Indications of induction of labor

Yvonne Cheng, MD, PhD
University of California, San Francisco

Disclosure

- No financial relationship with industry
- No financial relationship from any of the products or tests discussed herein

Objectives

- Induction of labor
  - Considerations for induction of labor
  - ACOG: common indications of induction
  - Clinical scenarios
    - Hypertensive disorders
    - Diabetes mellitus
    - Post-term
    - Elective
      - Macrosomia
      - Prior stillbirth

Induction of labor: U.S.

- Induction more than doubled since 1990
  - Increased among newborns of all gestational ages

Considerations before induction

- Consideration of any maternal/fetal risks
- Counseling:
  - Indications of induction
  - Agents/methods of labor stimulation
  - Possible need for repeat induction or cesarean


Considerations before induction

- Assessment of gestational age:
  - Ultrasound (<20 weeks) supports GA ≥ 39
  - FHT documented by doppler for 30 weeks
  - At least 36 weeks since a positive pregnancy test


Considerations before induction

- Amniocentesis for fetal lung maturity
  - If indication for delivery exists, use of amniocentesis to assess FLM would not assist in guiding management
    - If significant maternal/fetal risk exists, delivery should occur regardless of FLM result
    - If delivery could be deferred due to absence of pulmonary maturity, there is not a stringent indication for delivery
    - Neonates delivered between 36-38 weeks after FML still at risk of adverse outcome


ACOG Committee Opinion No 475: Antenatal corticosteroids therapy for fetal maturation. Obstet Gynecol 2011

Considerations before induction

- Antenatal corticosteroids
  - One course considered before 34 weeks
  - Benefit after 34 weeks unclear
    - Study on-going (MFMU)
    - One RCT: improved neonatal respiratory outcome prior to elective cesarean at term
  - Current recommendations: do not include steroids on or at 34 weeks

ACOG Committee Opinion No 475: Antenatal corticosteroids therapy for fetal maturation. Obstet Gynecol 2011
Stutchfield P, et al. Antenatal steroids for term elective caesarean section. BJM 2005
Contraindications of induction

- Vasa previa / complete placenta previa
- Transverse fetal lie
- Umbilical cord prolapse
- Previous classical cesarean delivery
  - Previous myomectomy entering endometrial cavity
- Active genital herpes infection

Common indications of induction

Pregnancy conditions:
- Abruptio placentae
- Chorioamnionitis
- Premature rupture of membranes
- Post-term pregnancy
- Fetal demise

Common indications of induction

Maternal medical conditions:
- Hypertensive diseases
  - Preeclampsia/eclampsia
  - Gestational hypertension
- Diabetes mellitus
- Antiphospholipid syndrome
- Renal / pulmonary / cardiac diseases

ACOG: Induction of labor

Practice Bulletin: No 107, August 2009
- Induction: not absolute
- Balance: risks / benefits

Maternal/fetal conditions
- Gestational age
- Cervical status
- Other factors
  - Maternal preferences
  - Experience
  - Cost

Common indications of induction

Fetal conditions:
- Severe fetal growth restriction
- Oligohydramnios
- Isoimmunization

Elective / “logistic” reasons:
- Risk of rapid labor
- Distance from hospital
- Psychosocial indications

Others
- History of unexplained stillbirth
- Macrosomia

Clinical scenario #1

28 y.o. G1P0 at 34 weeks with severe preeclampsia (by BP) stable on meds x 1 week. You recommend:

A. Induction at 34 weeks
B. Cesarean at 34 weeks
C. Continuing pregnancy until worsening symptoms

Severe preeclampsia

Management: maternal safety with expedited delivery

- Incidence in the US: 0.9%
- 2 RCTs: Odendaal (1990), Sibai (1994)
  - Aggressive: steroids → delivery in 48 hrs
  - Expectant: steroids → delivery for mat/fetal indications
  - Similar maternal morbidity
  - Prolongation of pregnancy (mean 7.1 days)
  - ↓ neonatal morbidity (33% vs 75%)

