated with shorter labors even when initiated in latent labor. (See **Appendix D: Water Immersion**)
- Avoid amniotomy (See **Appendix E: Amniotomy**)

Latent Labor- Prolonged:

- No range exists for the new latent labor definition of 0-6 cm
 - Nulliparas: >18 hours from 3-6cm
 - Multiparas: >10.7 hrs from 4-6cm⁹
- Per Friedman: >20 hours in the nullipara, >14 hours in the multipara from 0-3 cm⁸

Management:

For patients with risk factors or trending towards dystocia:

1. Membrane Sweeping (See **Appendix F: Membrane Sweeping**)
2. Breast/nipple stimulation (See SFGH Birth Center Policy 2.24)
3. Encourage upright positions (standing, walking, kneeling, sitting) (See **Appendix C: Upright Positioning During Labor**)

Three options for prolonged latent labor:

1. Expectant Management: Observe, ambulate, or send home.
2. Sedation: Consider therapeutic rest (see triage order set for dosing recommendations)
3. Stimulation of labor: Stimulation is reasonable to consider in women with a ripe cervix or in women who have failed therapeutic rest and have presented for multiple triage visits: consider various methods of induction/ augmentation. For more information on oxytocin, see SFGH oxytocin policy.
 - a. Most women with prolonged latent phase will enter active phase with expectant management alone. Those that don't will often either 1) stop contracting, or 2) reach active phase with amniotomy or oxytocin or both. Thus prolonged latent phase is not an indication for cesarean delivery.²
 - b. If patient is being induced, consider failed induction if unable to generate UC's q3 minutes after at least 24 hours of pitocin with ruptured membranes, if feasible.¹

First Stage: Active Labor 6-10 cm

Definition: Point at which the labor curve becomes steep, with steady and rapid cervical change. Exact point in labor varies considerably from person to person.

Normal Active Labor:

- Nulliparas: Median duration of 2.1 hours; 95th percentile: 7 hours
- Multiparas: Median duration of 1.5 hours; 95th percentile: 5.1 hours⁹

Management: For ALL patients

- Involve patient and family in care plan and shared decision making.
- Encourage continuous labor support. Continuous labor support has been shown to shorten labor and promote physiologic birth. (See **Appendix B: Continuous Labor Support**)
- Supportive care:
 - Hydration: Encourage PO fluids (not exclusively water) and offer IV fluids if PO fluid intake is low. Beware of overuse of IV hydration, consider maintaining total IV fluid intake below 125 mL/hour unless clinically indicated.
 - Nourishment: Offer small portions of food that sound appealing to the laboring mother. Eg: fruit, yogurt, crackers, cheese, popsicles, sandwich. An average of 81 calories kcal/hr prevents the development of ketosis during labor.¹⁶
- Encourage movement and frequent position changes. Encourage upright positions (standing, walking, kneeling, sitting) (See **Appendix B: Upright Positioning During Labor**)
- Provide psychological support

Optional Interventions:

- Acupressure of SP6 and/or L14 point (See **Appendix G: Acupressure**)

Active Labor- Prolonged/ Slow Slope

- Slow progress after 6 cm dilation: Presence of labor progress, but duration outside the 95th percentile range of normal (> 7 hours in a nullip, or > 5 hours in a multipara).⁹
 - Consider all possible etiologies when troubleshooting
 - Involve the patient and family in the care plan and shared decision making.

Emotional dystocia: Assess mom's level of coping. Is she distressed, afraid, exhausted, in severe pain?

- Assess mother's emotional/psychological well being through open-ended questions and active listening, and provide appropriate reassurance and education. Between contractions ask questions like:
 - What was going through your mind during that last contraction?
 - How are you feeling right now?
 - Do you have any idea why your labor has slowed down?
 - Is there anything that you feel needs to happen before you have your baby?
- Refocus and comfort patient: shower/bath, massage/soothing touch, aromatherapy
- Pain relief: Ideally starting with non-pharm methods and escalating as needed.
- Encourage continuous labor support. Continuous labor support has been shown to shorten labor and promote physiologic birth. (See **Appendix B: Continuous Labor Support**)

Cervical dystocia: Persistent anterior cervical lip, swollen cervix, or rigid os?

