

## Induction of Labor

- E** There can be no doubt that elective induction for convenience of the practitioner or the patient is becoming more prevalent.
- E** Despite this, the American College of Obstetricians and Gynecologists does not support this practice, except for logistical reasons such as risk of rapid labor; the woman lives a long distance from the hospital, or for psychosocial indications.
- E** One reason is that induced labor is associated with an increased cesarean delivery rate, especially in nulliparas. **A number of investigators have reported that elective induction consistently results in a two- to threefold risk for cesarean delivery**
- E** For all of these reasons, we agree that routine elective induction at term cannot be justified. Cesarean delivery imposes increased risk for severe, albeit infrequent, adverse maternal outcomes including death
- E** Induction is indicated when the benefits to either the mother or the fetus outweigh those of continuing the pregnancy.
- E** Indications include emergent conditions such as ruptured membranes with chorioamnionitis or severe preeclampsia. More common indications include membrane rupture without labor, hypertension, nonreassuring fetal status, and postterm gestation
- E** Although induction is widely practiced for suspected fetal macrosomia, there is little evidence that it is of benefit.
- E** Women whose labor is induced have an increased incidence of chorioamnionitis and cesarean delivery compared with those in spontaneous labor. **In many cases, it seems that the uterus is simply poorly prepared for labor.**
- E** One example is an **"unripe cervix."** It is also likely that the increase in cesarean deliveries associated with induction is influenced by the duration of the induction attempt, especially in the circumstance of an unfavorable cervix.

## Contraindications

- E** Contraindications to labor induction are similar to those that preclude spontaneous labor or delivery. The most common example is a prior uterine disruption such as a classical incision or some type of uterine surgery that involved the myometrium. **Most types of placenta previa preclude labor. Labor prohibition due to fetal factors includes appreciable macrosomia, severe hydrocephalus, malpresentations, or nonreassuring fetal status.**

- E** The few maternal contraindications are related to small maternal size, distorted pelvic anatomy, and conditions such as active genital herpes infection or cervical cancer.

## Pre induction Cervical Ripening

- E** The condition of the cervix—or "favorability"—is important to the success of labor induction. One quantifiable method predictive of an outcome of labor induction is that described by Bishop.
- E** A **score of 9 conveys** a high likelihood for a successful induction

Bishop Scoring System Used for Assessment of Inducibility					
	Factor				
Score	Dilatation (cm)	Effacement (%)	Station (–3 to+3)	Cervical Consistency	Cervical Position
0	Closed	0–30	–3	Firm	Posterior
1	1–2	40–50	–2	Medium	Midposition
2	3–4	60–70	–1	Soft	Anterior
3	≥5	> 80	+1, +2	—	—

## 1. Pharmacological Techniques

### A. Prostaglandin E2 (dinoprostone, Prepidil and Cervidil)

- E** Local application of **prostaglandin E2 (dinoprostone)** is commonly used for cervical ripening.
- E** **Prostaglandin E2 gel (Prepidil)** is available in a 2.5-mL syringe for an intracervical application of 0.5 mg of dinoprostone.
- E** Owen and colleagues (1991) did a meta-analysis of 18 studies that included 1811 women. **They found that prostaglandin E2 improved Bishop scores and induction-to-delivery times when compared with those of untreated controls. Unfortunately, they found no benefit in lowering the cesarean delivery rate.** This finding may be the result of other factors. For example, Ramsey and colleagues (2002) reported that dinoprostone gel was more effective when the vaginal pH was greater than 4.5 compared with that of 4.5 or less.
- E** A **10-mg dinoprostone** vaginal insert (Cervidil) also is approved for cervical ripening. The insert provides slower release of medication (**0.3 mg/hr**) **than the gel**. As with dinoprostone gel, these inserts will shorten the induction-to-delivery interval. An advantage of the insert is that it can be removed should hyperstimulation occur.

