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Induction of Labour

This clinical practice guideline has been prepared by the Clinical Practice Obstetrics Committee, reviewed by the Maternal Fetal Medicine and Family Practice Advisory Committees, and approved by the Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

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Abstract

Objective: To review the most current literature in order to provide evidence-based recommendations to obstetrical care providers on induction of labour.

Options: Intervention in a pregnancy with induction of labour.

Outcomes: Appropriate timing and method of induction, appropriate mode of delivery, and optimal maternal and perinatal outcomes.

Evidence: Published literature was retrieved through searches of PubMed, CINAHL, and The Cochrane Library in 2010 using appropriate controlled vocabulary (e.g., labour, induced, labour induction, cervical ripening) and key words (e.g., induce, induction, augmentation). Results were restricted to systematic reviews, randomized control trials/controlled clinical trials, and observational studies. There were no date or language restrictions. Searches were updated on a regular basis and incorporated in the guideline to the end of 2010. Grey (unpublished) literature was identified through searching the websites of health technology assessment and health technology-related agencies, clinical practice guideline collections, clinical trial registries, and national and international medical specialty societies.

Values: The evidence in this document was rated using criteria described in the Report of the Canadian Task Force on Preventative Health Care (Table 1).

Summary Statements

1. Prostaglandins E_2 (cervical and vaginal) are effective agents of cervical ripening and induction of labour for an unfavourable cervix. (I)
2. Intravaginal prostaglandins E_2 are preferred to intracervical prostaglandins E_2 because they results in more timely vaginal deliveries. (I)

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Key Words: Induction, labour, cervical ripening, post-dates

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Table 1. Key to evidence statements and grading of recommendations, using the ranking of the Canadian Task Force on Preventive Health Care

Quality of evidence assessment*	Classification of recommendations†
I: Evidence obtained from at least one properly randomized controlled trial	A. There is good evidence to recommend the clinical preventive action
II-1: Evidence from well-designed controlled trials without randomization	B. There is fair evidence to recommend the clinical preventive action
II-2: Evidence from well-designed cohort (prospective or retrospective) or case–control studies, preferably from more than one centre or research group	C. The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
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	D. There is fair evidence to recommend against the clinical preventive action
	E. There is good evidence to recommend against the clinical preventive action
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees	L. There is insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

*The quality of evidence reported in these guidelines has been adapted from The Evaluation of Evidence criteria described in the Canadian Task Force on Preventive Health Care.[111]

†Recommendations included in these guidelines have been adapted from the Classification of Recommendations criteria described in the Canadian Task Force on Preventive Health Care.[111]

Recommendations

1. The indication for induction must be documented, and discussion should include reason for induction, method of induction, and risks, including failure to achieve labour and possible increased risk of Caesarean section. (III-B)
2. If induction of labour is unsuccessful, the indication and method of induction should be re-evaluated. (III-B)
3. Inductions should not be performed solely for suspected fetal macrosomia. (III-D)
4. Inductions should not be performed solely because of patient or care provider preference. (III-D)
5. Health care providers should assess the cervix (using the Bishop score) to determine the likelihood of success and to select the appropriate method of induction. (II-2A)
6. The Bishop score should be documented. (III-B)
7. Care providers need to consider that induction of women with an unfavourable cervix is associated with a higher failure rate in nulliparous patients and a higher Caesarean section rate in nulliparous and parous patients. (II-2A)
8. Every woman should ideally have an ultrasound, preferably in the first trimester, to confirm gestational age. (I-A)
9. Institutions should have quality assurance programs and induction policies, including safety tools such as checklists, to ensure that inductions are performed only for acceptable indications. (II-2B)
10. Women should be offered induction of labour between 41+0 and 42+0 weeks as this intervention may reduce perinatal mortality and meconium aspiration syndrome without increasing the Caesarean section rate. (I-A)
11. Women who chose to delay induction > 41+0 weeks should undergo twice-weekly assessment for fetal well-being. (I-A)
12. Intracervical Foley catheters are acceptable agents (II-2B) that are safe both in the setting of a vaginal birth after Caesarean section (I-B) and in the outpatient setting. (II-2B)
13. Double lumen catheters may be considered a second-line alternative. (II-2B)
14. Prostaglandins E_2 (cervical and vaginal) should not be used in the setting of vaginal birth after Caesarean section due to the increased risk of uterine rupture. (II-2D)
15. Vaginal prostaglandins E_2 may be considered with ruptured membranes at term and can be used in this setting. (I-A)
16. Misoprostol can be considered a safe and effective agent for labour induction with intact membranes and on an inpatient basis. (I-A)
17. Misoprostol should not be used in the setting of vaginal birth after Caesarean section due to the increased risk of uterine rupture. (II-3D)