- With freedom of movement mom will often assume positions that help to reduce cervical lip and swollen cervix.
 - Gravity neutral or anti-gravity positions like hands and knees and open knee chest will help to lift the fetal head away and reduce pressure on the cervix.
 - To help redistribute the pressure on the cervix and promote more even dilation, try the following: side-lying, semi-prone, standing.
- Water immersion reduces gravitational force and can help relieve pressure on the cervix.
- If patience, position change, and water immersion fail, try manual reduction of a persistent cervical lip.¹³

Uterine dystocia: Assess for inadequate or inefficient contractions

- Consider IV fluids if not already running. IV hydration is shown to shorten active labor by 1 hr. and 2nd stage by 15 min. Also decreases need for oxytocin augmentation (50% w/ PO fluids vs. 20% w/ IVF)¹²
- Breast/nipple stimulation (See SFGH Birth Center Policy 2.24)
- Ensure adequate forces
 - Ensure adequate forces: MVU of 200 is thought to be adequate (ACOG) or, if no IUPC, UCs every 2-3 min x 80-90 sec that palpate strong
 - Consider IUPC placement
 - Consider oxytocin augmentation
 - Consider membrane sweeping in conjunction with oxytocin augmentation (See **Appendix E: Membrane Sweeping**)

Fetal dystocia: Assess for malposition, CPD, and macrosomia

- Reposition fetus: Upright and forward leaning positions, walk/movement, pelvic rock, lunge, hands and knees. Suggest frequent position change (q 30 min.)¹³ (See **Appendix C: Upright Positioning During Labor**)
 - If the preceding measures do not improve fetal position and/or dilation: Assess fetal position by ultrasound, if OP and > 7cm dilated, consider manual rotation. (See **Appendix F: Occiput Posterior Position**, See **Appendix G: Manual Rotation**)

Iatrogenic dystocia:

- Has active labor been diagnosed too early?

Pelvic dystocia: This is a diagnosis of exclusion and should not be made prior to investigating all other causes.

Note: Operative delivery is not indicated for prolonged labor as long as maternal/fetal status is reassuring. When evaluating labor progress consider effacement, station, and rotation in addition to cervical dilation.

Active Phase Arrest

- Absence of labor progress/progressive cervical dilation for:
 - 4 hours OR MORE of adequate UCs (MVUs >200)
 - 6 hours OR MORE if UCs inadequate¹

If Active Phase Arrest:

- Involve patient and family in care plan and shared decision making.
- Management options include:
 1. Augmentation:
 - a. Consider oxytocin augmentation and “tincture of time”.
 - b. Can consider amniotomy as an alternative or adjunct to oxytocin
 - c. IUPC may be useful in diagnosing adequate forces but is not necessary to titrate Pitocin.
 - d. In cases of active phase arrest, waiting for a vaginal delivery rather than doing a cesarean decreases the risk of adverse maternal outcomes without causing any additional risk to the newborn.³
 2. Cesarean: Consider if pt. meets arrest criteria and rupture of membranes has already occurred.

Second Stage Labor

Definition: Time of complete cervical dilatation to birth of the neonate.

Normal Second Stage*

- Nulliparas: <3 hours WITHOUT epidural, <4 hours WITH epidural
- Multiparas: <2 hours WITHOUT epidural, <3 hours WITH epidural¹

*New data suggests that 95% of nullips with epidurals will deliver safely within 5 hours and 19 minutes and 95% of multiparae will deliver safely within 5 hours.⁷

General management:

- Ensure adequate hydration
- Encourage upright and comfortable positioning
- Allow for the physiologic resting phase and passive descent.
- Delayed pushing: allow mother to rest until strong urge to push is noted—usually 1-2 hours
 - Especially beneficial for: epidural w/ no urge to push, fetal head above +2 station at onset of 2nd stage, women w/ limited strength or motivation to push.
 - Delayed pushing decreased pushing time by 20 mins while increasing duration of 2nd stage by 54 mins. No difference in operative vaginal delivery rate.¹⁷
- Evaluate progress early and frequently: expect some progress each hour of active pushing.

Prolonged Second Stage:

Presence of descent, but duration outside normal range.

- Nulliparas: >3 hours WITHOUT epidural, >4 hours WITH epidural
- Multiparas: >2 hours WITHOUT epidural, >3 hours WITH epidural¹

It may be prudent to begin assessing and addressing potential causes of slow progress once second stage has extended past the **half-way point** of the upper limit of normal:

- Nulliparas: >1.5 hours WITHOUT epidural, >2 hours WITH epidural
- Multiparas: >1 hour WITHOUT epidural, >1.5 hours WITH epidural

In general, consider all of the same factors listed for prolonged active first stage labor, with the following exceptions and specifications:

Uterine dystocia:

- Encourage walking or position changes
- Consider augmentation with breast/nipple stimulation or oxytocin
- IUPC likely not useful in pushing phase, but may consider during passive descent if concerned about uterine hypocontractility.