Severe preeclampsia

Indications of delivery: Fetal
- Severe growth restriction (<5th centile)
- Persistent severe oligohydramnios (AFI<5)
- Repetitive late or variable decelerations
- Persistent BPP ≤4 (6hrs apart)
- Umbilical artery Doppler: reverse diastolic flow
- Fetal death


Severe preeclampsia

Indications of delivery: Maternal
- Neurologic: severe headache, visual changes, eclampsia
- SOB, O₂<94% on RA, pulmonary edema
- Epigastric/RUQ pain; AST, ALT >2x upper normal
- Oliguria (<500ml/24hr) or Cr ≥1.5mg/dL
- Persistent platelet <100K/mm³
- Uncontrolled severe hypertension despite max dose
- Suspected abruptio placentae, labor, ROM


Clinical scenario #2

28 y.o. G1P0 at 36 weeks 0 days with stable mild preeclampsia since 35 weeks. You recommend:

A. Induction at 36 weeks (now)
B. Induction at 37 weeks
C. Continuing pregnancy until spontaneous labor or worsening preeclampsia

Koopsman CM et al.  IOL vs. Expectant monitoring for gestational hypertension or mild preeclampsia after 36 weeks (HYPITAT) Lancet 2009
ACOG Practice Bulletin.  Diagnosis and Management of preeclampsia and eclampsia. No 33, Jan 2002

Mild preeclampsia

Gestational hypertension/preeclampsia: 26-29% of pregnancies in nulliparous women

- HYPITAT: IOL vs. expectant monitoring for gestational hypertension or mild preeclampsia after 36 weeks gestation
  - 756 women (377 IOL; 379 EM)
  - Primary outcome: poor maternal outcome
    - 44% in EM; 31% in IOL (RR 0.71, 95% CI 0.59-0.86)
Mild preeclampsia

Cost of IOL vs. expectant management
- HYPITAT: IOL vs. expectant monitoring for gestational hypertension or mild preeclampsia after 36 weeks gestation
  - IOL cost: € 7077
  - EM cost: € 7908
  - 11% difference: cost of antenatal monitoring vs. IOL
  - No difference in postpartum, follow-up, non-medical

Koopman CM et al. Induction vs. Expectant management for gestational hypertension or mild preeclampsia after 36 weeks (HYPITAT); Lancet 2009


Management of mild preeclampsia between 34-36 weeks unclear: RCT in progress (HYPITAT II)
- Habli M: neonatal outcomes in pregnancies with preeclampsia/gestational hypertension and in normotensive pregnancies delivered at 35, 36, 37 weeks
  - Observational, week-by-week comparison
  - Hypertensive pregnancies have higher risk of:
    - SGA (17.9% vs. 1.7%)
    - NICU admission (51.1% vs. 34.5%)
    - Longer hospital stay (3.9 vs. 2.0 days)

Clinical scenario #3

28 y.o. G1P0 at 37 weeks 0 days with well-controlled type 2 DM. You recommend:

A. Induction at 37 weeks
B. Induction at 38 weeks
C. Induction at 39 weeks
D. Continuing pregnancy until spontaneous labor

Pregestational diabetes

Pregestational DM: 1% of all pregnancies
- Timing of delivery: balancing risk of IUFD vs. risk of preterm birth
  - Early delivery in patients with vasculopathy, nephropathy, poor control, hx stillbirth
  - Poorly controlled DM:
    - Amnio for FLM prior to 39 weeks
  - Well controlled DM:
    - May progress to EDD with reassuring testing

ACOG Practice Bulletin: Pregestational diabetes mellitus. No 60, 2005
Clinical scenario #4

28 y.o. G1P0 at 38 weeks 0 days with well-controlled GDM diet controlled. You recommend:

A. Induction at 39 weeks
B. Induction at 40 weeks
C. Induction at 41 weeks

Gestational diabetes mellitus

GDM: 2-5% prevalence in US
- No good evidence to support routine delivery prior to 40 weeks
  - One RCT: IOL vs. expectant management
    - No difference in cesarean
    - IOL: less LGA babies
  - One cohort study: IOL 38-39 weeks vs. EM (historical control)
    - No difference in cesarean, macrosomia
    - Reduced shoulder dystocia (1.4% vs. 10%)

