Induction of Labor: Indications, Methods, Challenges and Outcomes

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Learning Objectives

1) List common indications and contraindications for induction of labor
2) Describe methods available for labor induction
3) Understand appropriate use of each method of induction
4) Discuss challenges faced with labor induction
5) Identify outcomes associated with induction of labor
6) Comprehend recommendations for induction of labor of specific groups including women with history of previous cesarean section, premature rupture of membranes, post-term pregnancy, diabetes and hypertension

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Induction of Labor

- Definition
  - The use of techniques for stimulating uterine contractions to accomplish delivery prior to the onset of spontaneous labor
- Goal
  - Achieve vaginal delivery within 24 hours and reduce the rate of cesarean delivery without increasing adverse maternal and neonatal outcomes

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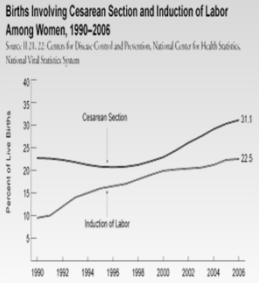
US Data: Induction of Labor Rates



- Between 1990 and last reported data in 2011 by CDC, rates of labor induction have more than doubled rising from 9.5% to 23.2%.

Medical and Obstetrical Indications for Induction

- Post-term pregnancy
- PROM
- Chronic/Gestational Hypertension, Preeclampsia, Eclampsia, HELLP
- Fetal demise
- Chorioamnionitis
- Placental abruption
- Maternal medical conditions
  - Diabetes, Renal disease, Chronic pulmonary disease, APS
- Fetal indications
  - Growth restriction, Isoimmunization, Oligohydramnios

Contraindications for Induction

- Vasa previa
- Placenta previa
- Transverse lie
- Umbilical cord prolapse
- Active genital herpes infection
- Invasive cervical cancer
- Previous classical cesarean delivery
- Previous myomectomy entering endometrial cavity
- Prior uterine rupture
- Category III fetal heart rate tracing

Elective Induction

Cost of Elective Induction

- Results in over 12,000 excess cesarean deliveries
- Imposes costs to the US medical system of nearly $100 million per year
- Most costly inductions?
  - Nulliparous women with unfavorable cervix at 39 weeks
  - When favorable, costs are reduced by half!

Once we determine induction is indicated and appropriate, what is the next step?

COUNSEL THE PATIENT!!!

- Discuss indication for induction
- Introduce the agents and methods of labor stimulation
- Acknowledge the possibility of need for repeat induction or cesarean delivery
- Set expectations for length of process

Where to start?

Table 1. Bishop Scoring System

	Factor				
Score	Dilation (cm)	Position of Cervix	Effacement (%)	Station*	Cervical Consistency
0	Closed	Posterior	0–30	–3	Firm
1	1–2	Midposition	40–50	–2	Medium
2	3–4	Anterior	60–70	–1, 0	Soft
3	5–6	—	80	+1, +2	—

*Station reflects a –3 to +3 scale.
Modified from Bishop EH. Pelvic scoring for elective induction. Obstet Gynecol 1964;24:267.

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Cervical ripening vs. Labor induction

- Unfavorable cervix: Bishops score less than or equal to 6
  - Probability of vaginal delivery is lower if labor is induced
- Favorable cervix: Bishops score greater than 8
  - Probability of vaginal delivery is the same whether labor is spontaneous or induced
- In general: Patient's with an unfavorable cervix will benefit from initiation with cervical ripening

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Cervical Ripening

- Ripening Agents
  - Misoprostol (PGE1)
  - Prepidil (PGE2)
  - Cervidil (PGE2)
  - Oxytocin
- Mechanical Methods
  - Single or double balloon catheters
  - Hygroscopic/Osmotic dilators

Misoprostol

- Prostaglandin E1
- Brand name: Cytotec
- FDA approved for treatment and prevention of gastric ulcers
- Off label use for labor induction in women without history of cesarean section

Misoprostol administration

- Available in 100 mcg and 200 mcg tablets
- Route: oral, sublingual, buccal or vaginal
- Typical use: 25 mcg vaginally every 3-6 hours