Fetal dystocia:

Assess for malposition, CPD, and macrosomia

- Encourage upright, forward leaning, pelvic-opening positions. (See **Appendix B: Upright Positioning During Labor**)
- Check fetal position with ultrasound, and consider manual rotation of the occiput posterior fetus. (See **Appendix H: Occiput Posterior Position**, See **Appendix I: Manual Rotation**)

Ineffective Pushing:

- Consider decreasing maternal anesthesia, although evidence re: effectiveness of this is inconclusive.
- If pain is interfering, consider increasing analgesia at least temporarily to refocus

Arrest of descent: No descent after good pushing efforts for:

Nulliparas: >3 hours without epidural, >4 hours with epidural

Multiparas: >2 hour without epidural, >3 hours with epidural

If arrest of second stage:

- Consider all the same factors as were noted in the above section on prolonged second stage
- Consider operative delivery. Be aware of risk factors for shoulder dystocia.

A specific absolute maximum length of time spent in the second stage of labor beyond which all women should undergo operative delivery has not been identified as long as fetal heart rate pattern are normal and some degree of progress is made.

---ACOG, 2003, 2014 (Strong recommendation, low- quality evidence)²

It is important to assess fetal position in the setting of abnormal fetal descent and manual rotation of the OP fetus is a reasonable option to consider before moving onto operative delivery or cesarean delivery.

---ACOG, 2014 (Strong recommendation, moderate quality evidence)²

Appendix A: Normal Labor Curve

Duration of Labor in Hours by Parity in Spontaneous Onset of Labor: Contemporary Patterns of Spontaneous Labor with Normal Neonatal Outcomes⁹

Cervical Dilation (cm)	Parity 0	Parity 1	Parity 2+
3-4	1.8 (8.1)		
4-5	1.3 (6.4)	1.4 (7.3)	1.4 (7.0)
5-6	0.8 (3.2)	0.8 (3.4)	0.8 (3.4)
6-7	0.6 (2.2)	0.5 (1.9)	0.5 (1.8)
7-8	0.5 (1.6)	0.4 (1.3)	0.4 (1.2)
8-9	0.5 (1.4)	0.3 (1.0)	0.3 (0.9)
9-10	0.5 (1.8)	0.3 (0.9)	0.3 (0.8)
2 nd stage with epidural	1.1 (3.6)	0.4 (2.0)	0.3 (1.6)
2 nd stage without epidural	0.6 (2.8)	0.2 (1.3)	0.1 (1.1)

Key: Data are median (95th percentile)

