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# INDUCTION OF LABOUR AT TERM

*This guideline has been reviewed by the Maternal Fetal Medicine Committee and the Clinical Practice Obstetrics Committee, and approved by Council of the Society of Obstetricians and Gynaecologists of Canada.*

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**Abstract**

**Objectives:** To review indications and contraindications of induction of labour and to summarize methods of cervical ripening and labour induction, including their effectiveness and safety.

**Options:** Clinical situations in which cervical ripening or labour induction is considered.

**Outcomes:** Success of cervical ripening and labour induction, including induction to delivery intervals, maternal morbidity, including Caesarean delivery rates, and perinatal morbidity and mortality.

**Evidence:** Medline search 1966 to June 2000 for English language articles related to cervical ripening or induction of labour, the Cochrane Library, the Cochrane Collaboration, and other national bodies including the American College of Obstetricians and Gynecologists and the Royal College of Obstetricians and Gynaecologists.

**Values:** The evidence obtained was reviewed and evaluated by the Maternal-Fetal Medicine Committee of the Society of Obstetrics and Gynaecology of Canada under the leadership of the principal author and recommendations were made according to guidelines developed by the Canadian Task Force on the Periodic Health Exam.

**Benefits, harms, and costs:** Cervical ripening prior to labour induction in the presence of an unfavourable cervix reduces the likelihood of not being delivered in 12 and 24 hours, lowers the epidural anesthesia rate, decreases Caesarean delivery and operative vaginal delivery rates, but increases the rate of uterine hypertonus. There is limited information on the dosing of $PGE_2$ gel, its use in an outpatient setting, level of monitoring required, and the use of oxytocin after $PGE_2$ gel administration. Controlled-release prostaglandin appears to be an effective cervical ripening agent, but when compared with intracervical $PGE_2$ gel may result in a higher rate of excessive uterine activity. Further studies of controlled-release prostaglandin with larger sample sizes are needed to assess maternal morbidity and perinatal outcomes. Misoprostol is effective in cervical ripening, and the vaginal form may result in a lower Caesarean delivery rate compared to other forms of cervical ripening, but a higher rate of excessive uterine activity. There does not appear to be a difference in neonate intensive care unit admissions or low five minute Apgar scores. The ideal route, dose, and frequency of misoprostol for cervical ripening has yet to be determined. Insertion of a Foley urinary catheter through the cervix appears to be effective in cervical ripening, but further research is needed in this area. In the presence of a favourable cervix, the use of oxytocin from the time of amniotomy results in a higher rate of delivery in 12 and 24 hours and a lower rate of operative delivery, compared with amniotomy alone. The ideal dosing regime of oxytocin is not known, but increasing intervals no more frequently than every 30 minutes is appropriate. The best dosing regime of prostaglandin for labour induction with a favourable cervix is not known. When compared with oxytocin for labour induction, prostaglandin reduces the likelihood of operative delivery and failed induction but increases the rate of gastrointestinal side effects and fever (likely due to the fact that intravenous prostaglandins were used in several studies). Sweeping membranes promotes onset of labour but does not seem to produce important benefits on maternal and neonatal outcomes, and thus must be weighed against discomfort and other adverse effects such as bleeding and uterine irritability.

**Recommendations:** The indication for induction of labour should be discussed with the patient along with the benefits and potential risks. If the cervix is unfavourable, ripening of the cervix should be considered before labour induction. Artificial rupture of membranes in association with oxytocin administration or prostaglandins can be used to induce labour with a favourable cervix.

**Validation:** These guidelines have been reviewed and approved by the Maternal-Fetal Medicine and the Clinical Practice Obstetrics Committees of the Society of Obstetricians and Gynaecologists of Canada, and approved by its Council.

**Sponsor:** The Society of Obstetricians and Gynaecologists of Canada.



FOR INFORMATION ON THE SELF-DIRECTED LEARNING EXERCISE SEE PAGE 745.

## INTRODUCTION

Induction of labour is the artificial initiation of labour before its spontaneous onset for the purpose of delivery of the feto-placental unit. The rate of induction of labour varies by location and institution but appears to be increasing. The objective of this guideline is to summarize current methods of cervical ripening and labour induction, and to review their safety and effectiveness. Sources of information include MedLine, the Cochrane Library, the Cochrane Collaboration, guidelines from other national bodies including the American College of Obstetricians and Gynecologists and the Royal College of Obstetricians and Gynaecologists, and the Compendium of Pharmaceuticals and Specialties. References from the identified publications were manually searched and cross-referenced to identify additional relevant articles. The quality of evidence was evaluated and recommendations were made according to guidelines developed by the Canadian Task Force on the Periodic Health Exam (Health Canada).[1]

## INDICATIONS

Induction should be considered when it is felt that the benefits of vaginal delivery outweigh the potential maternal and fetal risks of induction. These issues should be discussed with the woman prior to initiation of induction.

