



## Induction of Labor

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### Course Description:

Induction of labor (IOL) refers to any technique used to stimulate uterine contractions during pregnancy to accomplish a vaginal delivery. This is performed prior to the onset of spontaneous labor. A successful IOL results in a vaginal birth [1].

**Approximate Time to Complete:** 45 minutes



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Introduction







**This course will:**

- Help participant develop sound critical judgment in the delivery of health care in a labor and delivery unit when induction of labor occurs.
- Expand participant's knowledge base on learning theories and their instructional implications regarding health care delivery in a labor and delivery unit when induction of labor occurs.
- Enable participant to develop, implement, and evaluate health care delivery in a practice setting prior to an actual event. This will allow for early recognition of an actual event.
- Enhance participant's ability to put knowledge into active health care delivery. This will allow for rapid implementation of the necessary steps needed when events occur during an induction of labor.
- Prepare participant to address issues and implement changes in the health care unit as necessary to ensure a safe environment. Equipment and supplies needed when induction of labor occurs will be in every labor and delivery room.
- Enable participant to convert proven learning into actual health care delivery.





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  - Etiology
  - Possible Causes in Variability of IOL Rates
  - Possible Causes in Variability of IOL Rates Cont'd
  - Preparing for an Induction
  - Preparing for an Induction con't
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## Induction of Labor (IOL)

*Induction of labor (IOL) refers to any technique used to stimulate uterine contractions during pregnancy to accomplish a vaginal delivery and is performed prior to the onset of spontaneous labor. A successful IOL results in a vaginal birth [1].*



- The frequency of IOL doubled between 1990 and 2012, from 9.5 to 23.3%.\*
- Natality Data File, National Vital Statistics System, identified trends in induction rates that are variable by gestational age with declining rates in all gestational age groups since 2012.\*
- After nearly 20 years of increases in rates, IOL for singleton births was as high as 23.8% in 2010, declined to 23.7% in 2011, and further declined to 23.3% in 2012.\*



[Click here to view a chart of Induction rates by Gestational Age.](#)

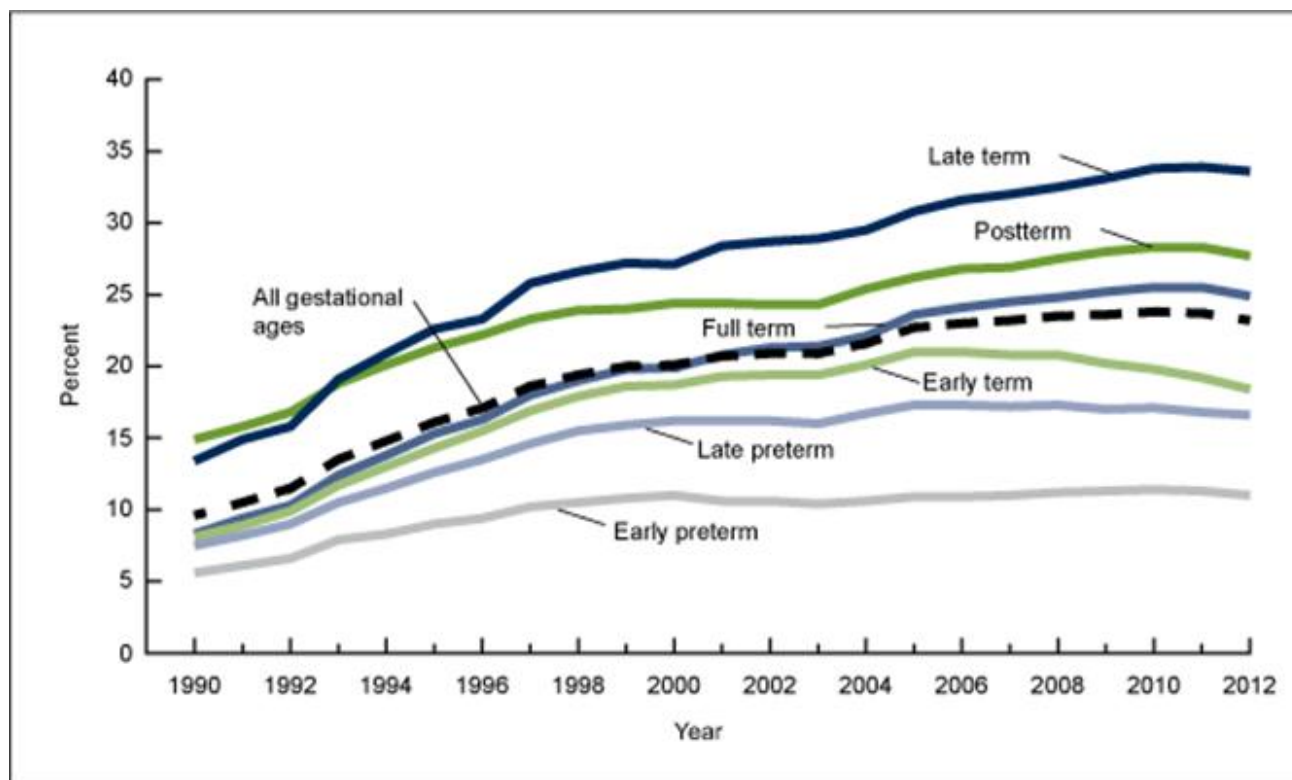
- IOL rates also vary by gestational age, with rates for most age groups declining since 2010. \*
- Gestational ages 36, 37, and 38 weeks have continued to decline since 2006. \*
- The largest decline is noted at 38 weeks.\*
- The decrease in rates of IOL at 38 weeks, from 2006 through 2012, declined for all maternal age groups under 40 years of age including the largest race of Hispanic origin groups. \*
- The District of Columbia (DC) and 36 states recorded declines of IOL at 38 weeks from 2006 through 2012. The rate of decline ranged from 5% to 48%; rates for 31 states and DC declined at least 10%.\*

