Indications of induction of labor

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Disclosure

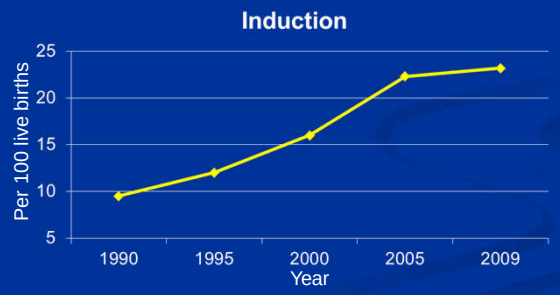
- No financial relationship with industry
- No financial relationship from any of the products or tests discussed herein

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**



National Vital Statistics Report. Final Birth: 2009.

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

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

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

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

Considerations before induction

- Amniocentesis for fetal lung maturity
  - If indication for delivery exists, use of amniocentesis to asses FLM would not assist in guiding management
    - if significant maternal / fetal risk exists, delivery should occur regardless of FML 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

Spong CY, et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
Bates E, et al. Neonatal outcomes after demonstrated fetal lung maturity before 39 weeks. Obstet Gynecol 2010

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

Spong CY, et al. Timing of indicated late-preterm and eraly-term birth. Obstet Gynecol 2011
NICHD Maternal-Fetal Medicine Units Network. Current studies: Antenatal late preterm: randomized placebo-controlled trial. http://www.bsc.gwu.edu/mfmu/projects/brieftrl.cgi#ALP
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

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

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

Pregnancy conditions:

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

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

Common indications of induction

Maternal medical conditions:

- Hypertensive diseases
  - Preeclampsia/eclampsia
  - Gestational hypertension
- Diabetes mellitus
- Antiphospholipid syndrome
- Renal / pulmonary / cardiac diseases

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

Common indications of induction

Fetal conditions:

- Severe fetal growth restriction
- Oligohydramnois
- Isoimmunization

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

Common indications of induction

Elective / "logistic" reasons:

- Risk of rapid labor
- Distance from hospital
- Psychosocial indications

Others

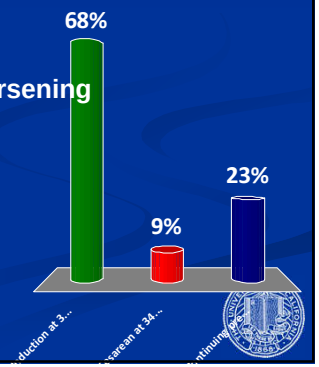
- History of unexplained stillbirth
- Macrosomia

ACOG Practice Bulletin: Induction of labor. No 107, Aug 2009

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 7.1days)
    - ↓ neonatal morbidity (33% vs 75%)

Sibai BM, et al. Expectant management of severe preeclampsia remote from term. Am J Obstet Gyencol 2007
Odendaal HJ et al. Aggressive or expectant management for patients with severe preeclampsia 28-34 weeks GA. Obstet Gynecol 1990
Sibai BM, et al. Aggressive vs. expectant management of severe preeclampsia at 28-32 weeks GA. Am J Obstet Gynecol 1994

Severe preeclampsia

Indications of delivery: Fetal

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

Sibai BM, et al. Expectant management of severe preeclampsia remote from term. Am J Obstet Gyencol 2007

Severe preeclampsia

Indications of delivery: Maternal

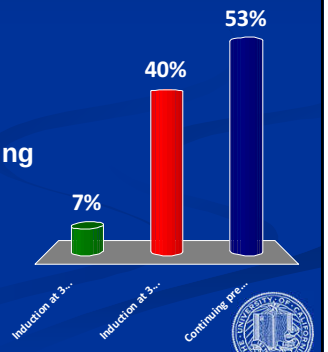
- Neurologic: severe headache, visual changes, eclampsia
- SOB, O_2<94% on RA, pulmonary edema
- Epigastric/RUQ pain; AST, ALT >2x upper normal
- Oliguria (<500ml/24hr) or Cr ≥1.5mg/dL
- Persistent platelet <100K/mm^3
- Uncontrolled severe hypertension despite max dose
- Suspected abrutio placentae, labor, ROM

Sibai BM, et al. Expectant management of severe preeclampsia remote from term. Am J Obstet Gyencol 2007

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



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)

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

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

Vijgen SM, et al. An economic analysis of induction of labour and expectant monitoring in women with gestational hypertesion or preeclampsia at term (HYPITAT). BJOG 2010