One of the most common indications for induction is post-term pregnancy with a gestational age of at least 41 completed weeks. Induction for this indication has been shown to reduce the likelihood of perinatal death.[2,3] Other indications for induction include premature rupture of membranes,[4-6] potential fetal compromise (significant fetal growth restriction, non-reassuring fetal surveillance), maternal medical conditions (type I diabetes, renal disease, significant pulmonary disease, hypertension-gestational or chronic), antiphospholipid syndrome, suspected or proven chorioamnionitis, abruption, and fetal death. This list is not meant to be all inclusive.

Induction is sometimes performed for "social" or "geographic" reasons, without a medical or obstetric indication.[7,8] There have been few well designed studies evaluating induction for this indication, with no randomized clinical trials since 1983.[9,10] Two early randomized clinical trials[11,12] suggest no increased risks to the mother or fetus, but the sample size did not provide adequate power to make these conclusions. A retrospective study[13] concluded that elective induction should be discouraged in the nulliparous woman, since the rate of Caesarean delivery is increased with elective induction. A case control study[14] did not find elective induction itself to be predictive of Caesarean delivery. A meta-analysis of early trials concluded that there is no benefit to elective induction and there is no place for it in term pregnancy.[9] The American College of Obstetricians and Gynecologists suggests that labour may be induced for logistic reasons, including risk of rapid labour, distance from hospital, and psychosocial reasons.[15]

## RISKS

Potential risks of induction include increased rate of operative vaginal delivery,[9] Caesarean birth,[13,16] excessive uterine activity,[17] abnormal fetal heart rate patterns,[17] uterine rupture,[18] maternal water intoxication,[19] delivery of preterm infant due to incorrect estimation of dates, and possibly cord prolapse with artificial rupture of membranes.

## CONTRAINDICATIONS

The contraindications to induction of labour include contraindications to labour or vaginal delivery. Examples of this include previous myomectomy entering the uterine cavity, previous uterine rupture, fetal transverse lie, placenta previa, vasa previa, invasive cervical cancer, active genital herpes, and previous classical or inverted T uterine incision (except in unusual circumstances such as extreme prematurity).

## PREREQUISITES

Prior to initiation of induction the following should be assessed:

- indication for induction/any contraindications
- gestational age
- cervical favourability (Bishop score assessment, Table 1)[20]
- assessment of pelvis and fetal size/presentation
- membrane status (intact or ruptured)
- fetal wellbeing/fetal heart rate monitoring prior to labour induction
- documentation of discussion with the patient including indication for induction and disclosure of risk factors

### RECOMMENDATIONS

1. As elective induction is associated with potential complications it should be discouraged, and only undertaken after fully informing the woman of these risks and establishing accurate gestational age.[21] (II-2 B)
2. If induction of labour is being considered the following

TABLE 1

**PRE-INDUCTION CERVICAL SCORING**

| | Points Assigned | | | |
|---|---|---|---|---|
| **Factor** | **0** | **1** | **2** | **3** |
| Dilatation (cm) | 0 | 1-2 | 3-4 | 5-6 |
| Effacement (%) | 0-30 | 40-50 | 60-70 | 80 |
| Station | -3 | -2 | -1 or 0 | +1 or +2 |
| Consistency | Firm | Medium | Soft | |
| Position | Posterior | Mid | Anterior | |

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should be addressed: indication for induction, any contraindications, gestational age, cervical favourability, fetal presentation, potential for cephalopelvic disproportion, fetal wellbeing/fetal heart rate, and membrane status. (III B)

## CERVICAL RIPENING PRIOR TO INDUCTION

The state of the cervix is one of the important predictors of successful labour induction. In 1964, Bishop described a scoring system based on cervical examination that predicted vaginal delivery in multiparous women.[20] If the cervix is unfavourable (Bishop score ≤ 6), cervical ripening is warranted prior to labour induction. There are several methods available:

- prostaglandin $PGE_2$ gel
- intracervical $PGE_2$ gel
- intravaginal $PGE_2$ gel
- controlled-release $PGE_2$
- misoprostol
- mechanical methods

Each of these methods will be addressed individually.

### PROSTAGLANDIN

Intracervical $PGE_2$ gel (dinoprostone: Prepidil®) 0.5 mg and intravaginal $PGE_2$ gel (dinoprostone: Prostin®) 1 mg and 2 mg are marketed for cervical ripening. When compared with placebo or no treatment, a meta-analysis has concluded that the use of prostaglandins for cervical ripening does ripen the cervix, reduces the likelihood of not being delivered in 24 hours, and decreases the use of oxytocin for augmentation.[17] There was a higher rate of "uterine hypertonus" or "uterine hyperstimulation" in those receiving prostaglandins.[17]

#### Intracervical compared with intravaginal $PGE_2$ gel

A meta-analysis of initial studies[22-25] suggested that delivery within 12 hours occurred more often with intracervical than with intravaginal gel but noted no other differences.[26] The choice of route, therefore, could be based on the preferences of the woman and caregivers (related to the ease of administration and comfort). More recent studies have noted a higher success rate of induction,[27,28] increased ease of administration,[29,30] greater change in Bishop score,[29,31] and shorter induction to delivery times[28,31] with vaginal gel. Therefore, there may be some potential advantages to the use of vaginal prostaglandin over intracervical prostaglandin. A more recent meta-analysis concluded there was insufficient data to make any meaningful conclusions for the comparison of vaginal $PGE_2$ and intracervical $PGF_2\alpha$.

