



Induction of Labor

Click the next button to continue...



Copyright ©2022 Shelly Betancourt and Michelle Becher

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law. For permission requests, write to the publisher at the address below.

Maternal 911 Education Systems, LLC
475 West Center St.
Ithaca, MI 48847
www.maternal911.com



Maternal 911 and Maternal 911 in Action contains information designed as an educational resource to aid practitioners in providing obstetric care and the use of this information is voluntary. This information should not be considered as inclusive of all proper treatments or methods of care or as a statement of the standard of care. It is not intended to substitute for the independent professional judgement. Maternal 911 reviews the publication regularly, but may not reflect the most recent evidence.

Maternal 911 makes every effort to present accurate and reliable information. The Maternal 911 and Maternal 911 in Action are publications provided 'as is' without any warranty of accuracy, reliability or otherwise, either express or implied. Maternal 911 does not guarantee, warrant, or endorse the products or services of any firm, organization, or person. Neither co-founder nor any officers, directors, members, employees, participants, or agents will be liable for any loss, damage or claim with respect to liabilities, including direct, special, indirect, or consequential damages, incurred in connection with this publication or reliance on the information presented.

Data from completing the modules may be used in research and publications with privacy maintained.



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





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.



- Introduction
 - Definition
 - Occurrence Rates
 - 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
 - Risks of IOL
 - Etiology
- Planning and Prevention
 - Bishop Score
 - Planning and Prevention
 - Planning and Prevention Con't
- Management and Treatment
 - Induction of Labor
 - Other Methods
 - Nipple Stimulation
 - Management of Tachysystole
 - Management and Treatment
- Guidelines and Complications
 - Guidelines from Professional Organizations
 - Failed Induction of Labor
- Summary
 - Summary
 - Course Completed Page



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].



- Induction of labor is one of the most commonly performed obstetric procedures in the United States [3].
- In 2010, the United States began an initiative to eliminate elective inductions prior to 39 weeks. Thereafter, the rates of IOL began to fall, according to National Vital Statistics System [2].
 - However, in recent years, the rate of IOL is again climbing.

- In general, induction of labor is recommended when the benefit of delivery outweighs the risks of continuing the pregnancy [4].
- The benefits of labor induction must be weighed against the potential maternal and fetal risks associated with the intervention [4].