## Administration

- ♥ Prostaglandin preparations should only be administered in or near the delivery suite and where uterine activity and fetal heart rate monitoring can be performed.
- ♥ When contractions occur, they are usually apparent in the first hour and show peak activity in the first 4 hours.
- ♥ Perry and Leaphart (2004) compared intracervical with intravaginal administration of the insert and found the latter to result in quicker delivery—11.7 versus 16.2 hours. When more than two sequential doses were used, Chan and associates (2004) reported that 59 percent of women required emergency cesarean delivery.
- ♥ Finally, according to manufacturer guidelines, oxytocin induction that follows prostaglandin use for cervical ripening should be delayed for **6 to 12 hours following prostaglandin E2 administration.**

## Side Effects

- Uterine tachysystole has been reported to follow vaginally administered prostaglandin E2 in **1 to 5 percent of women.**
- Because hyperstimulation that can cause fetal compromise may occur when prostaglandins are used with preexisting spontaneous labor, **such use is not recommended.**
- When hyperstimulation occurs with the 10-mg insert, its removal by pulling on the tail of the surrounding net will usually reverse this effect.
- Irrigation to remove the gel preparation has not been helpful.

## B. Prostaglandin E1

- a Misoprostol (Cytotec) is a synthetic prostaglandin E1, available as a 100- or 200-microg tablet for prevention of peptic ulcers.
- a It has been used "off label" for pre induction cervical ripening and may be administered orally or vaginally. The tablets are stable at room temperature. Misoprostol costs less than \$1 per 100-microg tablet compared with \$75 for the 0.5-mg dose of dinoprostone gel.
- a Despite this, in December 2000, the American College of Obstetricians and Gynecologists reaffirmed its recommendation for use of the drug because of proven safety and efficacy.

## Vaginal Administration

- ♠ Several investigators have reported that misoprostol tablets placed into the vagina were either superior to or equivalent in efficacy when compared with intracervical prostaglandin E2 gel.
- ♠ The Committee on Obstetrics of the American College of Obstetricians and Gynecologists (1999b) reviewed 19 randomized trials in which more than 1900 women were given intravaginal misoprostol in doses ranging from 25 to 200micro g. **The Committee on**

**Obstetrics recommended the use of a 25-microg intravaginal dose, which** is one fourth of a 100-micro g tablet.

- ♠ The drug is evenly distributed among these quartered tablets.
- ♠ Although Williams and colleagues (2002) showed that accurate dosing with 25 micro g is possible if the quartered tablets are individually weighed, this seems unnecessary.
- ♠ Also, although it may lower pH, moistening of misoprostol tablets **with 3-percent acetic acid solution does not improve efficacy.**
- ♠ Misoprostol use may decrease the need for oxytocin, achieve higher rates of vaginal delivery within 24 hours of induction, and reduce induction-to-delivery intervals.
- ♠ Data from the United Kingdom Cochrane Centre support these recommendations, but the investigators cautioned that increased uterine hyperstimulation with adverse fetal heart rate changes was of concern.
- ♠ A 50-micro g misoprostol intravaginal dose was associated with significantly increased **tachysystole, meconium passage, and meconium aspiration when compared with prostaglandin E2 gel.**
- ♠ A 25-microg dose was found comparable to dinoprostone.
- ♠ There is also an increased cesarean delivery rate due to uterine hyperstimulation when compared with that from dinoprostone.
- ♠ Uterine rupture has been reported with prostaglandin E1 use in women with a prior cesarean delivery.
- ♠ Plaut and associates (1999) described uterine rupture in 5 of 89 **(6 percent)** women with a prior cesarean incision who were induced with misoprostol.
- ♠ This finding is compared with only 1 of 423 such women not given misoprostol.
- ♠ Most now agree that prior uterine surgery, including cesarean delivery, precludes the use of misoprostol.

## Oral Administration

- ♥ Prostaglandin E1 tablets are also effective when given orally.
- ♥ Windrim and associates (1997) reported oral misoprostol to be of similar efficacy for cervical ripening as intravaginal administration.
- ♥ Wing and collaborators (1999) reported that 50 microg of oral misoprostol was less effective than 25 microg administered vaginally for cervical ripening.
- ♥ Subsequently, Wing and colleagues (2003) and Hall and associates (2002) reported that a 100 micro-g oral dose was as effective as the 25micro -g intravaginal dose.