#### Dosing of $PGE_2$ gel

There is limited information regarding most appropriate dose, the dosing interval, and maximum dose of prostaglandin $E_2$ gel. The manufacturers of intravaginal dinoprostone recommend an initial dose of 1 mg, and then a dose of 1 mg or 2 mg repeated six hours later if necessary.[32] Several studies have examined different dosing regimes, with doses ranging from 0.5 mg intracervically every six hours up to three doses,[26-30] 1 mg vaginally every six hours up to three doses,[26,27] 2 mg vaginally every six hours up to three doses,[27,28] 2 mg vaginally every 12 hours up to three doses,[33] 0.5 mg intracervically every six hours up to four doses (over two days),[31] 0.5 mg intracervically three times a day up to two days.[34] One study evaluated intravaginal $PGE_2$ gel dosing every six hours compared with every hour.[35] The mean number of doses was 4.4 ± 3.6 in the six hour group and 6.5 ± 5.9 in the one hour group. There was no significant advantage to dosing every hour.[35]

#### Outpatient Use Of Prostaglandin

There have been few published studies of outpatient use of prostaglandin gel for cervical ripening. Several small trials[36-45] suggest outpatient use may be appropriate in selected women, but further studies are needed to evaluate this practice in order to assess maternal and neonatal outcomes with adequate power.

#### The Use Of Oxytocin After Prostaglandin Gel

There are no randomized clinical trials comparing different timing of the use of oxytocin after prostaglandin gel. The manufacturer of intravaginal dinoprostone suggests a minimum of 12 hours,[32] while the manufacturer of intracervical dinoprostone suggests a minimum of six hours.[46] Many studies have employed the use of oxytocin six hours after the last prostaglandin gel dose[27,29,30,34] with a range of zero to 24 hours.[17,47]

#### Monitoring With Prostaglandin Gel

There are no randomized trials evaluating the level or duration of fetal heart rate and uterine activity monitoring required after prostaglandin gel dosing. The manufacturers do not comment on monitoring specifically.[32,46] The pattern of uterine activity with prostaglandin gel suggests that contractions usually start one hour after PG gel application and peak in the first four hours.[48] Most studies suggest monitoring 30 minutes to two hours after administration of gel and to continue monitoring if regular uterine contractions are noted.

### CONTROLLED-RELEASE PROSTAGLANDIN

A controlled-release prostaglandin $E_2$ vaginal insert (dinoprostone) is available in Europe (Propess®), and the United States and Canada (Cervidil®).[49,50] In the United States it was approved by the Food and Drug Administration in 1995 and in Canada it was approved in 1998 by the Therapeutic Products Program of Health Canada. The controlled-release insert consists of a polymer base containing 10 mg of dinoprostone with a polyester retrieval string. The insert releases 0.3 mg per hour of prostaglandin $E_2$ over a 12 hour period and is placed in the posterior fornix of the vagina.[50] It is removed with the onset

of labour, spontaneous rupture of membranes, excessive uterine activity, or after 12 hours. Theoretical advantages include the ability of insertion without the use of a speculum, a slow continuous release of prostaglandin, only one dose being required, the ability to use oxytocin 30 minutes after its removal, and the ability to remove the insert if required (such as with excessive uterine activity). The manufacturer of controlled-release prostaglandin indicates it should not be used with ruptured membranes. Several studies have compared it to placebo demonstrating that it is effective in cervical ripening but has a higher incidence of excessive uterine activity and hyperstimulation.[51-54] Four published randomized trials have compared it to prostaglandin $E_2$ intracervical gel with varying results, depending on the dosing regime of gel used. When compared with intracervical dinoprostone given according to the manufacturer's directions, there was a higher rate of excessive uterine activity with controlled-release prostaglandin but less need for oxytocin.[55,56] When compared with intracervical dinoprostone combined with immediate oxytocin there was a lower rate of delivery in 12 hours with controlled-release prostaglandin.[54,57,58] When compared with misoprostol there was a lower rate of vaginal delivery in 12 hours and a higher rate of oxytocin use with controlled-release prostaglandin.[54,59,60] The induction to delivery interval was shorter with controlled-release prostaglandin than with placebo or intracervical dinoprostone (mean difference of 5.4 hours), but longer than with intracervical dinoprostone combined with immediate oxytocin (mean difference of 13.3 hours). Although no differences were seen in maternal morbidity (such as Caesarean delivery) or neonatal outcomes, the sample sizes of these studies were not adequate to evaluate these outcomes.

