Induction of Labor: Why, When, and How?

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I have nothing to disclose.
Discuss the rationale behind medical versus elective inductions
Review the timing of inductions and risks and benefits based on parity
Review methods of cervical ripening including prostaglandins and the cervical ripening balloon
Discuss inductions in patients with a previous Cesarean
Direct initiation of labor without a medical obstetric reason

ACOG guidelines against EIOL < 39 wks
Medical Induction of Labor

- Direct initiation of labor that is medically indicated
- Risk of continuing pregnancy outweighs the benefit

Pregnancy indications:
- Placental abruption
- PROM
- Post Term Pregnancy (≥ 41 weeks)
- Chorioamnionitis

Maternal Medical Indications
Fetal Indications
Maternal Medical Indications

- Pre-Eclampsia, Gestational or Chronic Hypertension
- HELLP
- Diabetes
- Chronic Renal Disease
- Antiphospholipid Syndrome
- Systemic Lupus Erythematosus
- Hx of thromboembolism, on anti-coagulation
- Intrahepatic cholestasis of pregnancy
- Alloimmunization/RH sensitized
Fetal Indications

- Fetal growth restriction <10th percentile
- Oligohydramnios (AFI 5 cm OR DVP <2)
- Polyhydramnios (AFI > 30 cm)
- Severe congenital anomalies
- Abnormal antenatal testing
- Previous stillbirth
- Unstable lie
- Fetal demise
- Multiple gestation
Other Indications

- **Logistics**
  - Travel $>45$ min
  - Length of patient’s last labor $< 2$ h
  - $\geq 5$cm cervical dilation

- **Psychosocial**
Patient Name ___________________________ Date of Birth ___________________________

Physician or CNM Name ___________________________ Patient Phone Number ___________________________

Induction Date ___________________________ Gestational Age at Induction ___________________________ EDC ___________________________

Parity ___________________________ GBS: □Positive □Negative □Unknown

□Elective Delivery (Induction or C-Section)

□Medical Indication for Delivery (select indication below)

■ Placental abruption
■ Placenta previa □ Vasa previa □ Suspected Placenta accreta- percreta spectrum
■ PROM (ROM ≤ 24 hours prior to onset of labor) □ pPROM (ROM ≥ 24 hours prior to onset of labor)
■ Chorioamnionitis
□ Post-term pregnancy (≥ 41 weeks)

□Maternal medical indications (mark applicable indication below)

■ Hypertensive disorders
  ■ Gestational hypertension or pre-eclampsia, with in-hospital or prenatal record indicating two or more systolic BPs ≥ 140 or diastolic BPs ≥ 90
  ■ Chronic hypertension (essential, renal, or NOS), with in-hospital or prenatal record indicating two or more systolic BPs ≥ 140 or diastolic BPs ≥ 90
  ■ Chronic hypertension (essential, renal, or NOS), with documentation of current maternal antihypertensive treatment
  ■ Severe preeclampsia or eclampsia

■ Coagulation defects
  ■ Thrombocytopenia - Current (within past 2 weeks) platelet count ≤ 100,000, or thrombocytopenic condition requiring treatment to maintain acceptable platelet count
  ■ Von Willebrand’s disease, with documentation in medical record
  ■ Hemophilia, with documentation in medical record

■ Human immunodeficiency virus
■ Maternal cardiac disease - current
■ Long term (current) use of anticoagulants
■ Maternal-fetal hemorrhage

□Fetal indications (mark applicable indication below)

■ Suspected fetal growth restriction, with US documentation of EFW < 10th percentile for GA
■ Polyhydramnios, with documented AFI ≥ 5 or deepest vertical pocket ≤ 2
■ Polyhydramnios, with documented AFI ≥ 30
■ Abnormal fetal surveillance testing, documented by specific diagnosis, e.g., non-reassuring FHR
■ Multiple gestation

□ Other moderate to severe maternal condition or fetal indication not on this list (MFM approval required)