\* Reference [2]



After increasing nearly every year since 1990, the IOL rate for singleton births declined in 2011 and 2012.

**Induction of labor, by gestational age: United States, 1990–2012.**



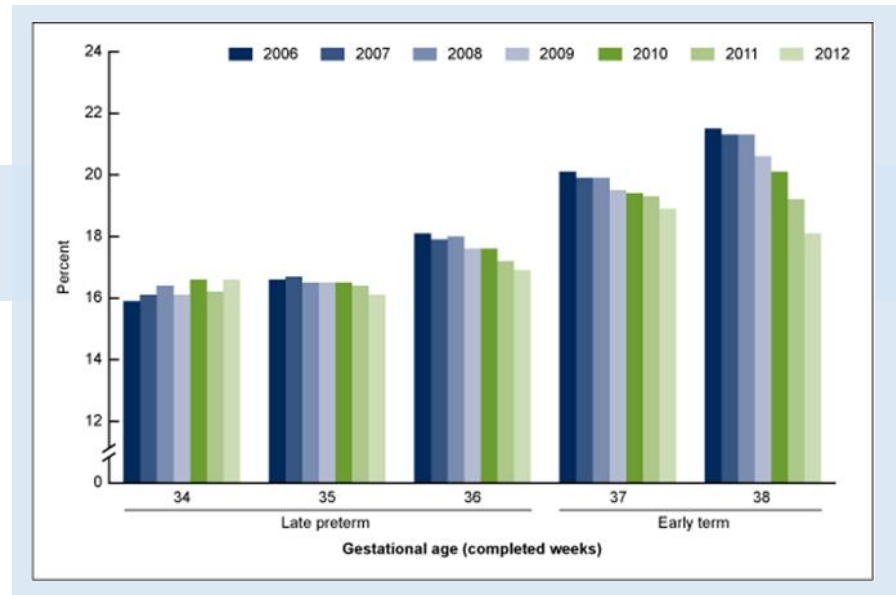
**NOTES:** Singletons only. Early preterm is less than 34 weeks of gestation; late preterm is 34–36 weeks; early term is 37–38 weeks; full term is 39–40 weeks; late term is 41 weeks; post term is 42 weeks or more.

SOURCE: CDC/NCHS, National Vital Statistics System



- From 2006 through 2012, induction rates declined at each gestational week 35–38, with the greatest decline at 38 weeks.
- Different patterns emerged in induction rate trends from 2006 through 2012 for late preterm and early-term births.
- The largest changes occurred among early-term births, with induction rates declining at both 37 (down 6%) and 38 (down 16%) weeks.

