Induction of Labor

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Induction of Labor

- Statistics
- Cervical Ripening
- Induction of Labor
- Specific Situations
Induction of Labor

- Definition: “Iatrogenic stimulation of uterine contractions to accomplish delivery prior to the onset of spontaneous labor”
- One of the most common obstetrical procedures in the United States
Statistics

- Rate of induction:
  - 90/1000 in 1989
  - 184/1000 in 1997
  - 205/1000 in 2001
- From 1990 to 2006 the frequency went from 9.5 to 22.5% of pregnancies
- Now more than 1 out of every 5 births
Reasons

- Better induction agents
- Patient and clinician desire to control timing of delivery
- Relaxed attitude about marginal indications
- Patient and clinician fear of fetal demise
- Increase in high risk pregnancies
Reasons

- The increase is mostly elective
Indications

- Post dates
- Abruption
- Chorioamnionitis
- Preeclampsia
- Premature rupture of membranes
- Maternal disease
- Fetal growth restriction
- Nonreassuring antenatal testing
- Fetal demise
Contraindications

- Malpresentation
- Placenta previa or vasa previa
- Prior transfundal uterine incision
- Need for emergent delivery
  - Cord prolapse
  - Nonreassuring fetal status
  - Maternal hemorrhage
- Active genital herpes infection
Cervical Ripening

- Definition: “Complex process that results in physical softening and distensibility of the cervix, ultimately leading to partial cervical effacement and dilatation”
- Remodeling of the cervix involves enzymatic dissolution of collagen fibrils, increase in water content, and chemical changes
The Cervix

- Initially 20% smooth muscle, 50% collagen, and 30% ground substance including elastin, chondroitin, dermatan sulfates, and hyaluronidase
- The vascularity and water content increase throughout gestation
- Hyaluronidase which weakly binds to collagen increases from 6 to 33%
- Dermatan and chondroitin sulfates which tightly bind to collagen decrease
- Collagenase and elastase enzymes increase to break down the structure of the collagen
## The Bishop Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Dilation</th>
<th>Efface</th>
<th>Station</th>
<th>Consist</th>
<th>Position</th>
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<tbody>
<tr>
<td>0</td>
<td>Closed</td>
<td>0-30</td>
<td>-3</td>
<td>Firm</td>
<td>Posterior</td>
</tr>
<tr>
<td>1</td>
<td>1-2</td>
<td>40-50</td>
<td>-2</td>
<td>Medium</td>
<td>Mid</td>
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<tr>
<td>2</td>
<td>3-4</td>
<td>60-70</td>
<td>-1 or 0</td>
<td>Soft</td>
<td>Anterior</td>
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<tr>
<td>3</td>
<td>5-6</td>
<td>80</td>
<td>≥+1</td>
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</table>
Friedman in 1966 compared the Bishop score and success of labor induction

- 19.5% of patients with a Bishop score of < 5 failed
- 4% with a score of 5 to 8 failed
- No one failed with a score of 9 or more
- If the score is >8, the chance of a vaginal delivery with induction is similar to that of spontaneous labor
- If the score is <6, cervix ripening is indicated
Techniques

- **Mechanical**
  - Low cost
  - Low risk of tachysystole
  - Few side effects
  - No refrigeration or expiration dates
  - Increased risk of infection

- **Hormonal**
  - Risk of uterine rupture
  - Risk of tachysystole
  - More side effects
  - May be more effective
Techniques

- Prostaglandins
  - Prepidil, Cervadil, Cytotec
- Mifepristone
- Mechanical Dilators
  - Laminaria, EASI
- Membrane Stripping
Prostaglandins

- 20 carbon compound
- Dinoprostone, E2 analog
- PREPIDIL (Pharmacia, Upjohn, Kalamazoo, MI)
- FDA approved in 1992
- 2.5 ml gel containing 0.5mg of dinoprostone
- Instilled in the external cervical os
- Can be repeated every 6 hours up to a total of 3 doses
- $75 per dose
- Needs refrigeration
- 1% rate of hyperstimulation
- Fetal monitoring for 30 minutes to 2 hours after administration
- **CERVIDIL** (Forest Laboratories, St. Louis, MO)
- FDA approved in 1995
- 10 mg vaginal insert that releases prostaglandin E2 at 0.3mg/hr for 12 hours
- May need to be removed earlier if active labor is initiated
- 5% rate of hyperstimulation
- $150 per dose
- Needs refrigeration
- Fetal monitoring for entire duration and at least 15 minutes after removal
- Both are reported to increase the probability of a successful induction, shorten the interval to delivery, and decreased the amount of oxytocin required
- MISOPROSTOL (Cytotec; Searle, Chicago, IL)
- Prostaglandin E1 analog
- FDA approved for peptic ulcer disease
- $0.52 per 100ug tablet
- Hyperstimulation is dose dependent and occurs in 3 to 5% of cases
- Does not need refrigeration
- Cochrane Review-62 trials
- Compared to placebo, significant cervical ripening (p=0.09, CI 0.03 to 0.24)
- Compared to Cervidil, Prepidil, and oxytocin, there is less epidural use, fewer failures to achieve vaginal delivery, and more hyperstimulation (dose dependent)
- Misoprostol is the most effective ripening agent
- Doses not exceeding 25μg every 3 to 6 hours appears to have a similar effectiveness and risk of uterine hyperstimulation to other methods of labor induction
- ACOG Committee Opinion: Misoprostol is a safe and effective agent for cervical ripening and labor induction when used appropriately
- Contraindicated with a prior uterine scar
Other Routes