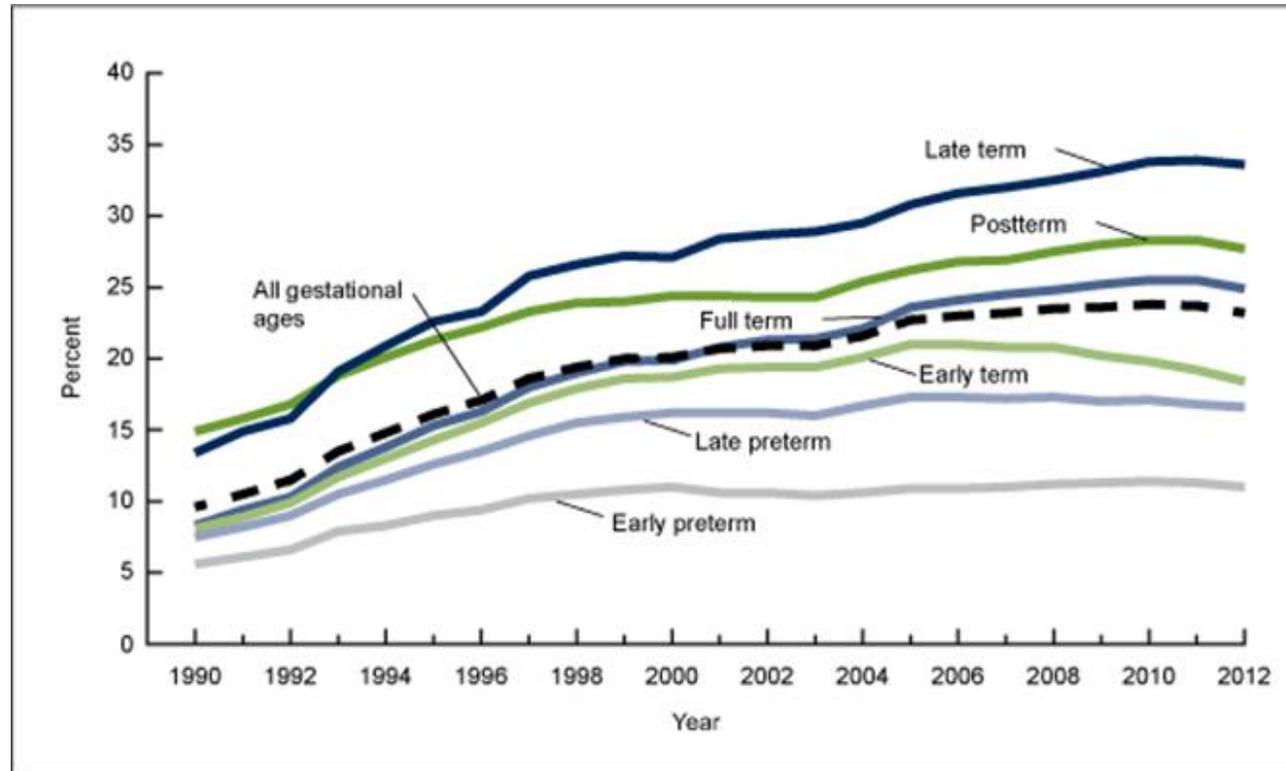


[Click here to view a chart of Induction rates by Gestational Age.](#)



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.

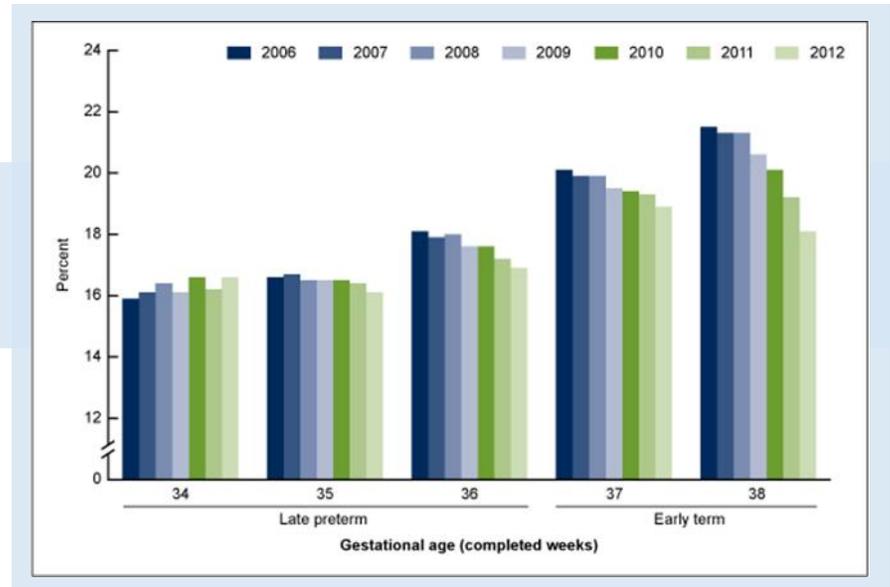


NOTES: Singletons only. Early preterm is less than 34 weeks of gestation; late preterm is 34–36 weeks; early term is 37–38 weeks; full term is 39–40 weeks; late term is 41 weeks; post term is 42 weeks or more.

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.
- The most recent changes occurred among early-term births, with induction rates declining at both 37 (down 6%) and 38 (down 16%) weeks.