Few studies have evaluated the cost effectiveness of controlled-release prostaglandin. Proposed financial advantages include the need for only one dose and shorter time from induction to delivery in some studies. Stewart *et al.*[57] found an 11 percent cost reduction with intracervical dinoprostone compared with controlled-release prostaglandin but this was not statistically significant. It should be noted that this study used intracervical dinoprostone followed by immediate oxytocin, which is not recommended by the manufacturer.

The randomized studies published do not appear to indicate any increase in adverse neonatal outcomes (such as Apgar score less than 7 at 1 and 5 minutes, pH less than 7.2, neonate intensive care unit (NICU) admission, meconium), but the number of neonates in these studies is not large enough to rule out these rare outcomes. There does not appear to be an increase in maternal side effects, such as nausea, vomiting, diarrhea, fever or postpartum hemorrhage, but again the number of women is relatively small. The manufacturer reports that data from over 2000 women treated with controlled-release prostaglandin provided no evidence to suggest that the retrieval string was a source of bacterial infection to enter the reproductive tract. This information, however, is not published in peer-reviewed literature. The manufacturer reports on adverse events from 320 patients receiving controlled-release prostaglandin with and without retrieval systems. Hyperstimulation with non-reassuring fetal heart rate occurred in 2.8 percent of women, and "hyperstimulation without fetal heart rate abnormalities" occurred in 4.7 percent. In 102 patients with the retrieval system, 2.9 percent of women had excessive uterine activity with abnormal fetal heart rates, and two percent had excessive uterine activity without abnormal fetal heart rates.[50]

The manufacturer of controlled-release prostaglandin does not specifically comment on monitoring, but does state that patients should remain in supine position for two hours following insertion but thereafter may be ambulatory.[50] Despite its "controlled-release" and retrieval string, uterine hyperstimulation has been reported with controlled-release prostaglandin, occurring 0.4 hours to 12 hours after insertion.[51-53,56,58,59] The majority of these episodes resolve after removal of the device but some require the use of a tocolytic,[51,53,56,59] with a case being described of Caesarean delivery for non-reassuring fetal heart rate due to hyperstimulation.[58] The American College of Obstetricians and Gynecologists recommends the fetal heart rate and uterine activity be continuously monitored electronically for the duration of insert placement and for 15 minutes after its removal.[61] Some authors agree with the approach of continuous monitoring.[52,53,59] However, since there have been no randomized trials to evaluate monitoring with controlled-release vaginal prostaglandin insert, the appropriate type of fetal surveillance is not clear at this time. There does not appear to be sufficient data in randomized trials to make a strong recommendation for or against monitoring.

#### Recommendations

3. If the cervix is unfavourable, ripening of the cervix should be considered prior to induction of labour. (II-2 A)
4. The use of a dosing interval of prostaglandin gel every six to 12 hours up to three doses is recommended; however, some studies have suggested additional doses. (I to II-3 B)

### OXYTOCIN FOR CERVICAL RIPENING

#### Recommendation

5. A meta-analysis of five trials has concluded that the use of oxytocin to ripen the cervix is not effective.[62] (I E)

### MISOPROSTOL

Misoprostol is an inexpensive synthetic prostaglandin E1 analog marketed for prevention and treatment of NSAID gastric and duodenal ulcers. Studies suggest that vaginal misoprostol is effective as a cervical ripening and labour induction agent.[63-68] Although no differences in maternal and perinatal outcomes were

noted, earlier studies were not large enough to evaluate these rarer outcomes. Misoprostol has not been approved for induction of labour by the Therapeutic Products Program of Health Canada or the United States Food and Drug Administration, and the manufacturer is not interested in pursuing its use for this indication.

There is some concern that the use of misoprostol may provoke excessive uterine activity leading to hyperstimulation.[64,66] A meta-analysis from the Cochrane Database concluded that although vaginal misoprostol appears to be more effective in inducing labour than conventional methods, it may result in an increase in uterine hyperstimulation, and therefore that further research is needed.[64] A meta-analysis by Sanchez-Ramos *et al.* has concluded that although there was a higher rate in tachysystole (20.1% misoprostol, 8.2% control) and hyperstimulation (5.8% misoprostol, 3.4% control) with misoprostol (OR = 2.98, 95% CI 2.43-3.66 and OR = 1.73, 95% CI 1.25-2.40 respectively), there were no significant differences in NICU admissions (13.8% misoprostol, 13.6% control) or Apgar score less than seven at five minutes (1.4% misoprostol, 1.4% control).[68] It was also noted that there was a shorter induction to delivery interval with misoprostol and a lower Caesarean delivery rate (17.3% versus 22.9%, OR = 0.88, 95% CI 0.77-0.99).[68]

Other potential benefits of misoprostol lie in the fact that it is much cheaper than currently available induction agents and is easily stored and stable at room temperature. Its ease of administration may also be of benefit if oral misoprostol is shown to be safe and effective.