A. Induction at 39 weeks
B. Induction at 40 weeks
C. Induction at 41 weeks

Clinical scenario #5

28 y.o. G1P0 at 37 weeks 0 days with dichorionic/diamniotic twins without complications. You recommend:

A. Induction at 37 weeks
B. Induction at 38 weeks
C. Induction at 39 weeks
D. Induction at 40 weeks
### Twin Gestations

**Morbidity and Mortality**

<table>
<thead>
<tr>
<th>Morbidity and Mortality</th>
<th>Twins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average birth weight</td>
<td>2.347g</td>
</tr>
<tr>
<td>Average GA at delivery</td>
<td>35.3 weeks</td>
</tr>
<tr>
<td>Percentage with growth restriction</td>
<td>14-52%</td>
</tr>
<tr>
<td>Percentage requiring admission to NICU</td>
<td>25%</td>
</tr>
<tr>
<td>Average length of stay in NICU</td>
<td>18 days</td>
</tr>
<tr>
<td>Risk of cerebral palsy</td>
<td>4 x (singleton)</td>
</tr>
<tr>
<td>Risk of death by age 1 year</td>
<td>7 x (singleton)</td>
</tr>
</tbody>
</table>

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**2009 US**

- 32.2 twins / 1,000 total births
- In 2009: 137,217 births in twin deliveries
- Role of assisted reproductive technology
  - Higher incidence of monochorionicity (3.2% vs. 0.4%)
  - Increased maternal age
- Complications of pregnancy
  - Preterm delivery
  - Gestational diabetes
  - Hypertension and preeclampsia
  - Acute fatty liver
  - Pulmonary embolism

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**Clinical Scenario #6**

28 y.o. G2P1 at 37 weeks 0 days with oligohydramnios (AFI 3cm). You recommend:

A. Induction at 37 weeks
B. Induction at 38 weeks
C. Induction at 39 weeks

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Sources:

- ACOG Practice Bulletin. Multiple gestations: complicated twins, triplets and higher orders. No 56, 2004
- ACOG Practice Bulletin. Multiple gestations: complicated twins, triplets and higher orders. No 56, 2004
Oligohydramnios

- **Isolated oligohydramnios:** DVP <2cm or AFI<5cm
  - **Incidence:** DVP– 2.3% @ 34-36 wks; 3% @ ≥37 wks
    AFI– 4.8% @ 34-36 wks; 10% @ ≥37 wks
  - Increased nonreactive NST (1.5 fold)
  - Fetal heart rate decelerations (1.8-fold)
  - Fetal intolerance of labor & stillbirth (4.5-fold)
  - Apgar<4 at 5min (11-fold)
  - Meconium aspiration (12-fold)


Oligohydramnios

- Isolated oligohydramnios may be less ominous than oligo + abnormal fetal growth
- Optimal definition of oligohydramnios not determined
  - Single DVP higher specificity in preterm period: fewer rates of delivery
  - In the setting of otherwise uncomplicated, isolated, and persistent oligohydramnios, delivery at 36-37 weeks is recommended

Nabhan AF et al. AFI vs. single DVP for preventing adverse pregnancy outcome. Cochrane Database 2008

Clinical scenario #7

28 y.o. G2P1000 at 36 weeks 0 days with history of unexplained stillbirth at 37 weeks. You recommend:

A. Induction at 37 weeks
B. Induction at 38 weeks
C. Induction at 39 weeks
D. Induction at 40 weeks

Stillbirth

- Incidence in US: 6.2 per 1000 births in 2004
  - Early stillbirth (20-27 wks): 3.2 per 1000 births
  - Late stillbirth (28+ wks): 4.3→3.1 per 1000 births
- **Risk factors**
  - Non-Hispanic black race
  - Nulliparity
  - Advanced maternal age
  - Obesity, smoking, drug/alcohol
  - Multiple gestations