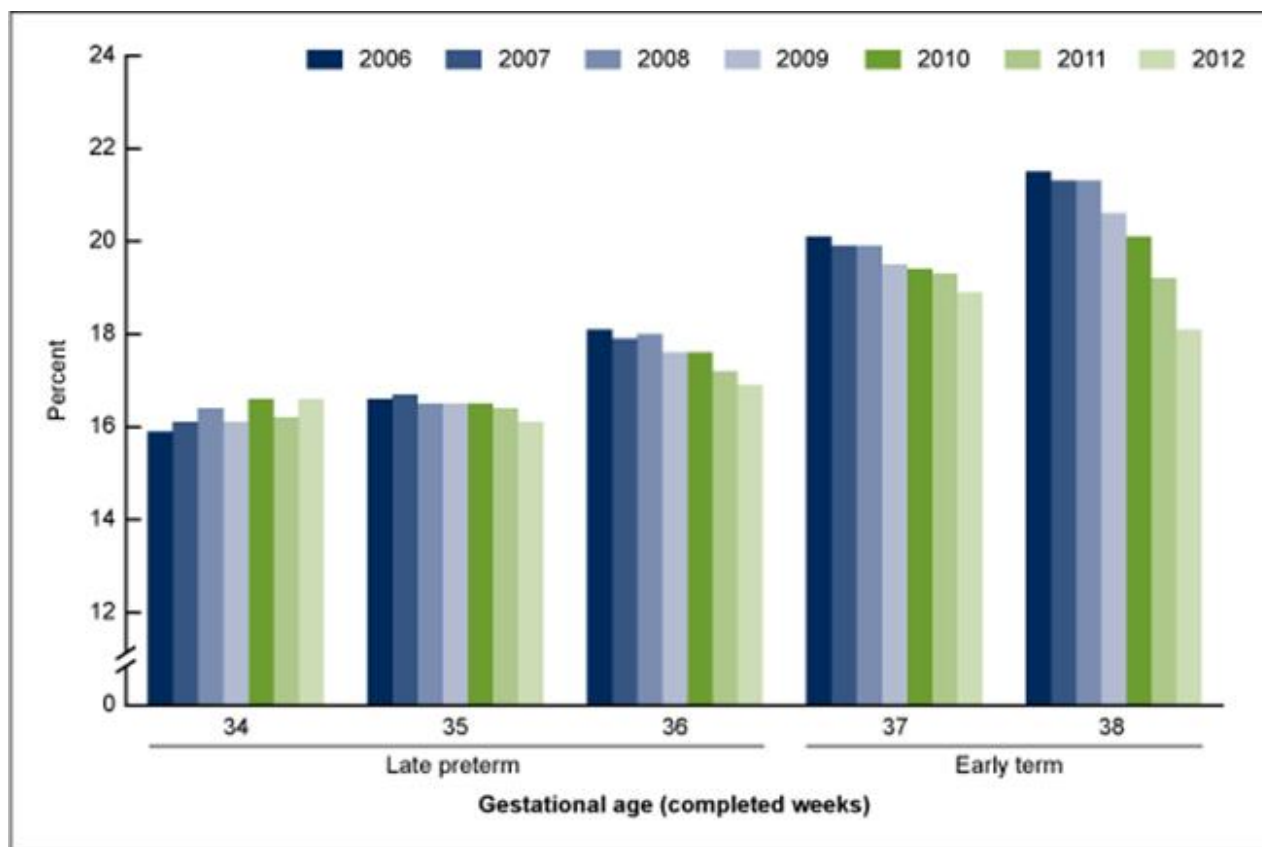
SOURCE: CDC/NCHS, National Vital Statistics System.



[Click here to view a larger version of the chart.](#)



Figure 2. Induction of labor at each gestational week 34–38: United States, 2006–2012.