Oral misoprostol has also been studied with conflicting results.[68-74]

Further studies are needed to determine the ideal route, dose, and frequency of misoprostol for cervical ripening. If vaginal misoprostol is to be used for cervical ripening, it is recommended that lower doses of 25 µg every four to six hours be used, as higher doses may be associated with more excessive uterine activity.[68,75] The American College of Obstetricians and Gynecologists describes the use of misoprostol for cervical ripening and labour induction but acknowledges that the Food and Drug Administration has not approved misoprostol for this use.[15,75,76] The Royal College of Obstetricians and Gynaecologists recommends that until the best dose regime is determined, misoprostol's use should be confined to clinical trials.[77]

#### Recommendation

6. Since the best dose and route of misoprostol for labour induction with a live fetus are not known and there are concerns regarding hyperstimulation, misoprostol's use for induction of labour should be within clinical trials. (I B)

### MECHANICAL METHODS

Mechanical methods of cervical ripening have been described, including the Foley catheter (with and without extraamniotic saline infusion), natural dilators (lamineria), and synthetic dilators. The mechanisms of action for mechanical methods include dilation of the cervix through mechanical pressure and increased prostaglandin production.[78-80] Advantages proposed for these mechanical methods include simplicity of use, potential for reversibility, reduction in certain side effects such as excessive uterine activity, and low cost.[80,81]

#### Foley Catheter

For cervical ripening, a no. 18 Foley catheter is introduced into the intracervical canal under sterile technique past the internal os and the bulb is then inflated with 30 to 60 cc of water.[41,82-84] The catheter is then left in place until it spontaneously falls out or up to 24 hours. Some place a small degree of traction on the catheter by taping it to the inside of the leg[41,82-84] or infuse extra-amniotic saline through the catheter.[85-89] A double balloon device has also been used.[90] Contraindications to the Foley catheter include low lying placenta, with relative contraindications being antepartum bleeding, rupture of membranes, and cervicitis. No randomized trials of the Foley catheter have specifically examined patients with a previous Caesarean delivery.

Compared with prostaglandin gel, several investigators have found that the Foley catheter results in no difference in operative delivery rates or maternal or neonatal morbidity.[41,81-87,91,92] One study involving the Foley catheter with extraamniotic saline did find a higher Caesarean delivery rate in the Foley catheter group.[88]

Several studies have found that although the cervix may be three to four cm dilated with the Foley catheter, this group was more likely to need oxytocin for induction or augmentation.[41,81,86,91] Some studies noted a shorter induction to delivery interval with the Foley catheter,[81,82,84,85,89,91] while others noted no difference.[41,83,86,90]

Thus, the heterogeneous results of these studies do not allow firm conclusions to be drawn about the effectiveness of the Foley catheter in comparison to other methods. Further research is needed in this area.

#### Hydroscopic Dilators

Hydroscopic dilators (natural or synthetic) have also been used to ripen the cervix.[93-101] Several studies, however, have reported a higher infection rate with this method of cervical ripening.[98,100,101]

### MANAGEMENT OF EXCESSIVE UTERINE ACTIVITY WITH CERVICAL RIPENING

Excessive uterine activity may occur during cervical ripening. Tachysystole has been defined as more than five contractions in 10 minutes (or more than 10 in 20 minutes), hypertonus as a contraction lasting more than 120 seconds, and hyperstimulation as excessive uterine activity with a nonreassuring fetal heart rate tracing.[102]

**RECOMMENDATION**

7. When excessive uterine activity occurs, especially if associated with a nonreassuring fetal heart rate pattern, one should attempt to correct the abnormal uterine activity. If a controlled-release prostaglandin is in place it should be removed. If a vaginal/intracervical prostaglandin is being used, one should attempt to remove any remaining prostaglandin, stop oxytocin if infusing, and do supportive/resuscitative measures such as maternal left lateral position and oxygen by mask. (III B)

If excessive uterine activity with nonreassuring fetal heart rate activity persists, a tocolytic can be administered. Options include terbutaline 250 µg subcutaneously or intravenously,[103] nitroglycerine 50 to 200 µg intravenously, or one to two metered doses (400-800 µg) of sublingual spray.[104]

## LABOUR INDUCTION

Several options are available for labour induction. These include amniotomy, oxytocin, prostaglandins, and mechanical methods of labour induction (such as sweeping membranes).