## 2. Mechanical Techniques

### A. Transcervical Catheter

- E** Sherman and colleagues (1996) summarized the results of 13 trials with balloon-tipped catheters to effect cervical dilatation and concluded that, with or without saline infusion, the method resulted in rapid improvement in Bishop scores and shorter labors. Several comparative trials have been done.
- E** Huang and colleagues (2002) randomized 135 women to labor induction with vaginal misoprostol, an intrauterine extra-amnionic Foley catheter with bulb inflation to 30 mL, or both therapies. Outcomes were similar in all three groups, and there was no apparent benefit of combining these two techniques. Bujold and co-workers (2004) retrospectively compared women with a prior cesarean incision undergoing a trial of labor.
- E** They reported a lower incidence of success when induction by Foley catheter was compared with that by oxytocin—56 versus 78 percent. Culver and colleagues (2004) compared oxytocin plus an intracervical Foley catheter to 25 microg of misoprostol administered vaginally every 4 hours in women with a Bishop score less than 6.
- E** The mean induction-to-delivery time was significantly shorter in the catheter-plus-oxytocin group—16 versus 22 hours.
- E** The addition of extra-amnionic saline infusion (EASI), has been reported to significantly improve the Bishop score and decrease induction-to-delivery times when compared with that by (1) 50-microg intravaginal misoprostol tablets, (2) 0.5 mg of intracervical prostaglandin E2 or (3) 50-micro g oral misoprostol.
- E** Abramovici and co-workers (1999) studied nulliparas with a Bishop score of 5 or less, and reported that 85 percent of those induced by catheter infusion delivered within 24 hours compared with 55 percent of those given misoprostol

## **B. Hygroscopic Cervical Dilators**

- E** Cervical dilatation has been achieved with hygroscopic osmotic cervical dilators.
- E** These dilators have long been accepted as efficacious when inserted prior to pregnancy termination.
- E** More recently, they have also been used for cervical ripening before labor induction in pregnancies with a healthy fetus.
- E** The use of hygroscopic dilators appears to be safe, although anaphylaxis has followed laminaria insertion.
- E** The attraction of dilators is their low cost and ease of placement and removal.

## **C. Membrane Stripping**

- E** Induction of labor by membrane "stripping" is a common practice. The incidence of ruptured membranes, infection, and bleeding was not increased. Importantly, subsequent induction for postterm pregnancy at 42 weeks was significantly decreased with stripping.

## **Summary of Preinduction Cervical Ripening**

- E** Labor induction frequently is indicated when there is an "unripe" cervix. The preceding pre induction techniques may have some benefit when compared with no attempt at cervical ripening before oxytocin induction.
- E** That said, there are few data to support the premise that any of these techniques results in a reduction in cesarean delivery rates or in lower maternal or neonatal morbidity compared with women in whom such techniques are not used.

## Labor Induction and Augmentation with Oxytocin

- E** Synthetic oxytocin is one of the most commonly used medications in the United States. It was the first **polypeptide hormone synthesized**, and the 1955 Nobel Prize in chemistry was awarded for this (DuVigneaud and co-workers, 1953).
- E** Regarding labor, it has two uses. Induction implies stimulation of contractions before the spontaneous onset of labor, with or without ruptured membranes.
- E** Augmentation refers to stimulation of spontaneous contractions that are considered inadequate because of failure of progressive cervical dilatation and fetal descent. With oxytocin use, the American College of Obstetricians and Gynecologists (1999a) recommends fetal heart rate and contraction monitoring similar to that for any high-risk pregnancy.
- E** Contractions can be monitored either by palpation or by electronic means of recording uterine activity. Uterine contraction pressures cannot be accurately quantified by palpation.

## Intravenous Oxytocin Administration

- E** The goal of induction or augmentation is to effect uterine activity sufficiently to produce cervical change and fetal descent while avoiding development of a nonreassuring fetal status.
- E** Oxytocin should be discontinued if the number of contractions persists with a frequency greater than five in a **10-minute period or seven in a 15-minute** period or with a persistent nonreassuring fetal heart rate pattern.
- E** Discontinuation of oxytocin nearly always rapidly decreases the frequency of contractions. When oxytocin is stopped, its concentration in plasma rapidly falls because the mean half-life is approximately 5 minutes.
- E** Seitchik and co-workers (1984) **found that a uterine response occurs within 3 to 5 minutes of beginning an oxytocin infusion and that a plasma steady state is reached in 40 minutes.**
- E** Response depends on preexisting uterine activity, cervical status, pregnancy duration, and individual biological differences.
- E** Caldeyro-Barcia and Poseiro (1960) **reported that the uterine response to oxytocin increases from 20 to 30 weeks and increases rapidly at term.**