**NOTES:** Singletons only. Thirty-four, 35, and 36 weeks are late preterm; 37 and 38 weeks are early term.  
**SOURCE:** CDC/NCHS, National Vital Statistics System



Induction of labor is recommended when the benefits of early delivery, from either a maternal or fetal standpoint, outweigh the risks of pregnancy continuation. Indications for induction of labor include, but are not limited to, the following:

- Gestational hypertension
- Chronic hypertension
- Pre-eclampsia, severe pre-eclampsia, eclampsia
- Diabetes
- Cholestasis of pregnancy
- Renal disease
- Antiphospholipid antibody syndrome
- Hypercoagulable disorders
- Systemic lupus erythematosus

- Fetal conditions:
  - Fetal growth restriction
  - Multiple gestations
  - Alloimmunization
  - Structural malformations
  - Genetic conditions
  - Non-reassuring fetal testing

- Obstetric complications:
  - Chorioamnionitis
  - Preterm premature rupture of membranes
  - Premature rupture of membranes
  - Oligohydramnios
  - Polyhydramnios
  - History of fetal demise
  - Placental abnormality
  - Post-term pregnancy





- Elective IOL prior to 39 weeks is contraindicated due to increased rates of neonatal morbidity and mortality [11].
  - Commonly encountered clinical scenarios such as accelerated fetal growth, advanced cervical dilation, history of pre-eclampsia in a prior pregnancy or history of fetal growth restriction in a prior pregnancy are not indications for early delivery.
  - Delivery prior to 39 weeks should also not be offered due to maternal discomfort, a particularly desired delivery date or provider convenience.



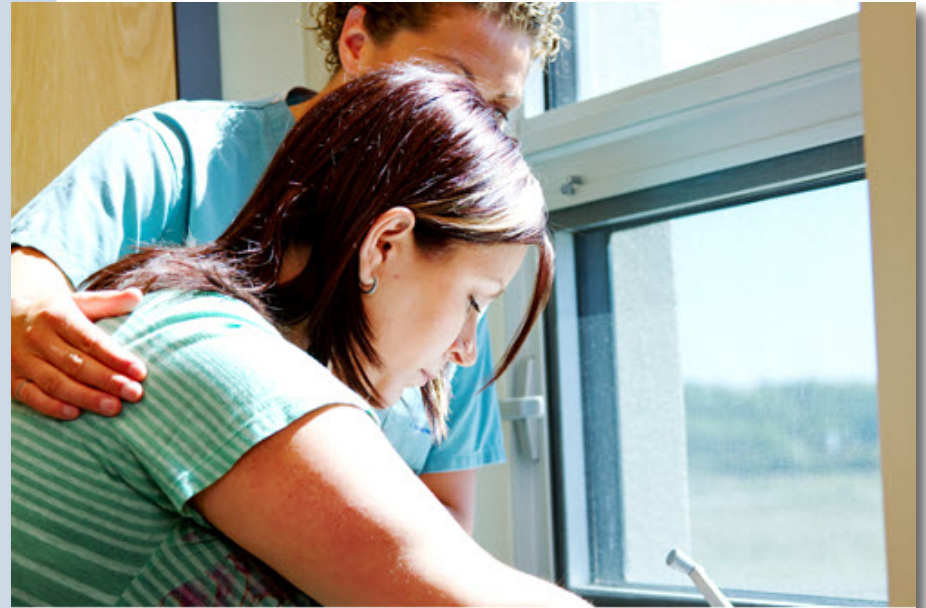
- All methods of IOL can carry some level of risk for the mother and/or the fetus.
- Risks and benefits of an IOL should be explained and understood by the patient and her family.
- The patient should be counseled regarding:
  - Indication for induction
  - Method of induction
- Prior to induction of labor, the patient and provider should discuss a plan for what may occur if the induction is unsuccessful
- Ensure documentation and confirmation of understanding.
  - Your institution may consider implementation of consent for this procedure.
- A department may consider a method of prioritizing scheduled IOL to ensure the availability of resources and staffing.
  - The algorithm should be based upon fetal and maternal conditions. This will create a safer patient care environment.