Stillbirth

- Maternal comorbidities:
  - Hypertensive disorders
    - Chronic hypertension: OR 1.5-2.7
    - Preeclampsia: OR 1.2-4.0
  - Diabetes
    - Diet: OR 1.2-2.2
    - Insulin: OR 1.7-7.0
  - SLE: OR 6-20
  - Renal disease: OR 2.2-30
  - Thyroid disease: OR 2.2-3.0
  - Thrombophilia: OR 2.8-5.0
  - Cholestasis of pregnancy: OR 1.8-4.4
  - Prior stillbirth: OR 1.4-3.2

Prior stillbirth

- Recurrence counseling often hampered by insufficient information regarding etiology of prior stillbirth
- In low-risk women with unexplained stillbirth
  - Recurrence: 7.8-10.5 / 1000, most before 37 weeks
- In women with prior live birth with IUGR,
  - Risk of stillbirth: 21.8 / 1000 in subsequent pregnancy

Clinical scenario #8

28 y.o. G1P0 at 39 weeks 0 days with fundal height=42, ultrasound EFW=4300gm (>90th centile); she does not have GDM on testing. You recommend:

A. Induction at 39 weeks
B. Induction at 40 weeks
C. Continuing pregnancy until onset of spontaneous labor or other indications arise
Fetal macrosomia

LGA: >90th centile for gestational age
Macrosomia: >4,000gm, or >4,500gm

- Incidence in US: 10% >4000gm; 1.5% >4500gm
- Risk of morbidity ↑↑ with >4,500gm
  - Shoulder dystocia: 9-24% if >4,500gm

Fetal macrosomia

Risk factors:
- Prior history of macrosomia
- Maternal prepregnancy weight
- Weight gain in pregnancy
- Multiparity
- Male fetus
- GA>40 weeks
- Maternal ethnicity, birth weight, height
- Maternal age <17 years
- Positive 50-gm glucose screen with negative GTT

Diagnosis
- Sonographic estimated fetal weight
- Clinical Leopald’s
- Asking parous women

Treatment
- DM: glycemic control
- No DM: no intervention available


1 RCT: 273 women with EFW 4000-4500gm
- Randomized to: IOL or expectant management
- Similar risk of cesarean: 11.4% for IOL; 21.6% for EM
- Similar risk of shoulder dystocia: 5 for IOL; 6 for EM

3 observational studies
- Risk of cesarean doubled in IOL
- Compared induction to spontaneous labor

Fetal macrosomia

- Observational study
  - Compared IOL to “expectant management”, accounting for intrauterine weight gain
  - Lower frequency of cesarean: 35.2% vs 40.9% (aOR 1.25, 95%CI 1.17-1.33)
  - No difference in Apgar score at 5min or neonatal injury

Summary: Indications of induction

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gestational Age</th>
</tr>
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<tbody>
<tr>
<td>Severe preeclampsia</td>
<td>34 weeks</td>
</tr>
<tr>
<td>Mild preeclampsia / gestational hypertension</td>
<td>37 weeks</td>
</tr>
<tr>
<td>Pregestational DM, well-controlled</td>
<td>39-40 weeks</td>
</tr>
<tr>
<td>DM, poorly controlled</td>
<td>34-39 weeks</td>
</tr>
<tr>
<td>DM, vascular disease</td>
<td>37-39 weeks</td>
</tr>
<tr>
<td>GDM, well-controlled</td>
<td>39-41 weeks</td>
</tr>
<tr>
<td>poorly controlled</td>
<td>34-39 weeks</td>
</tr>
<tr>
<td>Twins: monochorionic/monoamniotic</td>
<td>32-34 weeks</td>
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</tr>
<tr>
<td>Persistent oligohydramnios</td>
<td>37 weeks</td>
</tr>
<tr>
<td>Prior unexplained stillbirth</td>
<td>39-40 weeks</td>
</tr>
<tr>
<td>Amnio if &lt;39 weeks</td>
<td></td>
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</tbody>
</table>