## Oxytocin Dosage

- E** Oxytocin usually is diluted into 1000 mL of a balanced salt solution and administered by infusion pump.
- E** A typical oxytocin infusate consists of 10 or 20 units—or 10,000 to 20,000 mU—mixed into 1000 mL of lactated Ringer solution. This mixture results in an oxytocin concentration of 10 or 20 mU/mL, respectively.
- E** To avoid bolus administration, the infusion should be inserted into the main intravenous line close to the venipuncture site. The American College of Obstetricians and Gynecologists (1999a) recommends a number of oxytocin regimens for labor stimulation.
- E** Until about 15 years ago, only variations of low-dose protocols were used in the United States. In 1984, O'Driscoll and colleagues described a protocol for the active management of labor that called for oxytocin at a starting dosage of 6 mU/min and advanced in 6-mU/min increments.
- E** Following this, various trials during the 1990s compared **high-dose (4 to 6 mU/min)** versus conventional low-dose (**0.5 to 1.5 mU/min**) regimens both for labor induction and for augmentation

#### Low-Dose and High-Dose Oxytocin Regimen for Stimulation of Labor

Regimen	Starting Dose (mU/min)	Incremental Increase (mU/min)	Dosing Interval (min)
Low-dose	0.5–1	1	30–40
	1–2		15
High-dose	6	6	15
	6	6, 3, 1	20–40

#### Interval between Incremental Dosing

#### Maximal Dosage

The maximal effective dose of oxytocin to achieve adequate contractions in all cases is not known.

#### Risks Versus Benefits

- Z** Unless the uterus is scarred, uterine rupture associated with oxytocin infusion is rare, even in parous women.

- Z** Oxytocin has amino-acid homology similar to arginine vasopressin. Thus, not surprisingly, it has significant antidiuretic action and when infused at 20 mU/min or more, renal free water clearance decreases markedly.
- Z** If aqueous fluids are infused in appreciable amounts along with oxytocin, water intoxication can lead to convulsions, coma, and even death.

## **Uterine Contraction Pressures**

- E** Contraction forces in spontaneously laboring women range from 90 to 390 Montevideo units. The latter are calculated by subtracting the baseline uterine pressure from the peak contraction pressure for each contraction in a 10-minute window and adding the pressures generated by each contraction.
- E** Caldeyro-Barcia and associates (1950) and Seitchik and colleagues (1984) found that the mean or median spontaneous uterine contraction pattern resulting in a progression to a vaginal delivery was between 140 and 150 Montevideo units.
- E** However, in the management of active-phase arrest of labor, and with no contraindication to intravenous oxytocin, decisions must be made with knowledge of the safe upper range of uterine activity.
- E** More data are needed regarding the precise safety and efficacy of contraction patterns in subgroups of women with a prior cesarean delivery, with twins, or with an overdistended uterus.

## **Duration of Oxytocin Administration**

The American College of Obstetricians and Gynecologists (1989, 1995a) has defined arrest in first-stage labor as a completed latent phase along with contractions exceeding 200 Montevideo units for more than 2 hours without cervical change.

## **Amniotomy**

- E** A common indication for amniotomy includes the need for direct monitoring of the fetal heart rate or uterine contractions, or both.
- E** To minimize the risk of cord prolapse when membranes are ruptured artificially, care should be taken to avoid dislodging the fetal head.
- E** Fundal or suprapubic pressure, or both, may reduce the risk of cord prolapse. Some clinicians prefer to rupture membranes during a contraction.
- E** If the vertex is not well applied to the lower uterine segment, a gradual egress of amniotic fluid can be accomplished by several membrane punctures with a 26-gauge needle held with a ring forceps and with direct visualization using a vaginal speculum.
- E** The fetal heart rate should be assessed before and immediately after amniotomy.

## **Elective Amniotomy**



- Membrane rupture with the intention of accelerating labor is commonly performed. Amniotomy at about 5 cm accelerated spontaneous labor by 1 to 2 hours.
- This procedure was performed without increasing the overall cesarean delivery rate or the use of oxytocin stimulation.
- Although mild and moderate cord compression patterns were increased following amniotomy, cesarean delivery for fetal distress was not increased.
- Most importantly, there were no adverse perinatal effects

## Amniotomy Induction

- Artificial rupture of the membranes can be used to induce labor, but it implies a commitment to delivery.
- The main disadvantage of amniotomy when used alone for labor induction is the unpredictable and occasionally long interval to the onset of contractions.
- Early amniotomy was associated with significantly shorter labor by approximately 4 hours

## Amniotomy Augmentation

- It is common practice to perform amniotomy when labor is abnormally slow. As an adjunct to oxytocin infusion, however, amniotomy did not affect the route of delivery.