An IOL is contraindicated if conditions are present that would put the woman or fetus at risk if spontaneous labor occurred, including:

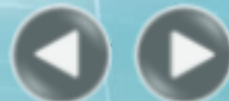
- Placenta previa, vasa previa
- Breech or transverse presentation
- Umbilical cord prolapse
- Prior classical cesarean section
- Prior myomectomy with entry into uterine cavity
- Prior uterine rupture
- Active genital herpes infection
- Invasive carcinomas of the genital tract
- Category III fetal heart tracing





## Risks of IOL

- Induction of labor carries slightly increased risk of complications at the time of delivery; however, in general, if induction of labor is planned for a medical indication, these risks do not outweigh the benefit of proceeding with delivery.
- IOL demonstrates slightly increased risks of the following complications [4]:
  - Chorioamnionitis
  - Postpartum hemorrhage
  - Uterine tachysystole
  - Uterine rupture in the setting of prior C/S
- Initial observational studies evaluating risk of IOL demonstrated increased risk of cesarean section. The ARRIVE trial, published in 2018, demonstrated that induction of labor at 39 weeks, even in women with an unfavorable cervix, reduces the risk of cesarean section [5].



- The Bishop Score is the best available tool for predicting the likelihood that induction will result in vaginal delivery [7].
- The Bishop Score is based on cervical dilation, effacement, position and consistency, in addition to, fetal station.
- The higher the score, the more likely a successful vaginal delivery will occur [1].
- A score greater than 8 is associated with similar rates of successful vaginal delivery as spontaneous labor. A score of 6 or less is considered unfavorable [1].
- A score of 6 or less typically requires cervical ripening with prostaglandins and/or mechanical dilator placement [1].

| Bishop Scoring System |              |                    |                |                    |                      |
|-----------------------|--------------|--------------------|----------------|--------------------|----------------------|
| Factor                |              |                    |                |                    |                      |
| Score                 | Dilation(cm) | Position of Cervix | Effacement (%) | Station (-3 to +3) | 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             | -                    |



*Click the table to view a larger version*

## Bishop Scoring System

*Factor*

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| 3     | 5-6          | -                  | 80             | +1, +2             | -                    |



## Cervical Ripening

- The goal of cervical ripening is to prepare the cervix for labor by starting the process of softening, thinning and dilation of the cervix. This is accomplished by administration of prostaglandins and/or by mechanical dilation.
- Performing this step reduces the rate of failed induction and induction to delivery time [3].





## Cervical Ripening <sup>[3]</sup>

| Prostaglandins                                                                            | Mechanical Dilation                                                                                                                                           |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Options include misoprostol (prostaglandin E1) and dinoprostone (prostaglandin E2)        | Options include membrane stripping, hygroscopic dilators, osmotic dilators, Foley balloon catheters, double balloon devices and extraamniotic saline infusion |
| Work by dissolving collagen bundles and increasing submucosal water content in the cervix | Work by enhancing release of prostaglandin from the decidua, adjacent membranes and cervix, in addition to, physical dilation                                 |
| The optimal route, frequency and dose of prostaglandins has not been determined           | Associated with minimal side effects                                                                                                                          |
| Possible side effects include fever, chills, vomiting and diarrhea                        | Minimal risk of fetal heart rate changes or uterine tachysystole                                                                                              |
| Contraindicated in women with prior cesarean section                                      |                                                                                                                                                               |