Mild preeclampsia

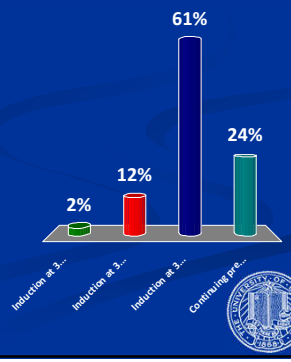
- **Management of mild preeclampsia between 34-36 weeks unclear: RCT in progress (HYPITAT II)**
- **Habli M:** neonatal outcomes in pregnancies with preeclampsia/gestational hypertension and in normotensive pregnancies delivered at 35, 36, 37 weeks
  - Observational, week-by-week comparison
  - Hypertensive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

Koopsman CM et al. IOL vs. Expectant monitoring for gestational hypertension or mild preeclampsia after 36 weeks (HYPITAT) Lancet 2009
Habli M et al. Neonatal outcomes in preeclampsia vs. normotensive pregnancies. Am J Obstet Gynecol 2007

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

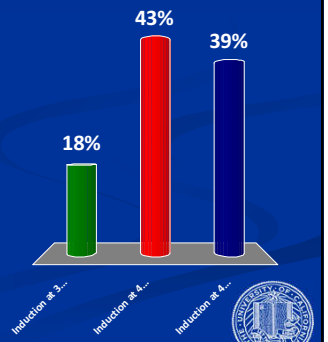
- **Timing of delivery: balancing risk of IUFD vs. risk of preterm birth**
  - **Early delivery in patients with vasculopathy, nephropathy, poor control, hx stillbirth**
  - **Poorly controlled DM:**
    - **Amnio for FLM prior to 39 weeks**
  - **Well controlled DM:**
    - **May progress to EDD with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

ACOG Practice Bulletin. Gestational diabetes mellitus. No 30, 2001
Kjos SL et al. Insulin-requiring diabetes in pregnancy. Am J Obset Gynecol 1993
Lurie S, et al. IOL at 338-39 weeks reduces shoulder dystocia in GDM-A2. Am J Perinatol 1996

Gestational diabetes mellitus

GDM: 2-5% prevalence in US

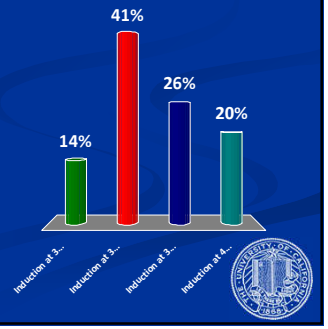
- GDM well-controlled
  - With good dates, RDS at 39 weeks is rare
    - Routine amniocentesis for FLM not necessary
- GDM poorly controlled
  - Assess FLM prior to induction
  - If early delivery planned because of maternal/fetal compromise, urgency of indication should be considered in the decision regarding amnio

ACOG Practice Bulletin. Gestational diabetes mellitus. No 30, 2001

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	Twins
Average birth weight	2,347g
Average GA at delivery	35.3 weeks
Percentage with growth restriction	14-52 %
Percentage requiring admission to NICU	25 %
Average length of stay in NICU	18 days
Risk of cerebral palsy	4 x (singletons)
Risk of death by age 1 year	7x (singletons)

Martin JA , et al. Birth: Final data for 2009. National Vital Statistics Reports 2011
ACOG Practice Bulletin. Multiple gestations: complicated twins, triplets and higher orders. No 56, 2004

Twin gestations

- **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

Martin JA , et al. Birth: Final data for 2009. National Vital Statistics Reports 2011
ACOG Practice Bulletin. Multiple gestations: complicated twins, triplets and higher orders. No 56, 2004

Twin gestations

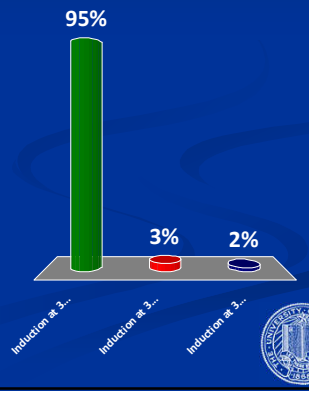
- **Timing of delivery**
  - Nadir of perinatal mortality for twins: ~ 38 weeks
  - No RCT to examine if elective delivery at ~38 weeks improves perinatal outcome
    - Dichorionic/diamniotic: 38 weeks
    - Monochorionic/diamniotic: 34-37 weeks
    - Monochorionic/monoamniotic: 32-34 weeks

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
ACOG Practice Bulletin. Multiple gestations: complicated twins, triplets and higher orders. No 56, 2004