Source: Zhang, 2010⁹

Average Labor Curve

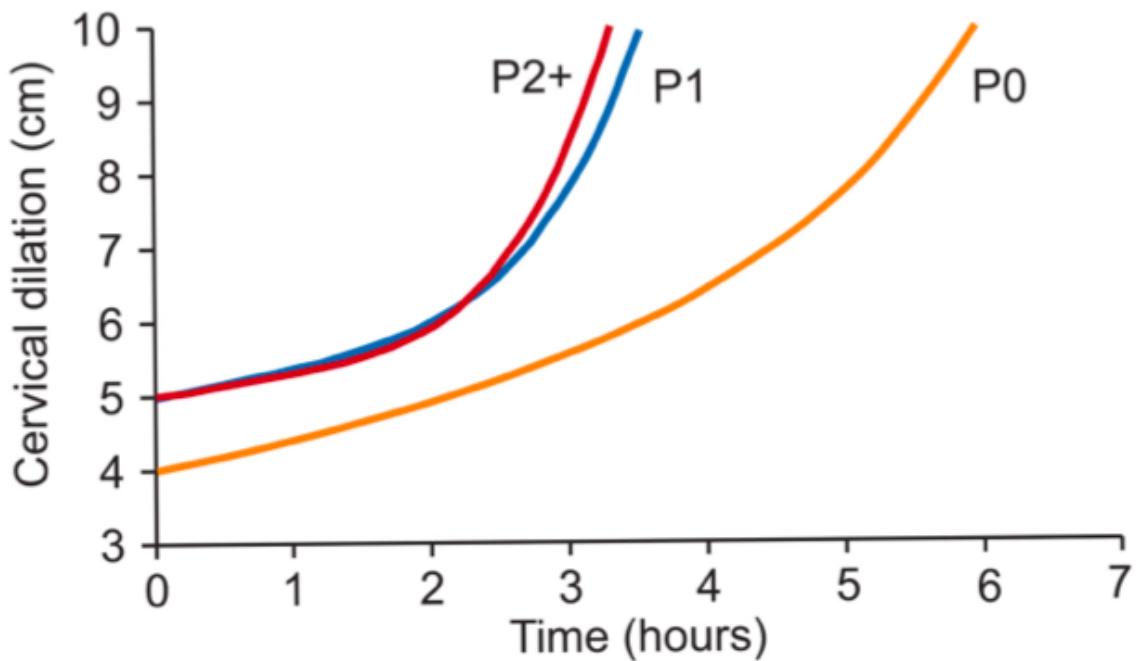


Figure 2.

Average labor curves by parity in singleton, term pregnancies with spontaneous onset of labor, vaginal delivery and normal neonatal outcomes. P0: nulliparas; P1: women of parity 1; P2+: women of parity 2 or higher.

Source: Zhang, 2010⁹

Appendix B: Continuous Labor Support

Continuous labor support is an evidence-based intervention shown to shorten labor, along with other benefits. In 2013 The Cochrane Collaboration conducted a review of the literature on continuous support for laboring women.¹⁸ The review included twenty-two trials involving 15,288 women. This systematic review found that continuous labor support is associated with the following benefits:

- Greater incidence of spontaneous vaginal birth (RR 1.08, 95% confidence interval (CI) 1.04 to 1.12).
- Lower rates of intrapartum analgesia (RR 0.90, 95% CI 0.84 to 0.96).
- Greater maternal satisfaction (RR 0.69, 95% CI 0.59 to 0.79).
- Shorter labor (MD -0.58 hours, 95% CI -0.85 to -0.31).
- Lower rates of cesarean (RR 0.78, 95%CI 0.67 to 0.91).
- Lower rates of instrumental vaginal birth (fixed-effect, RR 0.90, 95% CI 0.85 to 0.96).
- Lower rates of regional analgesia (RR 0.93, 95% CI 0.88 to 0.99).
- Fewer cases of low five-minute Apgar scores (fixed-effect, RR 0.69, 95% CI 0.50 to 0.95).

Labor support didn't appear to affect any other intrapartum interventions, maternal or neonatal complications, or breastfeeding. The review found that continuous support had the greatest positive effect when provided by a person outside of the laboring woman's family or social group, and not a member of the hospital staff.¹⁸

Appendix C: Upright Positioning during Labor

It is common for women to labor in bed, yet there is no evidence indicating that this is beneficial for women or neonates. In countries not influenced by western society, women are more likely to progress through the first stage of labor in upright positions and more free to change positions without evidence of harm to themselves or to their baby. Position changes and upright posturing are ways in which women cope with labor pain. Given the freedom and permission, many pregnant women will change positions since no position is comfortable for a long time. In many health facilities, many protocols and procedures pose barriers to pregnant women being mobile. The World Health Organization states that a woman should have the opportunity to assume any position she wishes, in or out of bed, during the course of labor. She should not be restricted to bed, and certainly not to the supine position, but should have the freedom to adopt upright postures such as sitting, standing, or walking, without interference by caregivers, especially during the first stage of labor.¹⁹

First Stage of Labor:

In a systematic review of randomized and quasi randomized trials comparing women randomized to upright position (walking, sitting, standing, kneeling) and recumbent position (supine, semi-recumbent and lateral) during the first stage of labor, upright position was associated with:

- A reduction in the first stage of labor duration by approximately one hour and 22 minutes (MD -1.36, 95% CI -2.22 to -0.51; 15 studies, 2503 women)
- Reduction in cesarean delivery (RR 0.71, 95% CI 0.54 to 0.94; 14 studies, 2682 women)
- Less use of epidural (RR 0.81, 95% CI 0.66 to 0.99, nine studies, 2107 women)
- One trial reported that babies of mothers who were upright were less likely to be admitted to the neonatal intensive care unit, (RR 0.20, 95% CI 0.04 to 0.89, 200 women)²⁰

In a study of 58 women who alternately assumed the sitting and supine positions for 15 minutes during cervical dilatation from 6 to 8 centimeters, women experienced significantly reduced lower back pain in the sitting position. This applies to continuous pain as well as pain with contractions. ($p<.001$)²¹