### OXYTOCIN FOR LABOUR INDUCTION (WITH AMNIOTOMY)

Intravenous oxytocin has been widely used since the 1950s for induction of labour.[105] It has a half life of five to12 minutes,[106,107] a time to study plasma concentration of 40 minutes,[106,108] and a steady state uterine response of 30 minutes or longer.[109] A meta-analysis of amniotomy and oxytocin has shown that those who receive oxytocin from the time of amniotomy were more likely to be delivered within 12 hours and within 24 hours than those who had amniotomy alone, and were less likely to have operative delivery.[110] This must be weighed against the disadvantages of having an intravenous and monitoring that may restrict mobility.

The ideal dosing regime of oxytocin is not known; however, a meta-analysis has found that increasing no more frequently than every 30 minutes resulted in fewer episodes of excessive uterine activity, a higher rate of spontaneous vaginal delivery, a lower rate of postpartum maternal infection and postpartum hemorrhage, and a trend towards a lower rate of Caesarean delivery.[111] A subsequent double blind study found a shorter induction to delivery time with a high dose protocol (4.5 mu/min increasing every 30 minutes versus 1.5 mu/min increasing every 30 minutes) and a trend towards a lower Caesarean delivery rate for dystocia in nulliparous women, but more excessive uterine activity in this last group.[112] The trials of low dose oxytocin used several different protocols. Most had a starting dose of 0.5 to 2.0 mu/min, increments of 1.0 mu/min to doubling of the dose, intervals of every 30 to 60 minutes, and a maximum dose ranging from 16 mu/min to 40 mu/min.[111] The American College of Obstetricians and Gynecologists, however, feels that both low dose and high dose protocols can be used.[19] Dawood *et al.* noted that most women achieved adequate uterine activity with 12 mu/min of oxytocin.[113]

A common concentration that is used for oxytocin is 10 IU of oxytocin in one litre of balanced solution (such as normal saline or Ringer's lactate). During labour induction with oxytocin fetal heart rate and uterine activity should be assessed and documented with each increasing dose. The oxytocin dose should be titrated to obtain adequate uterine activity. By using the above protocols, water intoxication becomes an infrequent issue.

There have been no randomized trials of the level of fetal heart rate monitoring required specifically for women undergoing labour induction. As close assessment of uterine activity and fetal heart rate is required when titrating the oxytocin dose, continuous fetal heart rate monitoring and uterine activity monitoring is often used during this time period.

**RECOMMENDATIONS**

8. When using oxytocin to induce labour use the minimum dose to achieve active labour, increasing intervals no more frequently than every 30 minutes. (I to II-3 B) Once a dose of 20 mu/min is reached, reassessment is reasonable. (III C)
9. If excessive uterine activity occurs with a normal fetal heart rate pattern, one may initially decrease the oxytocin infusion rate and then reassess uterine activity to determine if any further interventions are required. (III B)
10. If excessive uterine activity (greater than five contractions in 10 minutes or contractions lasting longer than 120 seconds) occurs with a non-reassuring fetal heart rate pattern, the intravenous oxytocin infusion should be discontinued to correct the abnormal pattern. Other steps that can be taken include repositioning of the woman in the lateral position, assessing blood pressure and increasing intravenous hydration if not contraindicated by the maternal condition, pelvic examination to assess cervical dilation and rule out cord prolapse, and oxygen by face mask (at 10 L/min). (III B)
11. Each obstetric department should establish guidelines for oxytocin use for labour induction. Prior to initiating oxytocin, assessment of fetal wellbeing by fetal heart rate monitoring is recommended. Oxytocin should be administered with an infusion pump to allow accurate dosing. To avoid inadvertent boluses, oxytocin should be connected as a secondary line to a main line infusion. Labour induction requires close monitoring of uterine activity and fetal heart rate. One-to-one nursing is recommended.(III B)

### PROSTAGLANDIN COMPARED WITH OXYTOCIN FOR LABOUR INDUCTION WITH A FAVOURABLE CERVIX

A meta-analysis comparing prostaglandin and oxytocin for induction of labour suggests that prostaglandins reduce the likelihood of operative delivery and failed induction, but increase the incidence of gastrointestinal side effects and pyrexia.[114]

These side effects may be due to the form of prostaglandin used (intravenous prostaglandin in older studies). A higher rate of excessive uterine activity occurred in those receiving prostaglandin (among the trials that recorded this outcome). There is not enough good evidence to make confident conclusions about the relative effects of prostaglandin and oxytocin on maternal and neonatal outcomes. The best dosing regime of prostaglandin gel for labour induction with a favourable cervix has not yet been determined. Thus, the use of prostaglandin or oxytocin with a favourable cervix is a matter of maternal and physician preference.