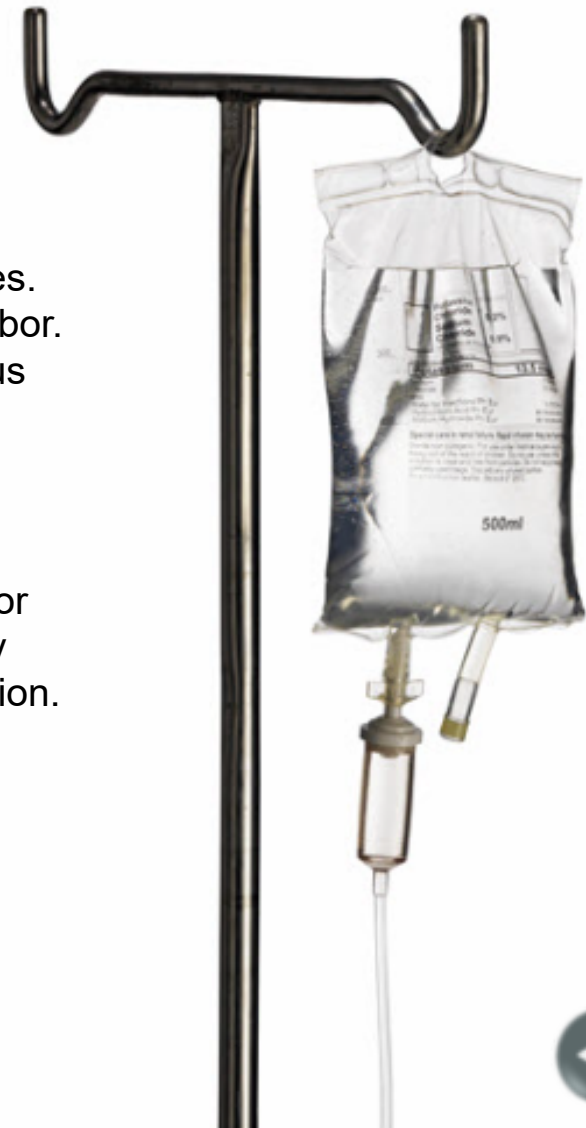


## Induction of Labor

The goal of induction or augmentation of labor is to effect uterine activity sufficient to produce cervical change and fetal descent without compromising maternal or fetal status.

### Oxytocin

- One of the most commonly used medications in the United States.
- Goal of use is to stimulate labor that is similar to spontaneous labor.
- Oxytocin is a polypeptide hormone produced in the hypothalamus and is secreted from the posterior pituitary gland in a pulsatile fashion; the synthetic version of the hormone is identical to that produced by the pituitary.
- Uterine response typically occurs 3-5 minutes after initiation of infusion. Steady state is achieved within 40 minutes of initiation or dose change. If infusion is stopped, uterine contractions typically decrease within 3-5 minutes, which is the half-life of the medication.
- Uterine response depends on individual patient sensitivity and gestational age.



## Induction of Labor

The goal of induction or augmentation of labor is to effect uterine activity sufficient to produce cervical change and fetal descent without compromising maternal or fetal status.

### Oxytocin

- Maternal factors associated with successful response include lower BMI, greater cervical dilation, parity and gestational age.
- The infusion typically includes 10 units of oxytocin diluted into 1,000 mL of crystalloid solution, which is administered by a pump. The concentration by this formulation is 10 mU/mL.
- Various regimens exist for initial infusion doses and incremental increases; typically ranging from 1-6 mU/min with increasing doses every 15-40 minutes. Most labor and delivery units have infusion rates outlined in a policy.
- High dose protocols have been associated with shorter labor and less chorioamnionitis. Low dose protocols are associated with decreased tachysystole. The overall C/S rate is similar for both protocols.



## Induction of Labor

The goal of induction or augmentation of labor is to effect uterine activity sufficient to produce cervical change and fetal descent without compromising maternal or fetal status.

### Oxytocin

- The maximal effective dose to achieve adequate contractions in all women is different. If contractions are not adequate, fetal status is reassuring and labor has arrested, an infusion rates up to 40 mU/min have not been demonstrated to have any apparent risks.

| Labor Stimulation with Oxytocin: Examples of Low- and High-Dose Oxytocin |               |                               |                       |
|--------------------------------------------------------------------------|---------------|-------------------------------|-----------------------|
| Regimen                                                                  | Starting Dose | Incremental Increase (mU/min) | Dosage Interval (min) |
| Low-Dose                                                                 | 0.5-2         | 1-2                           | 15-40                 |
| High- Dose                                                               | 6             | 3-6*                          | 15-40                 |



*Click the table to view a larger version*



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## Labor Stimulation with Oxytocin: Examples of Low- and High-Dose Oxytocin

| Regimen    | Starting Dose | Incremental Increase (mU/min) | Dosage Interval (min) |
|------------|---------------|-------------------------------|-----------------------|
| Low-Dose   | 0.5-2         | 1-2                           | 15-40                 |
| High- Dose | 6             | 3-6*                          | 15-40                 |

\*The incremental increase is reduced to 3 mU/min in presence of hyperstimulation and reduced to 1 mU/min with recurrent hyperstimulation.