Second Stage of Labor:

In a systematic review of randomized and quasi randomized controlled trials comparing upright or lateral position and supine and lithotomy position during the second stage of labor for women without epidural anesthesia, the upright group experienced:

- a reduction in assisted deliveries [risk ratio (RR) 0.78; 95% CI 0.68 to 0.90; 19 trials, 6024 women]
- a reduction in episiotomies [average RR 0.79, 95% CI 0.70 to 0.90, 12 trials, 4541 women]
- fewer abnormal fetal heart rate patterns [RR 0.46; 95% CI 0.22 to 0.93; two trials, 617 women]
- no difference in cesarean delivery [RR 0.97; 95% CI 0.59 to 1.59; 13 trials, 4824 women]
- non-significant reduction in the duration of the second stage [(MD) -3.71 minutes; 95% confidence interval (CI) -8.78 to 1.37 minutes; 10 trials, 3485 women]
- increased second degree perineal tears [RR 1.35; 95% CI 1.20 to 1.51, 14 trials, 5367 women]
- increased estimated blood loss greater than 500 ml [RR 1.65; 95% CI 1.32 to 2.60; 13 trials, 5158 women]²²

In women with epidural anesthesia in the second stage of labor, the upright group experienced:

- No significant difference in operative birth (RR 0.97; 95% CI 0.76 to 1.29; five trials, 874 women)
- No significant difference in duration of the second stage of labor (mean difference -22.98 minutes; 95% CI -99.09 to 53.13; two trials, 322 women)²³

Appendix D: Water immersion

Anxiety and pain may trigger a stress response leading to reduced uterine activity and labor dystocia. Shoulder-deep warm water immersion is found to improve maternal sense of control and privacy, lower rates of labor augmentation, epidural anesthesia, and possibly a reduction in the first stage of labor. A woman who feels in control of her childbirth experiences greater emotional wellbeing postpartum.

When compared to women with immediate augmentation (oxytocin and amniotomy), women with slow labor randomized to water immersion (≤ 4 hours) experienced:

- **greater satisfaction with freedom of movement** (91% v 63%)
- **greater feeling of privacy** (96% v 81%)
- **lower rates of augmentation** (RR 0.74, 95% CI 0.59 to 0.88, NNT 4)
- **lower rates of epidural anesthesia** (RR 0.71, 95% CI 0.49 to 1.01, NNT 5)²⁴

(n=99)

*Six neonates born to women in the water labor group were admitted to the neonatal unit compared with none in the augmentation group ($P = 0.013$). With the exception of an infant with cardiac defects, all these neonates, were reunited with their mothers within 48 hours and experienced no subsequent problems.²⁴

Review of 8 randomized controlled trials comparing water immersion during first stage of labor with no water immersion:

Water immersion is associated with:

- **a shorter first stage of labor** (mean difference -32.4 minutes; 95% CI, from -58.7 to -6.13, 7 trials, n=1461)
- **lower rates of epidural/spinal/paracervical anesthesia/analgesia** (RR 0.90; 95% CI 0.82 to 0.99, six trials, n=2499)
- **lower rates of any analgesia use** (RR 0.72, 95% CI 0.46 to 1.12, 5 trials, n=653)²⁵

There was no significant difference in:

- assisted vaginal deliveries (RR 0.86; 95% CI 0.71 to 1.05, seven trials, n=2628)
- cesarean deliveries (RR 1.21; 95% CI 0.87 to 1.68, eight trials, n=2712)
- use of oxytocin infusion (RR 0.64; 95% CI 0.32 to 1.28, five trials, n=1125)
- perineal trauma (RR 1.16; 95% CI 0.99 to 1.35, five trials, n=1337)
- maternal infection (RR 0.99; 95% CI 0.50 to 1.96, five trials, n=647),
- Apgar score less than seven at five minutes (RR 1.58; 95% CI 0.63 to 3.93, five trials, n=1834)
- neonatal unit admissions (RR 1.06; 95% CI 0.71 to 1.57, three trials, n=1260)
- neonatal infection rates (RR 2.00; 95% CI 0.50 to 7.94, five trials, n= 1295, 6 infections in immersion groups, 3 infections in non-immersion groups)²⁵

One limitation of research on water immersion during labor thus far is the lack of standardization of length of time for water immersion.²⁵

Appendix E: Amniotomy

Effects of early amniotomy on duration of labor and rates of cesarean delivery remain unclear. According to a 2013 Cochrane review of 14 trials with 8033 women, preventative use of amniotomy and oxytocin may or may not be associated with a reduced rate of cesarean delivery.²⁶ Results are unclear because although the RR was 0.87, the confidence interval included the null effect (95% CI 0.79 to 1.01).