Name of MFM Physician who approved ___________________________ Date __________ Time __________

Called in by: ___________________________ Date __________ Time __________

Receptionist/Scheduler signature: ___________________________ Date __________ Time __________

Physician or CNM signature: ___________________________ Date __________ Time __________

SCHEDULED DELIVERY DOCUMENTATION

IHCBI250 10/2015 Print on Demand © IHC Health Services, Inc. (2014)
Contraindications to IOL

- Prior classical or vertical transmural uterine incision
- Prior uterine rupture
- Placenta previa or vasa previa
- Active genital herpes infection
- Umbilical cord prolapse
- Transverse or breech fetal lie
- Invasive cervical cancer
- Category III fetal heart rate tracing
The numbers are rising

- More than 22% of women undergo induction of labor in the US
- CDC: increase in labor induction from 9.5% in 1990 and 21% in 2003
  - Elective IOL > medically indicated IOL
Comparison of induction indications at different hospitals:

- University: 5% elective inductions
- 2 Community Hosp: 44% and 57% elective IOL
- CS rates were similar

Beebe et al, 2000, J of Reproductive Medicine
2486 total deliveries, 1985 vaginal

- 700 inductions (28% of all deliveries)
  - 321 elective (46%)
  - 379 medically indicated (54%)
- Unfavorable cervix ≤ 6
- Score > 8, probability of SVD after induction similar to after spontaneous labor

<table>
<thead>
<tr>
<th>Modified Bishop scoring system</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>0</strong></td>
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<tr>
<td><strong>1</strong></td>
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<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Dilation, cm</td>
</tr>
<tr>
<td>Effacement, percent</td>
</tr>
<tr>
<td>Station*</td>
</tr>
<tr>
<td>Cervical consistency</td>
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<tr>
<td>Position of the cervix</td>
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</table>
Elective Induction of Labor

2009 ACOG Recommendations

- Consider the individual patient, studies are limited
- Confirm dates ≥ 39 wks
- Counsel nulliparous women with unfavorable cervix on increased risks
- Understand that labor progression differs with induction vs. spontaneous labor

ACOG Practice Bulletin, #107, 2009
Risks of Early Term Neonates

- Studies confirm higher rate of adverse outcomes for neonates born between 37-39 wks
- EMR review of 115,000 deliveries
  - Rate of NICU admissions and sepsis improves weekly until 39 wks

Bailit et al, 2010, American J of OB-GYN
ACOG Position on Early Term IOL

- Non-medically indicated delivery < 39 weeks is not appropriate
- Increased morbidity and mortality of neonates born < 39 compared to those delivered between 39-40 weeks
- Implement hospital policy to avoid early term elective IOL

ACOG Committee Opinion, #561, 2013
EIOL if Favorable Cervix

- EIOL $\geq 39$ wks in multiparous women with favorable cervix (Bishop $>4-5$)
  - Does not increase the risk of CS

- EIOL $\geq 39$ wks in nullips with favorable cervix (Bishop $>4-5$)
  - Does not increase the risk of CS
  - But length of labor is longer
Systematic review of 36 studies on elective induction:

- After 41 wks, expectant mgmt associated with higher risk of CS than elective IOL (OR 1.21, p<.001)
- <41 wks, difference in risk of CS is not statistically significant (p 0.26)
- Expectant mgmt associated with more meconium-stained fluid than elective IOL (OR 2.04, p<.001)
Benefits to Neonates

- EMR review of 115,000 deliveries
  - Elective IOL $\geq 39$ wks had overall lower risk of NICU admission, ventilator use, and sepsis

Bailit et al, 2010, American J of OB-GYN
Retrospective cohort study of 3 million CA deliveries, compared stillbirth risk to mortality rate of delivery at each GA

- At 38 wks, the risk of stillbirth is equal to mortality risk of delivery
- At 39 wks and above, risk of stillbirth exceeds risk of delivery (39 wks: 12.9 vs. 8.8 / 10,000; 40 wks: 14.9 vs. 9.5 / 10,000)