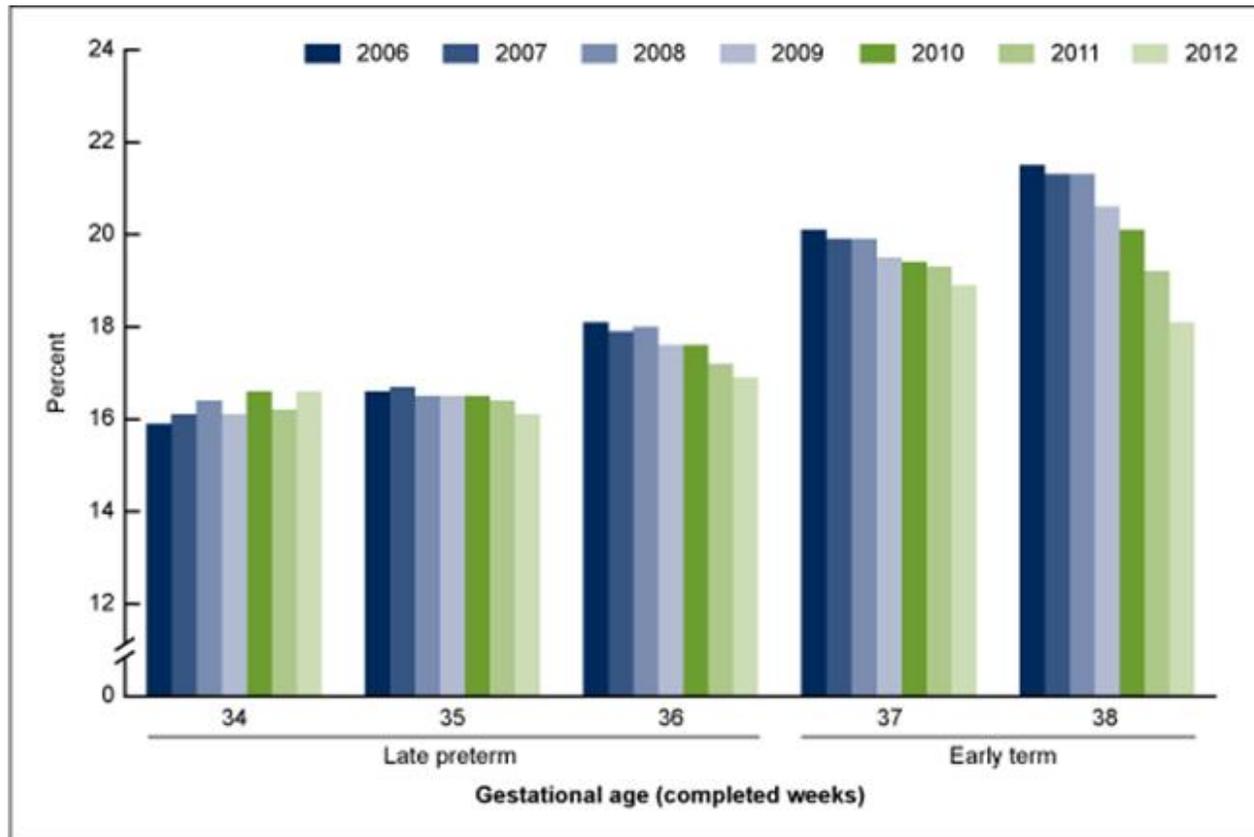
SOURCE: CDC/NCHS, National Vital Statistics System.



[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.





Prior to induction of labor, the following should be evaluated:

- Maternal Factors
 - Confirm indication for induction of labor
 - Ensure no contraindications to labor or vaginal delivery are present
 - Perform cervical exam and assign Bishop score
 - Review risks, benefits and alternatives of induction of labor with the patient
- Fetal/Neonatal Factors
 - Confirm gestational age
 - Estimate fetal weight by clinical or ultrasound exam
 - Determine fetal presentation
 - Confirm fetal well being



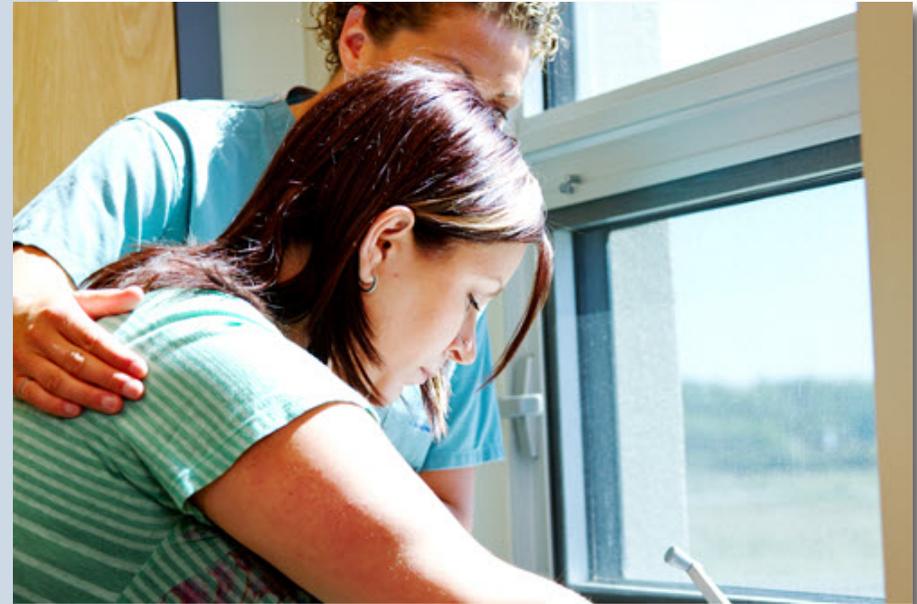
Risks of IOL

- 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].