Routine early amniotomy used in combination with early oxytocin was shown to shorten the duration of labor [average mean difference (MD) - 1.28 hours; 95% CI -1.97 to -0.59; eight trials; 4816 women]. When using amniotomy to treat labor dystocia, reviewers state that, “the severity of delay which was sufficient to justify interventions remains to be defined”. Reviewers saw no effects on other indicators measured regarding maternal and neonatal morbidity.²⁶

Appendix F: Membranes Sweeping

Membrane sweeping is thought to increase local prostaglandin release to stimulate labor. It is performed by inserting a finger past the internal os and rotating it to detach fetal membranes from the lower uterine segment.

Contraindications to membrane sweeping:

- low lying placenta or placenta previa
- cervicitis
- preterm status, unless the patient is being induced for a medical indication

Evidence:

Membrane sweeping in conjunction with induction: A randomized trial compared 274 women scheduled for induction at term to membrane sweeping or no membrane sweeping at the initiation of induction.²⁷ The aim was to determine whether membrane sweeping increases the likelihood of spontaneous vaginal delivery.

Results:

Membrane sweeping was associated with:

- Higher spontaneous vaginal delivery rate (69% vs 56%, $P=.041$)
- Shorter induction-to-delivery interval (mean 14 vs 19 hours, $P=.003$)
- Fewer requirements for oxytocin (46% vs 59%, $P=.037$)
- Shorter duration of oxytocin infusion (mean 2.6 vs 4.3 hours, $P=.001$)²⁷

Prevention of post-term pregnancies: A systematic review involving 22 trials and 2797 women showed that there is reduced frequency of pregnancy continuing beyond 41 weeks (RR 0.59, 95% CI 0.46 to 0.74) and 42 weeks (RR 0.28, 95% CI 0.15 to 0.50) when membranes are swept for women at term. To avoid one formal induction of labor, sweeping of membranes must be performed in eight women (NNT = 8). There was no evidence of a difference in the risk of maternal or neonatal infection. Rate of cesarean delivery is similar between the membrane sweeping group and the group without membrane sweeping (RR 0.90, 95% CI 0.70-1.15).²⁸

Appendix G: Acupressure

Acupressure is a low-risk intervention with multiple demonstrated benefits for laboring women, including pain relief, reduced anxiety, shorter labors, and decreased risk of cesarean delivery. Acupressure is a Traditional Chinese Medicine (TCM) treatment modality that is thought to exert its effects by: promoting the circulation of blood, energy and qi, balancing yin and yang, and promoting the secretion of neurotransmitters.^{29,30}

In 2011 The Cochrane Collaboration conducted a review of randomized clinical trials on the use of acupuncture and acupressure in laboring women. The review found that when compared to placebo, acupressure reduced pain intensity (SMD -0.55, 95% CI -0.92 to -0.19, one trial, 120 women, with a combined control; SMD - 0.42, 95% CI -0.65 to -0.18, two trials, 322 women).²⁹

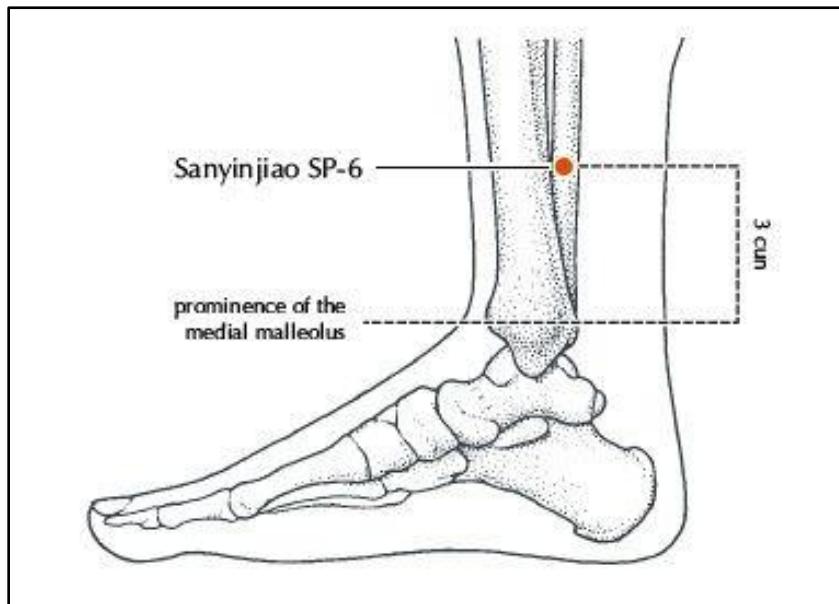
See the following discussion for evidence on the effects of specific acupressure points, as well as instructions for how to use them with laboring women.