**Authors stress that data cannot be used to change policy – neonatal and maternal morbidity not considered, absolute risk of stillbirth is very low, NNT would be very high, and cost would be high**

Rosenstein et al, 2012, J of OB-GYN
In Summary: The Benefits of EIOL

- Multips with a favorable cervix have no increased risk of CS
- Nullips with favorable cervix may or may not have increased risk of CS
- Elective IOL had overall lower neonatal risk of NICU admission, ventilator use, and sepsis
- Risk of stillbirth decreases with GA > 39 wks
The Risks of EIOL

- Nullips with unfavorable cervix have:
  - 2-fold higher rate of CS
  - Longer induction and PP stay

- EIOL may carry slightly higher risk of CS overall

- EIOL may have slightly higher risk of hysterectomy

- EIOL associated with more intrapartum interventions, epidurals, more NRFHT

- Higher costs, more resources, more hospital time
IOL for Suspected Macrosomia

- Macrosomia: EFW > 4000-4500g
- Diagnosis imprecise: U/S measurements are as accurate as Leopold’s
- Doubles the risk of CS
- Does not prevent shoulder dystocia or newborn morbidity

Suspected macrosomia is not an indication for IOL, because induction does not improve maternal or fetal outcomes.

Combs et al, 1993 J of OB-GYN
Cervical Ripening

- Facilitate the process of cervical shortening, thinning, and dilating
- If cervix is unfavorable
- Reduce the rate of failed inductions
- Use only if IOL is medically indicated
- Avoid use in elective IOL
Methods of Cervical Ripening

- Prostaglandins
  - $\text{PGE}_1 = \text{Misoprostol (Cytotec)}$
  - $\text{PGE}_2 = \text{Dinoprostone (Cervidil)}$

- Mechanical dilator
  - Balloon catheters
Prostaglandins

- Increase the likelihood of delivery within 24 hours compared to placebo or pitocin alone
- Do not reduce the rate of CS
- Increase the risk of uterine tachysystole with FHR changes
Approved for treatment for gastric ulcers
  • Not FDA approved for induction or ripening
ACOG supports use of Cytotec

Most data on intravaginal use
Buccal and oral route less studied
More effective than other prostaglandins given vaginally
  - Higher rate of vaginal delivery in 24 hours
  - Higher rate of successful cervical ripening
Same rate of CS as other prostaglandins
Higher rate of tachysystole with FHR changes
More effective than oxytocin alone
Vaginal Misoprostol

- **50mcg is more effective**
  - Higher rates of delivery after a single dose and delivery within 24 hours
  - Lower rate of oxytocin use

- **25mcg is safer**
  - Lower rates of tachysystole, CS for NRFHTs, NICU admissions, and meconium passage

- Give 25mcg initially, repeat Q3-6 hours
- Consider increasing to 50mcg with subsequent doses if inadequate contractions
Oral and Buccal Misoprostol

- **Oral:**
  - Similar efficacy to vaginal
  - Peaks sooner, declines more rapidly than vaginal
  - May be safer: better neonatal condition at birth and less postpartum hemorrhage

- **Buccal:**
  - Avoids 1\textsuperscript{st} pass hepatic metabolism
  - More may have increased bio-availability
  - Studies show that it is similar to vaginal and oral
  - Same risks/benefits
  - Easy to remove if tachysystole
FDA approved for cervical ripening

Cervidil = vaginal insert, 10 mg time-released (0.3mg/h)
- Left in place for up to 12 hours
- Can be easily removed if tachysystole

Prepidil = vaginal gel, 0.5mg in 2.5ml gel
- Repeat in 6-12 hours
Cytotec: most effective, although higher risk of tachysystole
- Vaginal is most studied, buccal and oral are options
- Not technically approved, cheap

Cervidil:
- Also effective, FDA-approved
- Easy to remove in case of tachysystole
- More expensive
Mechanical Dilation