Data from Hauth JC, Hankins GD, Gilstrap LC 3rd, Strickland DM, Vance P. Uterine contraction pressures with oxytocin induction/augmentation. *Obstet Gynecol* 1986;68:305-9; Satin AJ, Leveno KJ, Sherman ML, Brewster DS, Cunningham FG. High- versus low-dose oxytocin for labor stimulation. *Obstet Gynecol* 1992;80:111-6; Crane JM, Young DC. Meta-analysis of low-dose versus high-dose oxytocin for labour induction. *J SOGC* 1998;20:1215-23; Cummiskey KC, Dawood MY. Induction of labor with pulsatile oxytocin. *Am J Obstet Gynecol* 1990;163:1868-74; Blakemore KJ, Qin NG, Petrie RH, Paine LL. A prospective comparison of hourly and quarter-hourly oxytocin dose increase intervals for the induction of labor at term. *Obstet Gynecol* 1990;75:757-61; Mercer B, Pilgrim P, Sibai B. Labor induction with continuous low-dose oxytocin infusion: a randomized trial. *Obstet Gynecol* 1991;77:659-63; and Muller PR, Stubbs TM, Laurent SL. A prospective randomized clinical trial comparing two oxytocin induction protocols. *Am J Obstet Gynecol* 1992;167:373-80; discussion 380-1.





## Induction of Labor - Alternate Methods

### Membrane Stripping

- Refers to digital separation of the chorioamniotic membrane from the wall of the cervix and lower uterine segment by performing a digital exam and rotating fingers circumferentially along the lower uterine segment.
- The process is thought to lead to an increase in prostaglandins and phospholipase A2.
- Associated with a decrease in number of pregnancies continuing beyond 41 weeks, but associated with increased bleeding and contractions that do not lead to labor.

### Amniotomy

- Also known as AROM - Artificial Rupture of Membranes.
- If used alone as method for IOL, can be associated with unpredictable and lengthy period of time before onset of contractions.
- Insufficient evidence on efficacy and safety of amniotomy alone as a method of IOL.
- Limited data suggest shortened time until delivery when used in conjunction with oxytocin.
- Early amniotomy (performed when cervix <4 cm) in nulliparous women undergoing IOL has been shown to correlate with shortened time to delivery.
- Potential complications include cord prolapse, chorioamnionitis and subsequent cord compression.



- Amniotomy, also known as AROM (Artificial Rupture of Membranes), may be effective alone in labor induction.
- This may be performed when the cervix is partially dilated, effaced, and the fetal head is engaged into the maternal pelvis.
- This is accomplished using a medical instrument which makes a hole in the amniotic sac.
- This procedure may cause labor to start or speed up labor [17, 18].
- The fetal heart rate (FHR) is documented before and following the procedure.
- The color and character of the amniotic fluid is also included in documentation.



- Natural and inexpensive non-medical method for IOL
- Studies demonstrate a significant decrease in the number of women who have not gone into labor within 72 hours of implementing this method in the setting of a favorable cervix
- Potential complications include uterine tachysystole with fetal heart rate decelerations and possible increased risk of perinatal death
- No difference in rates of C/S
- This method has only been studied in low-risk pregnancies.
- Not recommended in unmonitored settings [1].

## Nipple Stimulation



- Uterine tachysystole
  - Defined as >5 contractions in 10 minutes, averaged over a 30 minute time period [1].
  - Should always be qualified as to the presence or absence of associated fetal heart rate decelerations
  - Tachysystole is more common with misoprostol than dinoprostone and oxytocin
  - Rates of tachysystole are less with misoprostol doses of 25 mcg versus 50 mcg and dosing every 6 hours rather than every 3 hours [1].
- Management of Tachysystole
  - Maternal repositioning
  - Consider administering oxygen and IV fluids
  - Discontinuation of oxytocin, if applicable
  - Removal of dinoprostone, if applicable
  - Irrigation of the cervix and vagina is not beneficial [1].
  - Consider administration of terbutaline, a uterine tocolytic, 250 mcg subcutaneously
  - Rapids IV infusions of oxytocin are not recommended due to risk of hypotension



### Hyponatremia

- If hyponatremia occurs or is suspected, Oxytocin and hypotonic solutions are to be immediately discontinued.
- Hyponatremia can be corrected by restricting water intake and administering hypertonic saline if necessary.
- Hyperbilirubinemia will be treated according to neonatal guidelines whether occurring from Oxytocin, prematurity, or a combination of both.