### SWEEPING MEMBRANES

Sweeping membranes is a simple procedure in which a vaginal examination is performed and the examining finger is placed though the internal os of the cervix and then swept in a circumferential motion separating the amniotic membrane from the lower uterine segment. It is currently performed by many physicians and is felt to increase local prostaglandin $F_2\alpha$ production and release from the decidua and adjacent membrane, thereby leading to onset of labour.[115,116]

Several randomized trials have examined sweeping membranes, with conflicting results.[117-132] Two meta-analyses have found that sweeping membranes at term reduced the duration of pregnancy and the rate of post-term pregnancy (greater than 41 weeks) and increased the rate of delivery in two and seven days.[131,132] A decrease in the use of formal induction methods was also noted. There were no significant differences in the mode of delivery or risk of infection. Discomfort during the examination and minor side effects including bleeding and uterine irritability were more frequently reported in those women undergoing sweeping membranes. These reviewers concluded that although sweeping membranes promotes onset of labour, it does not seem to produce clinically important benefits on maternal or neonatal outcomes when used as a method of induction of labour. If urgent induction is needed, sweeping membranes is not the method of choice. Its use as a means to decrease formal induction should be balanced against the discomfort and other adverse effects such as bleeding and uterine irritability.

## SPECIFIC CIRCUMSTANCES OR INDICATIONS

### PRELABOUR RUPTURE OF MEMBRANES AT TERM

Prelabour rupture of membranes (PROM) occurs in six to 19 percent of pregnancies at term. A summary of randomized trials found that induction with oxytocin, compared with expectant management, reduced the risk of maternal infection (both chorioamnionitis and endometritis) and neonatal infection.[5] Oxytocin use was associated with a higher rate of epidural use and internal fetal heart rate monitoring.[5]

Prostaglandins have also been used to induce labour with PROM. A meta-analysis has found that induction with prostaglandin decreased the rates of maternal infection and neonatal intensive care unit admission.[6] Prostaglandin use was associated with maternal diarrhea and analgesia use.[6] Women viewed induction of labour more positively than expectant management.[4] When prostaglandins were compared with oxytocin for induction of labour with PROM, prostaglandin use was associated with a lower rate of epidural use and internal fetal heart rate monitoring, but an increased rate of chorioamnionitis and nausea.[133]

### INDUCTION OF LABOUR AFTER CAESAREAN DELIVERY

A practice guideline previously published by the Society of Obstetricians and Gynaecologists of Canada on vaginal birth after Caesarean delivery advised that, while induction with oxytocin is not contraindicated, it does increase the risk of uterine rupture above that of spontaneous labour.[134] It was felt that the safety of prostaglandin gel in a woman with previous lower segment Caesarean section has not been established and that further research is required.[134] A recent summary of eight observational studies found that vaginal delivery was less likely in a woman with previous Caesarean delivery when cervical ripening was performed with $PGE_2$ compared to spontaneous labour (OR = 0.45, 95% CI 0.40-0.50).[135] Also, a lower rate of vaginal delivery was noted when induction of labour was performed with oxytocin compared with spontaneous labour (OR=0.52, 95 % CI 0.46-0.60).[135] A summary of 10 studies found that although there was no statistical difference in scar disruption rates between the prostaglandin $E_2$ group (1.60%) and the spontaneous labour group (1.23%), there was a higher rate in the former group (OR = 1.46, 95% CI 0.96-2.22).[135] There was no statistical difference in scar disruption rates with oxytocin induction (0.83%) compared to spontaneous labour (0.63%) (OR = 1.43, 95% CI 0.76-2.69). A higher rate of scar disruption was noted with misoprostol use (5.4%) compared with spontaneous labour (1.3%) (OR = 7.53, 95% CI 2.75-20.6).[135] A recent Canadian study has further confirmed that induction of labour is associated with an increased risk of uterine rupture among women with a previous Caesarean delivery compared to spontaneous labour.[136] This association was highest when prostaglandin $E_2$ gel was used (OR = 6.41, 95% CI 2.06-19.98).

### MULTIPLE GESTATIONS

Although there are no specific guidelines on induction of labour with multiple gestations, one should use similar precautions and prerequisites as in singleton gestations in the absence of published studies specifically evaluating labour induction of multiple gestations. Specific guidelines on intrapartum evaluation and management of labour in multiple gestations can be found in the Twins Consensus Conference Statement.[137]

### OBSTETRICAL SERVICES IN RURAL OR REMOTE COMMUNITIES

Augmentation with oxytocin and/or induction of labour by artificial rupture of membranes, prostaglandin $E_2$ vaginal gel or oxytocin may be offered in communities without local Caesarean section capability.[138] If caring for a woman in labour is appropriate in the community, then caring for her during augmented or induced labour is equally appropriate when there is support by trained local staff and resources.