San-Yin-Jiao / "SP6"

Results of two randomized clinical trials comparing the effects of 30 min. of SP6 acupressure compared with SP6 touch:

- **Reduced pain**
 - "There were significant differences between the groups in subjective labor pain scores at all time points following the intervention: immediately after the intervention ($F=6.646, p 0.012$); 30 minutes after the intervention ($F=5.657, p 0.021$); and 60 minutes after the intervention ($F= 6.783, p 0.012$)."
- **Shortened labor**
 - Shorter total length of labor from 3 cm to complete dilation ($n = 75, t=-2.864, p = 0.006$)
- **Reduced risk of cesarean delivery (CD)**
 - CD rate for acupressure group was 12.8%, SP6 touch group 29.8%, and control group was 22.4% ($p=0.049$).
 - CD rates were significantly different between the SP6 acupressure and non-SP6 acupressure group ($p=0.035$).³¹

How To Use SP6: SP6 is located 4 finger breadths (using patient's fingers) above the tip of the inner malleous, just posterior to the border of the tibia (see image below). During contractions apply bilateral and



simultaneous firm pressure to SP6 for 30min.

Large Intestine 4 (LI4) and Bladder 67 (BL67)

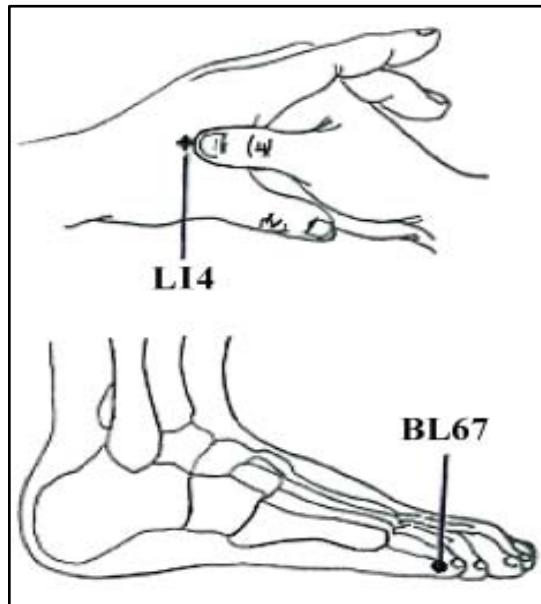
Results of a randomized clinical trial, n= 100, with women at 3-4 cm of cervical dilation and regular uterine contractions comparing LI4 acupressure with LI4 touch:

- **Reduced pain for up to 2 hours:**
 - There were significant differences between the groups in subjective labor pain scores immediately and 20, 60, and 120 minutes after intervention ($P \leq .001$), using a 10 point pain scale (0 meaning no pain, 10 meaning unbearable pain).
 - 20 minutes post intervention: acupressure group: 6.5 vs control group: 8.26 (p value 0.001)
 - 60 minutes post intervention: acupressure group: 7.12 vs control group: 8.92 (p value 0.001)
 - 120 minutes post intervention: acupressure group: 8.57 vs control group: 9.83 (p value 0.001)
- **Shorter first and second stage labor duration**
 - First stage: acupressure group: mean 2.44 hours, control group: mean 3.09 hours
 - Second Stage: acupressure group: mean 20.51 mins, control group: mean 28.5 mins
- **Significant difference in perception of labor pain assessed 24 h after birth using a 10 point pain scale (0 meaning no pain, 10 meaning unbearable pain):**
 - acupressure group: mean 6.3, control group: mean 8.3, p value = 0.0001
- **Greater maternal satisfaction**
 - acupressure group: 5.76 vs control group: 5.36³²

Results of a clinical trial randomizing laboring women to one of three groups: LI4 and BL67 acupressure, light skin stroking, or no treatment/conversation only (n=127):

- **Decreased pain during active phase of labor:** There was a significant difference in decreased labor pain between the acupressure and control groups ($W = 5.607$, $p = .017$). W is the Wilcoxon rank sum statistic.
- **No effect on uterine contractions³⁰**

How To Use LI4: LI4 is located in the soft fleshy web between the thumb and forefinger. Apply firm pressure to LI4 for the duration of each contraction, over 20 minutes at the onset of active labor.