- Directly dilates the cervix
- Hypothesized release of PGF$_2$-alpha from the decidua and membranes, and PGE$_2$ from the cervix
Evidence for Balloon Catheters

- Associated with mean change in Bishop score from 3.3 to 5.3
- Systematic review: unfavorable cervix found after 12h in 6% of women treated with balloon catheter vs. 86% in the no treatment group
- Reduced risk of CS

Balloon Vs. Prostaglandins

- As effective as prostaglandins
- Twenty-three studies:
  - No significant difference in achieving a vaginal delivery within 24 hours
  - No difference in the incidence of CS
  - Balloon had higher rate of oxytocin augmentation
- Substantial reduction in tachysystole with fetal heart rate changes (RR 0.19, 95% CI)

Randomized trial of 376 women

Balloon catheter resulted in:
- Shorter time to delivery
- Higher proportion of women delivered and delivered vaginally within 24 hours
- CS rates were similar

Double Vs. Single Balloon

- Comparative trials show similar efficacy and outcomes
- Randomized controlled trial 217 women
  - Longer labor length in double balloon group
  - Single balloon catheter associated with less pain
- Prospective randomized trial 293 women
  - Length of labor the same
  - Incidence of vacuum delivery or CS:
    - Single-balloon group: 14.4%
    - Double-balloon group: 25.7%

Pennell CE. BJOG. 2009.
Single balloon catheter can be attached to traction with 500cc weighted fluid bag

Randomized controlled trial of 191 women

- Taping to inner thigh vs. traction
- Traction group: Time to catheter expulsion shorter
- No difference in:
  - Change in Bishop score
  - Change in pain scores
  - CS delivery rate
  - Chorioamnionitis

Randomized controlled trial comparing Foley balloon alone vs. Foley with oxytocin

Addition of oxytocin
- Does not shorten the time to delivery
- No effect on the likelihood of delivery within 24 hours
- No effect on vaginal delivery rate
- Increased use of analgesia during ripening

Combined use is not justified
Adverse Effects

- Vaginal bleeding if low-lying placenta
- Displacement of the presenting part
- Theoretical risk of infection
  - Studies have not proven it
- ROM
  - Debate over management after ROM
  - Some remove it immediately
  - Others remove it within 12 hours
- Cook catheter advises against use in women with ROM
  - Some centers will use balloon with ROM
#16 Foley catheter (Bard catheter)
- 30-80cc balloon (NOT 5-10cc balloon)
- Insert with speculum and ring forceps or insert manually without speculum
- Through the internal cervical os and into the extraamniotic space
- Inflate balloon with sterile water or NS to 60-80cc
- Gently tape to the inner thigh

Inflation to 60cc more likely to achieve delivery in 12 hours compared with 30cc inflation

Procedure – Double Balloon

 “Cook Catheter” Cervical Ripening Balloon

 Use stylet to assist with insertion manually
 Inflate each balloon to 80cc if tolerated
 No traction, tape gently to inner thigh

 Nurses tug on catheter Q2h
 Nurses check placement digitally Q4h
  • May need to deflate vaginal balloon to feel the uterine balloon
## Comparing Cost

<table>
<thead>
<tr>
<th>Device</th>
<th>Foley balloon</th>
<th>Cook balloon</th>
<th>Misoprostol (100 mcg)</th>
<th>Dinoprostone vaginal insert (10 mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$3.00</td>
<td>$41.00</td>
<td>$1.09</td>
<td>$218.94</td>
</tr>
</tbody>
</table>
1. Loosen the fitting on the proximal hub of the stylet and adjust the wire so that the distal tip of the stylet is even with the distal tip of the Cervical Ripening Balloon.

2. Tighten the fitting so that the wire does not move during manipulation, and seat the adjustable handle firmly into the blue port labeled “S.”