- **Oral**—
  - Faster peak but then more rapid decline in concentration
  - More GI complaints, in particular vomiting, and fever
  - May be appropriate for SROM
- **Buccal and sublingual**—
  - High bioavailability
  - Possibly less side effects and less tachysystole, but still experimental
Mifepristone

- RU 486 in Europe
- Mifeprex (Danco Laboratories, LLC) in USA
- 200 mg oral tablets
- Antiprogesterone action from competitive inhibition at the progesterone receptor site
- www.fda.gov/cder/drug/infopage/mifepristone/default.htm
- Cochrane Review-7 trials
Compared to placebo, women who received mifepristone were more likely to have a favorable cervix by 48 hours, have delivered by 48 hours, and were less likely to undergo a Cesarean delivery (RR 0.71, 95% CI 0.53-0.95).

Two new studies from February 2005 in women >36 weeks’ gestation: both showed no benefit and one had a trend towards higher Cesarean section rates and more fetal distress compared to oxytocin.
Mechanical Dilators

- LAMINARIA
- made from the seaweed of *Laminaria japonicum*
- Expand by osmosis to 3 fold the original size
- Up to 10 dilators for at least 4 hours
- Synthetic hygroscopic dilators are now available (Lamicel)
- Only 2 to 4 are required in the cervix
- Usually used with oxytocin
- Compared to oxytocin use alone, dilators reduced the risk of cesarean from 32 to 17% (CI 0.33-0.91)
- May be associated with an increased risk of peripartum infections
- Safe for women with a uterine scar
- **FOLEY CATHETER**
- First described by Embrey and Mollison in 1967
- Works by direct stretching pressure of the balloon on the cervix and lower uterine segment and by the secretion of prostaglandins by membrane separation
- Multiple techniques: different size catheters, placement trans or supracervically, with or without oxytocin, and with or without weights
- All seem to be comparable to other methods
- Labor induction using a transcervical Foley catheter has not been associated with uterine rupture
- Cysto Bladder Irrigating Set
- 24 FR 30cc Foley
- 4 way Stopcock
- 5-In-1 Connector
- 30cc Syringe
- Run saline at 30cc/hour
- Leave in for 4 hours or until it falls out
- May also start oxytocin infusion
- Prostaglandin may be slightly more effective (Misoprostol)
- No risk for tachysystole
- Safe in women with a uterine scar
- May have a slightly higher risk of infection
Membrane Stripping

- Separating the amniotic membrane from the lower uterine segment causes a significant release of prostaglandins
- One randomized trial showed 2/3 of women who underwent membrane stripping labored spontaneously in 72 hours compared to only 1/3 without stripping
- Eight women need to have membrane stripping to avoid one formal labor induction
Induction of Labor

- Amniotomy
- Oxytocin
Amniotomy

- Artificial rupture of the membranes when the cervix is favorable
- A trial of amniotomy alone compared to with oxytocin showed shorter induction to delivery times with the added oxytocin
Oxytocin

- Oxytocin is a 9 amnio acid peptide that is normally produced in the hypothalamus and secreted by the posterior pituitary gland in a pulsatile fashion.
- When given intravenously, uterine response occurs after 3 to 5 minutes of infusion.
- Steady state occurs in plasma by 40 minutes
- The uterine response to oxytocin increases from 20 to 34 weeks of gestation then plateaus
- It increases again in labor
- Oxytocin has only about 1% the antidiuretic affect of vasopressin and water intoxication is usually only seen at high concentrations (40 to 50U over 3L of fluid)
- Boluses can cause hypotension and tachycardia
- Should always be on an infusion pump
- **Dosing regimens**
  - **Low dose**: 0.5 to 1mU/min increasing by 1 to 2mU every 30 to 40min
  - **High dose**: 6mU/min increasing by 1 to 6mU every 15 to 30min
- ACOG has no specific recommendations
- Patka et al. showed that higher doses resulted in a shorter induction, but did not decrease the incidence of Cesarean deliveries
- Xenakis et al. used 4mU/min increased by 4mU every 15min compared to low dose and showed a reduction in cesarean delivery from 25.7 to 10.4% with no increase in hyperstimulation
Special Cases

- Prior cesarean delivery
- Post dates
- Macrosomia
- Elective induction
Prior Uterine Scar

- Lyndon-Rochelle et al. reported a retrospective cohort analysis of 20,095 women from 1987 to 1996 who delivered a child after a primary cesarean delivery.