Outcomes using vaginal misoprostol

- Compared to no treatment/placebo
  - Improved rates of vaginal delivery within 24 hours (RR 0.40; CI 0.22-0.70, 2 trials).
- Compared to other prostaglandins
  - Decreased risk of failure to achieve vaginal delivery within 24 hours (RR 0.78; CI 0.67-0.91, 8 trials)
  - Decreased need for oxytocin augmentation (RR 0.69; CI 0.56-0.8, 10 trials)
- Compared to balloon catheters
  - No statistically significant difference in likelihood of vaginal delivery within 24 hours (RR 1.26, CI 0.94-1.68, 7 trials)
  - No statistically significant difference in cesarean delivery rates (RR 1.01, CI 0.90-1.13, 21 trials)
- Compared to oxytocin
  - Reduced risk of failure to achieve vaginal delivery in 24 hours (RR 0.53, CI 0.33-0.84, 1 trial)
  - Reduced cesarean delivery rate (RR 0.58, CI 0.37-0.90, 5 trials)

Dinoprostone

- Prostaglandin E2
- Brand Names (US):
  - Prepidil: Gel, contains 0.5 mg dinoprostone in 2.5 mL of gel
  - Cervidil: Vaginal insert, contains 10 mg dinoprostone in time release formulation (0.3 mg/h)
- FDA approved for use of cervical ripening in patients at or near term in whom there is a medical or obstetrical indication for induction of labor

Dinoprostone administration

- Prepidil
  - May repeat dose every 6-12 hours up to a maximum dose of 1.5 mg (three doses) within 24 hours
- Cervidil
  - Remove/replace every 12 hours

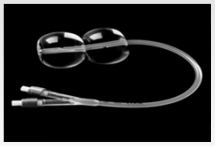
Outcomes using dinoprostone

- Compared to placebo/no treatment
  - Reduced likelihood of vaginal delivery not achieved in 24 hours (RR 0.19, CI 0.14-0.25, 2 trials)
  - Reduced rate of continuation of unfavorable cervix after 12-24 hours (RR 0.46, CI 0.35-0.62, 5 trials)
  - Reduced need for oxytocin augmentation (RR 0.83, C 0.73-0.94, 12 trials)
- Compared to balloon catheters
  - Proportion of women who did not achieve vaginal delivery within 24 hours was not significantly different (RR 1.72, CI 0.90-3.27, 3 studies)

Balloon catheters

- Options
  - Foley catheter #16 inflated with 30-80 mL
  - Cook catheter with intrauterine balloon inflated with 40-80 mL, vaginal balloon inflated with 20-80 mL

Balloon administration



- May place during digital exam or with speculum using a ring forceps or urologic sound
- May leave in place until extruded or for up to 12 hours
- Goal is to have intrauterine balloon distended with saline and retracted so it rests against the internal os

Balloon outcomes

- Compared to prostaglandins
  - Substantial reduction in tachysystole with fetal heart rate changes (RR 0.19, CI 0.08-0.43, 9 trials)
- With or without oxytocin
  - RCT in 2008 showed combined use did not shorten time to delivery, had no effect on likelihood of delivery within 24 hours, and had no effect on vaginal delivery rate
- Single versus Double balloon
  - In 2 comparative trials, there was no clinically important difference in outcomes with use of double versus single balloon catheter (time to delivery and cesarean delivery)
- Single balloon with 30 mL vs. 60 mL
  - Higher proportion of women who received 60 mL achieved delivery within 12 hours, but no difference in median time interval to delivery or proportion of women who achieved delivery within 24 hours
  - The median cervical dilation after balloon expulsion was significantly higher in the 60 mL group (4 versus 3 cm)
- With rupture of membranes
  - No data specifically looking at risk of infection with respect to duration of ruptured membranes before and/or after insertion of a balloon catheter
  - Some practitioners do not place in women with ROM, some remove catheter if membranes rupture at any time after placement, others limit duration to 12 hours if membranes rupture after placement
  - There is NO CONSENSUS ON OPTIMAL MANAGEMENT IN THIS SETTING

Oxytocin

- Brand name: Pitocin
- Synthetic analog of oxytocin
- Mechanism of action
  - Stimulates uterine contractions
  - Increases local prostaglandin production, further stimulating uterine contractions
- In general, less successful when used in women with a low Bishop score, and as such, a ripening process should be used prior to administering oxytocin to women with unfavorable cervixes

Oxytocin administration

- For IOL, typically given IV
- Low dose and high dose protocols given through infusion pumps
- Goal to have strong contractions every 2-3 minutes, or uterine activity reaches 200-250 Montevideo units
- No benefit in increasing dose when one of these endpoints is achieved