ABBREVIATIONS

ARM	artificial rupture of membranes
ART	artificial reproductive technologies
CFAS	Canadian Fertility and Andrology Society
FHR	fetal heart rate
GBS	group B streptococcus
NNT	number needed to treat
NST	non-stress test
PG	prostaglandins
PGE_1	prostaglandins E_1
PGE_2	prostaglandins E_2
PROM	pre-labour rupture of membranes

18. Oxytocin should be started no earlier than 4 hours after the last dose of misoprostol. (III-B)
19. Amniotomy should be reserved for women with a favourable cervix. Particular care should be given in the case of unengaged presentation because there is a risk of cord prolapse. (III-B)
20. After amniotomy, oxytocin should be commenced early in order to establish labour. (III-B)
21. In the setting of ruptured membranes at term, oxytocin should be considered before expectant management. (I-A)
22. Women positive for group B streptococcus should be started on oxytocin as early as possible after ruptured membranes in order to establish labour within 24 hours. (III-B)
23. Both high- and low-dose oxytocin may be considered within a hospital protocol. (III-B)
24. Because of the various concentrations, oxytocin infusion rates should always be recorded in mU/min rather than mL/hr. (III-L)
25. Oxytocin induction maybe considered in the hospital setting of vaginal birth after Caesarean section. (II-3B)

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INTRODUCTION

Induction of labour is the artificial initiation of labour before its spontaneous onset to deliver the feto-placental unit. The frequency of induction varies by location and institution. The rate of induction in Canada has increased steadily from 12.9% in 1991–1992 to 19.7% in 1999–2000.[1] The rate reached a high of 23.7% in 2001–2002, decreased slightly to 21.8% in 2004–2005, and has since remained steady.[2] The 2010 BC Perinatal Health Registry reveals a similar trend and rate, with post-term pregnancies (> 41+0 weeks) representing 34%, the largest group, of the total inductions in BC.[3] When undertaken for appropriate reasons, and by appropriate methods, induction is useful and benefits both mothers and newborns.

The goal of induction is to achieve a successful vaginal delivery that is as natural as possible. The objectives of this guideline are to summarize the indications for induction, review current methods of cervical ripening and labour induction, and evaluate the safety and effectiveness of agents and methods used in cervical ripening and labour induction.

Treatment and care should take into account women's individual needs and preferences. Women who are having or being offered induction of labour should have the opportunity to make informed choices about their care and treatment in partnership with their health care providers.

DEFINITIONS

Induction of labour is the initiation of contractions in a pregnant woman who is not in labour to help her achieve a vaginal birth within 24 to 48 hours.

Successful induction is defined as a vaginal delivery within 24 to 48 hours of induction of labour.

Elective induction is the induction of labour in the absence of acceptable fetal or maternal indications.

Cervical ripening is the use of pharmacological or other means to soften, efface, or dilate the cervix to increase the likelihood of a vaginal delivery.