- Since 1979, ACOG has cautioned against inductions before 39 weeks in the absence of a medical indication [1].
- ACOG has also noted that "a mature fetal lung maturity test result before 39 weeks of gestation, in the absence of appropriate clinical circumstances, is not an indication for delivery" [8, 9].



## Failed Induction of Labor

- No universal standard exists for what constitutes a "failed" induction.
- The key principle is to allow adequate time for cervical ripening and latent and active labor prior to making a diagnosis.
- A failed induction should be reserved for patients being induced who never progress to active labor.
- Typically, in order to diagnose a failed induction, attempt should be made to have performed amniotomy and administer oxytocin for up to 24 hours [4].
- If a woman has a medical indication for induction of labor and induction of labor fails, cesarean section should be performed. Discharging a patient home after decision to proceed with IOL for a medical indication is not recommended.





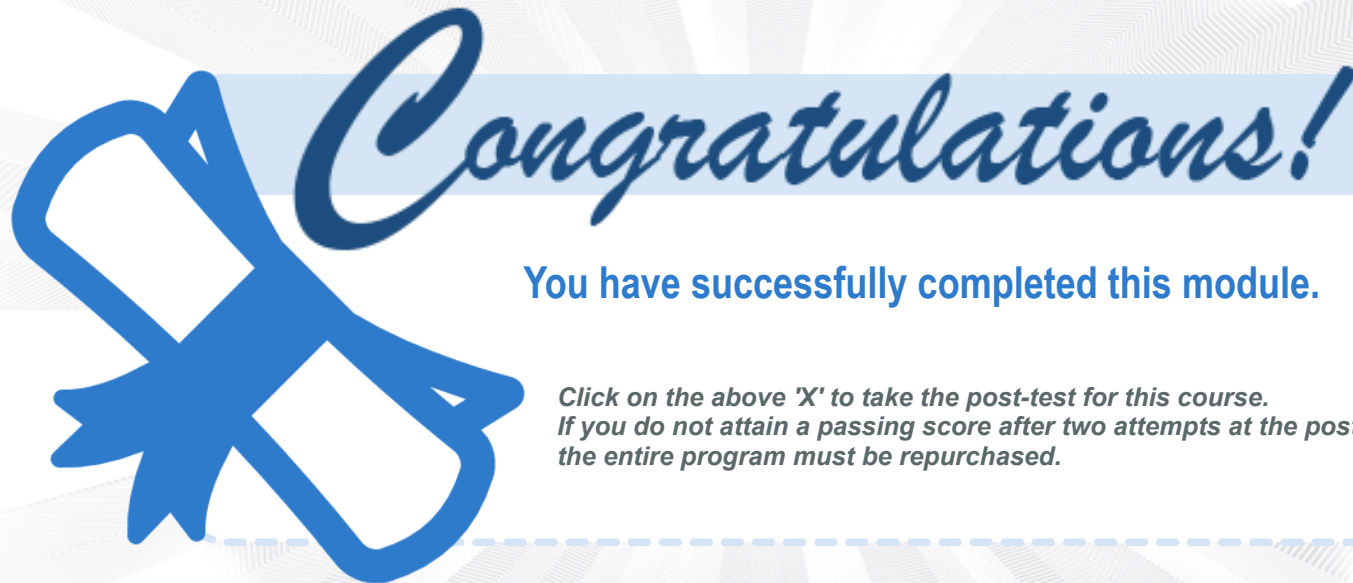
Limited data is available; however, IOL at term does not appear to be a risk of spontaneous preterm birth in subsequent pregnancies [10].

IOL, when performed in a patient safe environment, can result in a vaginal birth with a healthy woman and fetus.

Implementation of a conservative checklist-based protocol for IOL, including oxytocin administration, may result in positive maternal and newborn outcomes [12].

Summary





You have successfully completed this module.

*Click on the above 'X' to take the post-test for this course.  
If you do not attain a passing score after two attempts at the post-test,  
the entire program must be repurchased.*



1. ACOG Committee on Practice Bulletins, Obstetrics. ACOG Practice Bulletin No. 107: Induction of labor. *Obstet Gynecol.* 2009;114(2 Pt 1):386.
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