Cost of methods

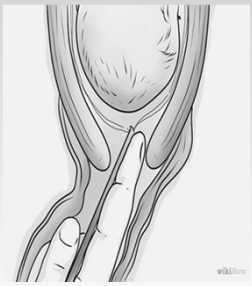
- Misoprostol 25 mcg: $0.21-0.61
- Cervidil: $175.00-277.90
- Prepidil: $150.00-480.24
- Foley catheter: ~$3.00
- Cook catheter: ~$41.00
- Pitocin (10u/mL): $7.19

Hygroscopic/Osmotic Dilators

- Laminaria and Dilapan
- Primarily used during pregnancy termination rather than for pre-induction cervical ripening of term pregnancies
- Concern for potential higher incidence of postpartum maternal and fetal infections compared to prostaglandin analogues

Amniotomy

- Deliberate rupture of the amniotic sac to induce or expedite labor
- Ensure head is well applied to reduce risk of prolapse of cord or fetal part

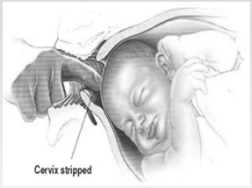


Amniotomy outcomes

- Amniotomy plus oxytocin versus amniotomy alone
  - Fewer women undelivered at 24 hours in combined group (RR 0.13, CI 0.04-0.41)
  - RCT showed greatest impact on duration of labor is to initiate oxytocin immediately after amniotomy, not delay administration
- Amniotomy plus oxytocin versus oxytocin alone
  - In one RCT, routine early amniotomy in nulliparous labor induction shortened the time to delivery by > 2 hours and increased the proportion of deliveries within 24 hours (RR 0.72, CI 0.59-0.89)

Membrane stripping

- During cervical exam, insertion of finger beyond the cervical os and rotating the finger circumferentially along the lower uterine segment to detach the fetal membranes
- Can be performed in the office in women with a partially dilated cervix who want to hasten onset of spontaneous labor



Membrane stripping outcomes

- Meta-analysis including 22 trials
  - Increased likelihood of spontaneous labor in 48 hours (RR 0.77, CI 0.70-0.84) or delivery within 1 week (RR 0.71, CI 0.65-0.78)
  - Compared to no intervention, reduced frequency of pregnancy continuing beyond 41 weeks (RR 0.59, CI 0.46-0.74) and 42 weeks (RR 0.28, CI 0.15-0.50)
  - Reduced frequency for formal induction compared to no intervention (RR 0.72, CI 0.52-1.00)
  - NNT: 8 women to avoid 1 formal induction
- NO IMPROVEMENT IN MATERNAL OR NEONATAL OUTCOMES

Should we offer routine membrane stripping?

- Important for patient's to understand no maternal or neonatal outcome improvements, solely improved rate of entering spontaneous labor
- Reasonable to offer in well-dated pregnancies greater than or equal to 39 weeks
- GBS infection?
  - No studies have shown a direct contra-indication, but there is no good safety data and so must discuss potential risks and benefits with GBS carriers

Nipple stimulation

- Cochrane meta-analysis
  - Not more useful in women with unfavorable cervix
  - Not more effective than oxytocin
  - Is effective for initiating labor within 72 hours in women with favorable cervix

Other methods

- Glucocorticoids
- Castor Oil
- Hyaluronidase
- Isosorbide mononitrate
- Acupuncture
- Evening primrose oil
- Herbal preparations
- Intercourse
- Exercising

Failed Induction

- No universal standard
- Important to allow adequate time for cervical ripening and development of active labor pattern
  - Decreases potential for cesarean delivery in women still in latent phase of labor
- Once induced women enter active labor, progression is comparable to women with spontaneous active labor or faster

When do we call it?