Clinical scenario #6

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

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



Oligohydramnois

- **Isolated oligohydramnois: DVP <2cm or AFI<5cm**
  - **Incidence:** DVP– 2.3% @ 34-36 wks; 3% @ ≥37 wks
    AFI– 4.8% @ 34-36wks; 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)**

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011

Oligohydramnois

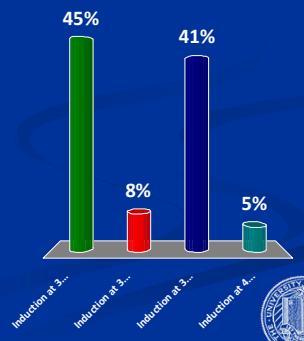
- Isolated oligohydramnois may be less ominous than oligo + abnormal fetal growth
- Optimal definition of oligohydramnois not determined
  - **Single DVP higher specificity in preterm period:** fewer rates of delivery
- **In the setting of otherwise uncomplicated, isolated, and persistent oligohydramnois,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

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
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**

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
ACOG Practice Bulletin. Management of Stillbirth. No 102, 2009

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**

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
ACOG Practice Bulletin. Management of Stillbirth. No 102, 2009
Fretts R et al. Etiology and prevention of stillbirth. Am J Obstet Gynecol 2005

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

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
Nabhan AF et al. AFI vs. single DVP for preventing adverse pregnancy outcome. Cochrane Database 2008

Prior stillbirth

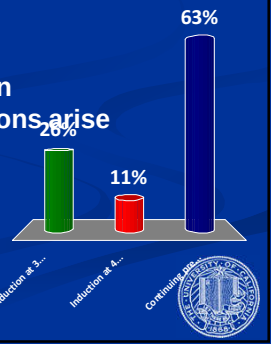
- Management:
  - Antepartum surveillance: little evidence-based evidence
    - Antepartum testing starting at 32-34 weeks
    - ~ 1.5% iatrogenic prematurity based on false-positive testing
- Timing of delivery:
  - Late preterm or early term delivery not recommended
  - Consider amniocentesis for FLM prior to 39 weeks

Spong CY et al. Timing of indicated late-preterm and early-term birth. Obstet Gynecol 2011
Nabhan AF et al. AFI vs. single DVP for preventing adverse pregnancy outcome. Cochrane Database 2008

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 on 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

ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000

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**

ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000

Fetal macrosomia

- **Diagnosis**
  - **Sonographic estimated fetal weight**
  - **Clinical Leopald's**
  - **Asking parous women**
- **Treatment**
  - **DM: glycemic control**
  - **No DM: no intervention available**

ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000

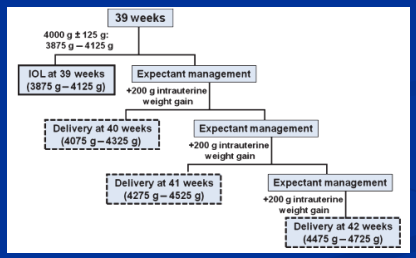
Fetal macrosomia

- **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**

ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000
Gonen O, et al. IOL vs. expectant management in macrosomia. Obstet Gynecol 1997
Combs CA et al. Elective induction vs. spontaneous labor after sonographic dx of fetal macrosomia. Obstet Gynecol 1993
Friesen CD et al. Influence of spontaneous or inducted labor on delivering macrosomic fetus. Am J Perinatol 1995
Leaphart WL et al. Labor induction with a prenatal dx of fetal macrosomia. J MFNM 1997

Fetal macrosomia

- **Observational study**
  - **Compared IOL to "expectant management", accounting for intrauterine weight gain**



ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000
Cheng YW et al. Impending macrosomia: will IOL modify the risk of cesarean delivery? BJOG 2012

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

ACOG Practice Bulletin. Fetal macrosomia. No 22, 2000
Cheng YW et al. Impending macrosomia: will IOL modify the risk of cesarean delivery? BJOG 2012

Summary: Indications of induction

Condition	Gestational Age
Severe preeclampsia	34 weeks
Mild preeclampsia / gestational hypertension	37 weeks
Pregestational DM, well-controlled DM, poorly controlled DM, vascular disease	39-40 weeks 34-39 weeks 37-39 weeks
GDM, well-controlled poorly controlled	39-41 weeks 34-39 weeks
Twins: monochorionic/monoamniotic monochorionic/diamniotic dichorionic/diamniotic	32-34 weeks 34-37 weeks 38 weeks
Persistent oligohydramnois	37 weeks
Prior unexplained stillbirth	39-40 weeks Amnio if <39 weeks