- Uterine rupture rates:
  - 1.6/1000 with repeat cesarean, no labor
  - 5.2/1000 with spontaneous labor
  - 7.7/1000 induced without prostaglandin
  - 24.5/1000 induced with prostaglandin
Relative risk of a uterine rupture was increased by all prostaglandins:

- 15.6 (8.1 to 30.0) for all
- 14.1 (6.1 to 33.0) even prior to misoprostol

The study is limited by coding issues.

In a review by Sanchez-Ramos et al, they concluded that PGE2 and oxytocin were safe and that only misoprostol should be avoided.

ACOG Committee Opinion: Induction with prostaglandins is discouraged, the use of oxytocin is not precluded by the data.
A recent study by Bujold et al. evaluate the Bishop score for predicting the success of an induction in patients with a previous Cesarean delivery.

- A score of ≥6 was associated with a successful VBAC (p<0.001)

- Number of future pregnancies should be part of counseling
Recent decision model analysis:

- For women who desire only one child, an elective repeat Cesarean is safest.
- For women who desire more than one child, a TOLAC is safest especially when considering future risk of hysterectomy.
For women who are undecided

- Spontaneous labor: TOLAC
- Delivery required:
  - Bishop score \( \geq 6 \): induction of labor
  - Bishop score \(< 6\): repeat Cesarean section
**Post Term**

- Definition: “a pregnancy that has extended to or beyond 42 weeks of gestation or 294 days from the first day of the last menstrual period”

- Approximately 6% of pregnancies

- Risks: primigravidity, prior post term, male fetal gender, obesity, placental sulfatase deficiency, and fetal anencephaly
- Perinatal mortality at 42 weeks is twice that at term (4 to 7 vs 2 to 3 per 1000 deliveries)
- Recent meta-analysis of induction vs. expectant management at 41 weeks by Sanchez-Ramos et al.
- 16 studies included
- Women who were induced had lower cesarean delivery rates at 20.1 vs. 22% (OR 0.88, CI 0.78 to 0.99)
- There were no differences in perinatal mortality, NICU admission, meconium aspiration, or abnormal Apgar scores.

- Overall, labor induction decreased the risk of a cesarean delivery by 12% regardless of the Bishop score.

- Conclusion: Women should be induced at ≥41 weeks of gestation.
Macrosomia

- Estimated fetal weight of ≥4500 grams

<table>
<thead>
<tr>
<th>Gestational age</th>
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<th>90%</th>
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<tr>
<td>42</td>
<td>2935</td>
<td>3522</td>
<td>4098</td>
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Macrosomia

- The outcomes for both retrospective and prospective studies do not support a policy of labor induction for macrosomia.

- Frieson et al. found a higher cesarean delivery rate when labor was induced (24% vs. 10%) when controlling for gestational age and parity.
Leaphart et al. looked at nondiabetic women who were induced for suspected macrosomia compared to spontaneous labor in women who were matched for birth weight. Despite a lower mean weight in the induced group, the cesarean rate was higher (36% vs. 17%).

Although intended to reduce Cesarean delivery rates, induction for macrosomia actually increases them.

Conclusion: Do not induce for macrosomia.
Elective

- ACOG: Labor may be induced for risk of rapid labor, distance from the hospital, or psychosocial indications.

- A decision analysis of elective induction at 39 weeks vs awaiting spontaneous labor showed 12,000 excess cesarean deliveries at a cost of $100 million per year.
Must first confirm term gestation by:

- Fetal heart tones have been documented for 30 weeks by Doppler
- It has been 36 weeks since a positive pregnancy test from a reliable laboratory
- An ultrasound measurement of a CRL at 6 to 12 weeks supports a gestational age of at least 39 weeks
- An ultrasound at 13 to 20 weeks confirms a gestational age of at least 39 weeks determined by clinical history and physical exam
- Largest retrospective study by Yeast et al. of 7001 consecutive inductions showed an increased rate of cesarean delivery for nulliparous women who were induced compared to spontaneous labor (16.2% vs. 7.9%, p<0.01)

- Increased RR of 2.8 when the cervix was unfavorable

- Conclusion: Do not induce nulliparous women electively
References


Up to Date:
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Post Term Pregnancy, Norwitz, Errol, MD, PhD. May 2010.