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



- 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

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	-

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 [3]

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	

Cervical Ripening - Prostaglandins

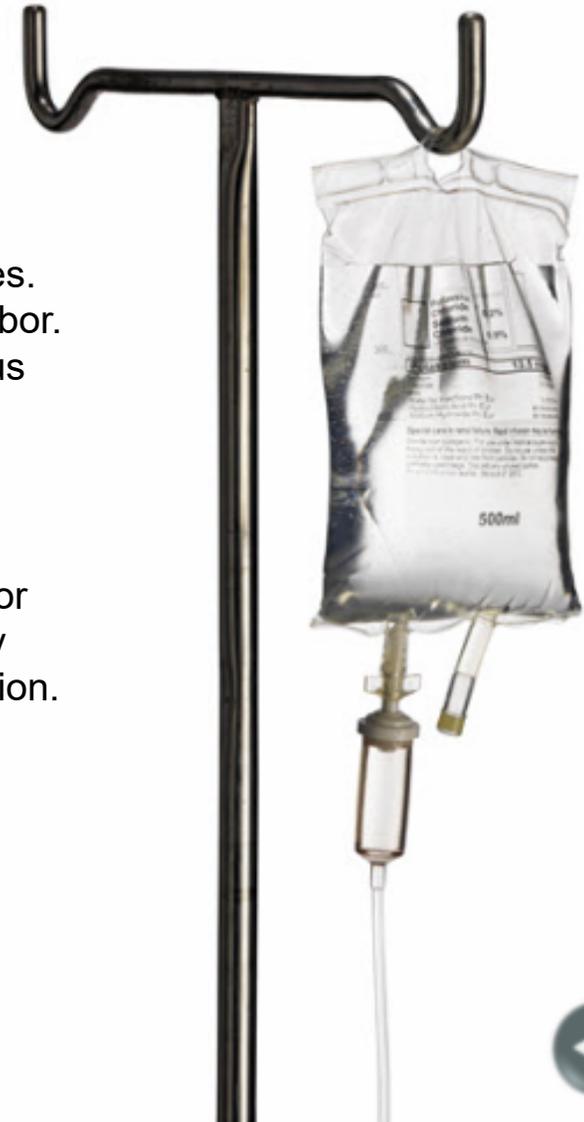
Misoprostol	Dinoprostone
Can be administered vaginally or orally	Available as a gel or vaginal insert.
Cervical ripening dose is typically 25 mcg every 3-6 hours.	The gel - Prepidil - contains 0.5 mg dinoprostone per 3-g syringe. The dose can be repeated in 6-12 hours.
When compared to dinoprostone, misoprostol was more effective in achieving vaginal delivery within 24 hours and required less oxytocin augmentation [3].	The vaginal insert - Cervidil - contains 10 mg dinoprostone in a timed-release formulation, releasing 0.3 mg/hr. This can be left in place for 12 hours.
Oral dosing appears comparable to vaginal with potentially less uterine tachysystole.	When compared to oxytocin use alone, it shortens induction-to-delivery interval, reduces oxytocin use and lowers risk of C/S [3].
Oral dosing obtains peak effect in 12-28 minutes and duration of action is 2 hours. Vaginal dosing obtains peak effect in 65-72 minutes and duration of action is at least 4 hours. Oral dosing can be repeated more frequently than vaginal dosing [3].	Most expensive. option for cervical ripening
Buccal and sublingual administration is not recommended for IOL.	
Inexpensive option.	

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



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.