#### RECOMMENDATION

12. The decision to support induction of labour in a rural community setting must be made with an awareness of what the increased likelihood of Caesarean delivery is and therefore what the need for the availability of support services is.[138] (III B)

## RECOMMENDATIONS

1. As elective induction is associated with potential complications it should be discouraged, and only undertaken after fully informing the woman of these risks and establishing accurate gestational age. (II-2 B)
2. If induction of labour is being considered the following should be addressed: indication for induction, any contraindications, gestational age, cervical favourability, fetal presentation, potential for cephalopelvic disproportion, fetal wellbeing/fetal heart rate, and membrane status. (III B)
3. If the cervix is unfavourable, ripening of the cervix should be considered prior to induction of labour. (II-2 A)
4. The use of a dosing interval of prostaglandin gel every six to 12 hours up to three doses is recommended; however, some studies have suggested additional doses. (I to II-3 B)
5. A meta-analysis of five trials has concluded that the use of oxytocin to ripen the cervix is not effective. (I E)
6. Since the best dose and route of misoprostol for labour induction with a live fetus are not known and there are concerns regarding hyperstimulation, misoprostol's use for induction of labour should be within clinical trials. (I B)
7. When excessive uterine activity occurs, especially if associated with a nonreassuring fetal heart rate pattern, one should attempt to correct the abnormal uterine activity. If a controlled-release prostaglandin is in place it should be removed. If a vaginal/intracervical prostaglandin is being used, one should attempt to remove any remaining prostaglandin, stop oxytocin if infusing, and perform supportive and resuscitative measures such as maternal left lateral position and oxygen by mask. (III B)
8. When using oxytocin to induce labour use the minimum dose to achieve active labour, increasing intervals no more frequently than every 30 minutes (I to II-3 B). Once a dose of 20 mu/min is reached, reassessment is reasonable. (III C)
9. If excessive uterine activity occurs with a normal fetal heart rate pattern, one may initially decrease the oxytocin infusion rate and then reassess uterine activity to determine if any further interventions are required. (III B)
10. If excessive uterine activity (greater than five contractions in 10 minutes or contractions lasting longer than 120 seconds) occurs with a non-reassuring fetal heart rate pattern, the intravenous oxytocin infusion should be discontinued to correct the abnormal pattern. Other steps that can be taken include repositioning of the woman in the lateral position, assessing blood pressure and increasing intravenous hydration if not contraindicated by the maternal condition, pelvic examination to assess cervical dilation and rule out cord prolapse, and oxygen by face mask (at 10 L/min). (III B)
11. Each obstetric department should establish guidelines for oxytocin use for labour induction. Prior to initiating oxytocin, assessment of fetal well being by fetal heart rate monitoring is recommended. Oxytocin should be administered with an infusion pump to allow accurate dosing. To avoid inadvertent bolusing, oxytocin should be connected as a secondary line to a main line infusion. Labour induction requires close monitoring of uterine activity and fetal heart rate. One-to-one nursing is recommended. (III B)
12. The decision to support induction of labour in a rural community setting must be made with an awareness of what the increased likelihood of Caesarean delivery is and therefore what the need for the availability of support services is. (III B)

## CONCLUSION

In the presence of an unfavorable cervix, the use of prostaglandins ripens the cervix, decreases operative delivery rates, and reduces the likelihood of not being delivered in 12 to 24 hours. Controlled-release prostaglandin is effective in cervical ripening, but may result in more excessive uterine activity compared to intracervical dinoprostone. Misoprostol appears to be an effective cervical ripening agent, but the ideal dose and route has yet to be determined. The Foley catheter appears to be effective for cervical ripening, but further research is needed. Artificial rupture of membranes with oxytocin can be used for labour induction with a favourable cervix. Prostaglandins can be used instead of oxytocin for labour induction with a favourable cervix, and their use over oxytocin is a matter of maternal and physician preference. Although sweeping membranes may promote onset of labour, it does not produce clinically important benefits on maternal and neonatal outcomes. Areas for further research include cervical ripening in the outpatient setting, controlled-release prostaglandin, misoprostol, and Foley catheter.

TABLE 2

| QUALITY OF EVIDENCE ASSESSMENT[1] | CLASSIFICATION OF RECOMMENDATIONS[1] |
|---|---|
| The quality of evidence reported in these guidelines has been described using the Evaluation of Evidence criteria outlined in the Report of the Canadian Task Force on the Periodic Health Exam.<br>I: Evidence obtained from at least one properly randomized controlled trial.<br>II-1: Evidence from well-designed controlled trials without randomization.<br>II-2: Evidence from well-designed cohort (prospective or retrospective) or case-control studies, preferably from more than one centre or research group.<br>II-3: Evidence obtained from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category.<br>III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees. | Recommendations included in these guidelines have been adapted from the ranking method described in the Classification of Recommendations found in the Report of the Canadian Task Force on the Periodic Health Exam.<br>A. There is good evidence to support the recommendation that the condition be specifically considered in a periodic health examination.<br>B. There is fair evidence to support the recommendation that the condition be specifically considered in a periodic health examination.<br>C. There is poor evidence regarding the inclusion or exclusion of the condition in a periodic health examination, but recommendations may be made on other grounds.<br>D. There is fair evidence to support the recommendation that the condition not be considered in a periodic health examination.<br>E. There is good evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination. |


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