- Definition offered by NICHD, SMFM and ACOG
  - Cervical ripening with prostaglandins over a period ranging from a single dose to several doses or mechanical methods over 1-2 days prior to oxytocin administration
    - CERVICAL RIPENING IS NOT INCLUDED WHEN CALCULATING THE LENGTH OF INDUCTION OR DIAGNOSING FAILED INDUCTION!!!!!
  - Failure to generate regular contractions approximately every 3 minutes and cervical change after at least 24 hours of oxytocin
  - Membranes should be artificially ruptured if safe and feasible
  - After AROM, may consider failed IOL if regular contractions and cervical change do not occur after at least 12 hours of oxytocin administration

The dreaded gray zone

- Active labor (Cervix 6 cm to complete)
  - So, what about 3 to 6 cm? Most data shows ripening agents get us to 3-4 cm
  - Based on retrospective cohort study comparing duration of first stage of labor in induced labor versus spontaneous labor
    - Can take 8 to 10 hours for each centimeter of dilation between 3 and 5 cm (95%ile)
    - Can take 4 to 6 hours for dilation between 5 to 6 cm (95%ile)

Take home message

Special population: TOLAC

- Best method, efficacy and safety of cervical ripening and/or labor induction in these women has not been established!

TOLAC: IOL

- IOL associated with significantly higher risk of unsuccessful TOLAC compared to spontaneous labor
- Women with a history of prior vaginal delivery and a favorable cervix have an increased chance of successful IOL
- Calculators exist to calculate likelihood of successful TOLAC

Uterine rupture and TOLAC IOL

- Systematic review of pooled data from controlled studies of women with prior CS reported the odds of uterine rupture with IOL vs. spontaneous labor OR 6.15 (CI 0.74-51.4)
- One large, well-designed prospective study reported an OR 2.86 (CI 1.75-4.67) and an absolute risk of rupture 1% with IOL versus 0.4% with spontaneous labor
- In a nested case-control study women induced with a favorable cervix had similar risk of rupture as women in spontaneous labor (HR 1.5, CI 0.97-2.36), whereas an unfavorable cervix increased risk of rupture (HR 4.09, CI 1.82-9.17)

IOL for TOLAC

- Misoprostol should NOT be used
- Mixed data regarding other types of prostaglandins, no definitive recommendation made, would not use for now
- Given the lack of compelling data suggesting increased risk with mechanical dilation and transcervical catheters, such interventions MAY be an option for TOLAC candidates with an unfavorable cervix
- Oxytocin augmentation may be used in patients undergoing TOLAC as there are varying outcomes of available studies and there is a small absolute risk reported in those studies
- Amniotomy not contra-indicated and if completed, consider addition of oxytocin

Special Population: PROM

- Patient's should be given adequate time for latent phase of labor to progress
- No evidence that using any type of prostaglandin vaginally increases the risk of infection
  - In one study, only one dose of intravaginal misoprostol was necessary to successful labor induction in 86% if patients
- Largest randomized study found that oxytocin administration reduced the time interval between PROM and delivery as well as frequency of chorioamnionitis, postpartum febrile morbidity and neonatal antibiotic treatments without increasing cesarean deliveries or neonatal infections
- A meta-analysis comparing expectant management versus IOL with prostaglandin or oxytocin showed reduction in risk of chorioamnionitis or endometritis and decreased NICU admissions for neonates in women who underwent IOL

Special Population: Post-term pregnancy

- Late-term (41+0-41+6)
  - Induction can be considered versus expectant management with antenatal testing
- Post-term (42+)
  - Induction is recommended

Special Population: Gestational Diabetes

- GDMA1
  - No early term induction indicated
- GDMA2
  - If well controlled, induce at 40 weeks
  - If poor control, induce at 37-39 weeks

Special Population: Pregestational Diabetes

- Type I DM
  - If good control, induce at 39 weeks
  - If poor control, induce at 37-39 weeks
- Type 2 DM
  - If good control, induce at 40 weeks
  - If poor control, induce at 37-39 weeks

Special Population: Gestational Hypertension

- Mild (No Magnesium required)
  - If develop > 39 weeks induce
  - Induce at 37 weeks, can be individualized 37-38+6 weeks
- Severe (Magnesium required)
  - If > 34 weeks induce
  - If < 34 weeks, may expectantly manage in hospital setting

Special Population: Pre-eclampsia

- Without severe features
  - Induce at 37 weeks
- With severe features
  - Induce at 34 weeks, development prior to 34 week, inpatient expectant management option

Special Population: Chronic Hypertension and Superimposed Preeclampsia

- Chronic Hypertension
  - Induce at 38 weeks
- Superimposed preeclampsia
  - Without severe features: Induce at 37 weeks
  - With severe features: Induce at 34 weeks, development prior to 34 weeks, inpatient expectant management option

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Questions?