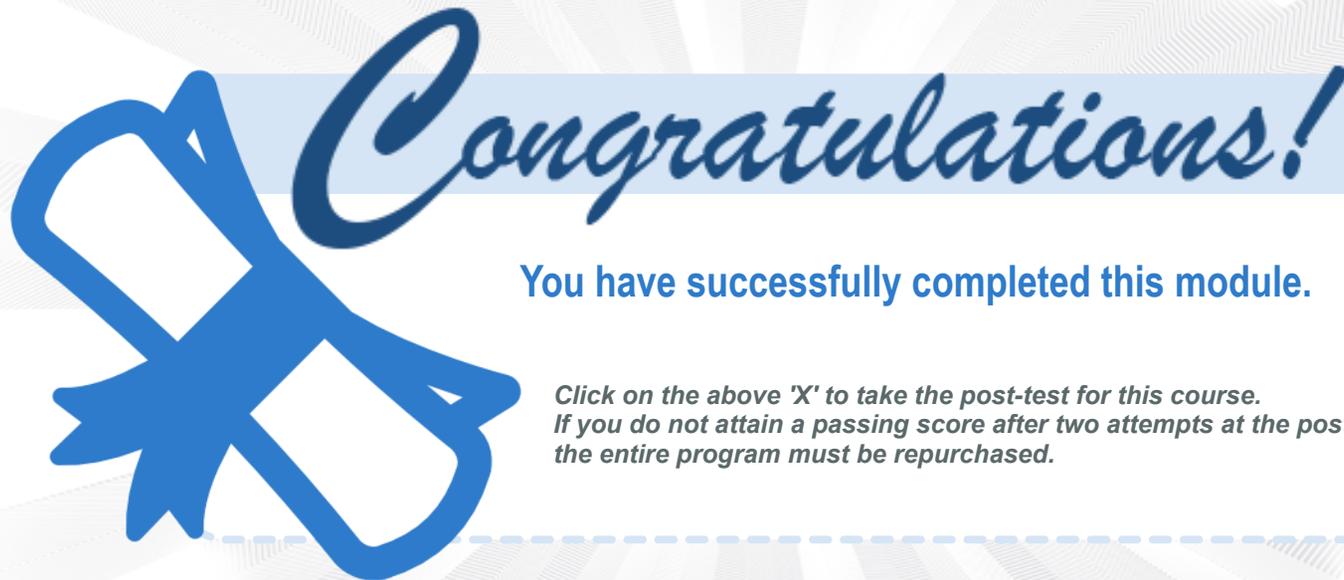
Limited data is available; however, IOL at term does not appear to be a risk of spontaneous preterm birth in subsequent pregnancies [10].

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.
2. Osterman, M. J., & Martin, J. A. Recent declines in induction of labor by gestational age. *NCHS Data Brief* 2014, Jun; (155): 1-8.
3. Gabbe, Steven, G., and Mark B. Landon. "Induction of Labor." *Gabbe's Obstetrics: Normal and Problem Pregnancies.* Elsevier, Philadelphia, PA, 2021 pp 226-239.
4. Cunningham F, Leveno KH, Bloom FL, Dashe JS, Hoffman BL, Casey BM, Spongy CY eds *Induction and Augmentation of Labor in Williams Obstetrics, 25e* McGraw Hill 2019
5. Grobman WA, Rice MM, Reddy UM, Tita AT, Silver RM, Mallett G, et al. Labor induction versus expectant management in low-risk nulliparous women. Eunice Kennedy shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. *N. Engl J Med* 2018; 379: 513-23.
6. Ornat L, Alonso-Ventura V, Buaon-Notivol J, Chedraui P, Perez-Lopez FR; Health Outcomes and Systematic Analysis (HOUSSAY) Research Group. Misoprostol combined with cervical single or double balloon catheters versus misoprostol alone for labor induction of singleton pregnancies: a meta-analysis of randomized trials. *J. Matern Fetal Neonatal Med.* 2020 Oct; 33 (20): 3453
7. Bishop, E. H. Pelvic scoring for elective induction. *Obstet Gynecol.* 1964;24:266.
8. ACOG Practice Bulletin No. 107. Induction of labor. American College of Obstetricians and Gynecologist. *Obstet Gynecol.* August 2009.
9. ACOG Practice Bulletin No. 561. Nonmedically indicated early-term deliveries. American College of Obstetricians and Gynecologist. *Obstet Gynecol.* April 2013.
10. Levine, L. D., Bogner, H. R., Hirshberg, A., Elovitz, M. A., Sammel, M. D., Srinivas, S. K. Term induction of labor and subsequent preterm birth. *Am J Obstet Gynecol.* 2014;210(4):354.e1.
11. Rosenstein MG, Cheng YW, Snowden JM, Nicholson JM, Caughey AB. Risk of stillbirth and infant death stratified by gestational age. *Obstet Gynecol.* 2012 Jul;120(1):16-82.
12. Clark, S., Belfort, M., Saade, G. et al. Implementation of a conservative checklist-based protocol for oxytocin administration: maternal and newborn outcomes. *Am J Obstet Gynecol* 2007; 197:480.e1-480.e5.