Appendix H: Occiput Posterior Position

At onset of labor 15-30% of fetuses are occiput posterior (OP) in relation to the maternal pelvis, and 1/3 are OP sometime during labor. Most OP fetuses rotate on their own, leaving only 3-8% being OP at birth. On the whole, OP position is underdiagnosed. Identifying persistently OP fetuses is important because the position is associated with:

- Increase in prolonged pregnancy (12% v 7% p<.001)
oxytocin induction (31% v 16% p<.001) and oxytocin augmentation (52% v 32% p<.001)
- Prolonged labor lasting more than 12 hours (12% v 1.7% p<.001)
- Increase in operative vaginal birth (84% v 40% p<.001)³³

OP position is also found to be associated with increased postpartum hemorrhage and increased 3rd and 4th degree perineal lacerations.³⁴

Neonatal outcomes associated with OP position vs OA position:

- 5-minute Apgar score less than 7 (OR 1.50, 95% CI 1.17-1.91)
- academic umbilical cord gases (OR 2.05, 95% CI 1.52-2.77)
- meconium-stained amniotic fluid (OR 1.29, 95% CI 1.17-1.42)
- birth trauma (OR 1.77, 95% CI 1.22-2.57)
- admission to the intensive care nursery (OR 1.57, 95% CI 1.28-1.92)
- longer neonatal stay in the hospital (OR 2.69, 95% CI 2.22-3.25)³⁵

Clinical signs of a fetus in occiput posterior position include: premature urge to push, prolonged labor, and contraction coupling. Low back pain has been long thought to be associated with the occiput posterior position, but this feature may or may not be present and is not be a reliable indicator of OP.

Ultrasound is the most accurate method for diagnosing OP position. Transabdominal ultrasound is reasonably accurate with an error rate of 6-8%, but can be difficult if the fetal head is deeply engaged. Transperineal ultrasound likely has highest accuracy, but is more intrusive. This method involves placing the transducer transverse on the vulva midway between the perineum and clitoris.³⁶

Appendix I: Manual Rotation

Manual rotation is a safe and effective option for correcting persistent occiput posterior position (OP). 73% of attempts result in a successful rotation.³⁴ An RCT of 731 women who had manual rotation (MR) compared to 3000 who did not undergo MR showed MR to be associated with the following outcomes.

- Compared to expectant management, women with manual rotation were less likely to have:
 - cesarean delivery [(aOR) 0.12; 95% CI (0.09-0.16)],
 - severe perineal laceration [aOR 0.64; 95% CI (0.47-0.88)],
 - postpartum hemorrhage [aOR 0.75; 95% CI (0.62-0.98)],
 - chorioamnionitis [aOR 0.68; (0.50-0.92)].
 - The number of rotations attempted to avert one CD was 4.³⁴

Risks: Women who had a trial of rotation had an increased risk of cervical laceration [aOR 2.46; (1.1-5.4)].

*aOR: adjusted odds ratio

Tips for manual rotation:

- There is no data to guide how to do it, or when to do it.
- If vertex is +3 station it is very difficult. 0 to +1 station is better
- Cervical dilation of 7 cm or more is thought to be ideal
- Membranes must be ruptured
- Use ultrasound to confirm OP position and to locate the fetal spine to guide the direction of your rotation of the fetal head.
- Need for anesthesia is very individual. Many women tolerate it well without anesthesia

*Document informed verbal consent and include the following:

- Risks of the procedure: cervical laceration and cord prolapse (if done vigorously or if there is a large de-station of the fetal head). Procedure is not associated with fetal distress.
- The procedure may be uncomfortable, and anesthesia is optional.
- Procedure is highly successful (73%), but failure is a possibility.

Two proposed methods for manual rotation

1. Spread fingers over posterior parietal bone, cradle head with fingers (maybe thumb on top side of head), slightly lift the head upward ("de-station the head") and rotate the head just before a contraction. Hold it there during a contraction while mom pushes to fix it into the new position. Best used if cervix is greater than 7-8 cm dilated.
2. Two fingers on sagittal suture, "like fingertip pull-up in rock climbing". This is best for when the cervix is not completely dilated, or there is a concern about cervical laceration.

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