4. Advance the Cervical Ripening Balloon through the cervix until both balloons have entered the cervical canal.

5. Inflate the uterine balloon with 40 mL of saline. Once the uterine balloon is inflated, pull the device back until the balloon abuts the internal cervical os.
3. Use the stylet with the Cervical Ripening Balloon to traverse the cervix if necessary. **NOTE:** Once the cervix has been traversed and the uterine balloon is above the level of the internal uterine opening (internal os), remove the stylet before further advancing the catheter.

6. The vaginal balloon is now visible outside the external cervical os and should be inflated with 20 mL of saline.

7. Once the balloons are situated on either side of the cervix, add saline—a maximum of 80 mL per balloon. Time the placement of the balloon so that it is in place no longer than 12 hours before active labour is induced.
Oxytocin

- Uterine response within 3-5 min
- Steady level in plasma by 40 min
- Predictors of successful response:
  - Lower BMI
  - Greater initial cervical dilation
  - Greater parity
  - Greater gestational age
After Cervical Ripening

- Start oxytocin:
  - 4 hours after last misoprostol dose
  - 30-60 min after removal of Cervidil
  - Wait 6-12 hours after Prepidil

- Start oxytocin immediately after balloon ripening
<table>
<thead>
<tr>
<th>Regimen</th>
<th>Starting Dose</th>
<th>Incremental Increase (mU/min)</th>
<th>Dosage Interval (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Dose</td>
<td>0.5 – 2</td>
<td>1 – 2</td>
<td>15 – 40</td>
</tr>
<tr>
<td>High-Dose</td>
<td>4 – 6</td>
<td>3 – 6</td>
<td>15 – 40</td>
</tr>
</tbody>
</table>
Low-Dose or High-Dose Oxytocin

- **Low-Dose**
  - Decreased uterine tachysystole with FHR changes

- **High-Dose**
  - Shorter labor
  - Less frequent chorioamnionitis
  - Less CS for dystocia
  - Increased tachysystole with FHR changes
Increase until:

- Labor progress is normal
- OR
- Contractions occur at two- to three-minute intervals
- OR
- Uterine activity reaches 200 – 250 Montevedio units
Increased risk of uterine rupture
  • 1% with IOL versus 0.4% with spontaneous labor

Lower chance of successful VBAC than spontaneous labor
  • Mean vaginal delivery rate 68% vs. 80%
  • Greater chance of success if:
    • Previous vaginal delivery and
    • Favorable cervix, Bishop score ≥6

McDonagh MS. BJOG. 2005.
20,095 women with prior CS

Rate of uterine rupture:
- 0.52% for spontaneous labor
- 0.77% for labor induced without prostaglandins
- 2.24% for prostaglandin-induced labor

33,669 women with prior CS

Rate of uterine rupture:
- 0.4% for spontaneous labor
- 1.1% for oxytocin alone
- 0.9% for mechanical dilation with or without oxytocin
- 1.4% for prostaglandins with or without oxytocin

Dose-response between higher oxytocin dose and uterine rupture
- Doses exceeding 20 mU/min increased the risk for uterine rupture

ACOG Recommendations

- Do not use misoprostol for labor induction in TOLAC
- Less data about dinoprostone, avoid use
- Cervical ripening balloon
  - Small studies show no increased risk of rupture
  - Lack of compelling data
  - May be used in induction
- Max dose of oxytocin not established
  - Low-dose protocol, max of 20mU/min
Take-Home Points

- Do not electively induce < 39 wks
- Can offer elective IOL after 39 weeks
  - Multips with favorable cervix
  - Can consider in primips with favorable cervix
  - Avoid cervical ripening if elective
- Suspected macrosomia not a valid reason for IOL
- Misoprostol is most effective prostaglandin, but higher rate of tachysystole with FHR changes
Take-Home Points

- Single or double balloon catheters both effective
- Traction on the catheter not necessary
- Combined use of balloon with oxytocin not justified
- Controversy over use in ROM
TOLAC

- Avoid IOL – higher rate of uterine rupture and unsuccessful VBAC
- Prostaglandins not safe, increased uterine rupture
- Balloon catheter may be used
- Low-dose pitocin, max of 20mU/min
References