Tachysystole refers to > 5 contractions per 10-minute period averaged over 30 minutes. This is further subdivided into two categories, one with and one without fetal heart rate changes.[4]

Hypertonus refers to excessive uterine contractions lasting > 120 seconds without FHR changes. This term should be abandoned and has been replaced in this guideline by tachystole without FHR changes.[4]

Hyperstimulation refers to excessive uterine contractions (tachysystole or hypertonus) with abnormal FHR changes. This term has been used in multiple induction studies. It should be abandoned and has been replaced in this guideline by tachystole with FHR changes.[4]

INDICATIONS

Induction is indicated when the risk of continuing the pregnancy, for the mother or the fetus, exceeds the risk associated with induced labour and delivery. The indication must be convincing, compelling, consented to, and documented. The reason for and method of induction should be discussed between the care provider and the woman in order to obtain clear consent. These conditions are not met when induction is proposed solely for the convenience of the care provider or patient. Induction should be prioritized by the health care team according to the urgency of the clinical situation and the availability of resources. The following list of indications for induction of labour is not meant to be exhaustive or absolute:

High Priority

- Preeclampsia ≥ 37 weeks
- Significant maternal disease not responding to treatment
- Significant but stable antepartum hemorrhage

- Chorioamnionitis
- Suspected fetal compromise
- Term pre-labour rupture of membranes with maternal GBS colonization

Other Indications

- Postdates (> 41+0 weeks) or post-term (> 42+0 weeks) pregnancy
- Uncomplicated twin pregnancy ≥ 38 weeks
- Diabetes mellitus (glucose control may dictate urgency)
- Alloimmune disease at or near term
- Intrauterine growth restriction
- Oligohydramnios
- Gestational hypertension ≥ 38 weeks
- Intrauterine fetal death
- PROM at or near term, GBS negative
- Logistical problems (history of rapid labour, distance to hospital)
- Intrauterine death in a prior pregnancy (Induction may be performed to alleviate parental anxiety, but there is no known medical or outcome advantage for mother or baby.)

Unacceptable Indications

- Care provider or patient convenience
- Suspected fetal macrosomia (estimated fetal weight > 4000 gm) in a non-diabetic women is an unacceptable indication because there is no reduction in the incidence of shoulder dystocia but twice the risk of CS.[5–7]

CONTRAINDICATIONS

Induction should be avoided if there are any contraindications to labour or vaginal delivery. They include, but are not limited to the following:

- placenta or vasa previa or cord presentation
- abnormal fetal lie or presentation (e.g. transverse lie or footling breech)
- prior classical or inverted T uterine incision
- significant prior uterine surgery (e.g. full thickness myomectomy)
- active genital herpes
- pelvic structural deformities
- invasive cervical carcinoma
- previous uterine rupture

Whenever possible, for patients with prior uterine incision or surgery, the operative report or the opinion of the surgeon should be obtained and reviewed.

Induction of labour using various methods may be associated with an increased risk of:

- failure to achieve labour
- Caesarean section
- operative vaginal delivery
- tachysystole with or without FHR changes
- chorioamnionitis
- cord prolapse with ARM
- inadvertent delivery of preterm infant in the case of inadequate dating
- Uterine rupture in scarred and unscarred uteri

Recommendations

1. The indication for induction must be documented, and discussion should include reason for induction, method of induction, and risks, including failure to achieve labour and possible increased risk of Caesarean section. (III-B)
2. If induction of labour is unsuccessful, the indication and method of induction should be re-evaluated. (III-B)
3. Inductions should not be performed solely for suspected fetal macrosomia. (III-D)
4. Inductions should not be performed solely because of patient or care provider preference. (III-D)

PRE-INDUCTION ASSESSMENT

The goal of labour induction is to achieve a successful vaginal delivery, although induction exposes women to a higher risk of a CS than spontaneous labour. Before induction, there are several clinical elements that need to be considered to estimate the success of induction and minimize the risk of CS. Factors that have been shown to influence success rates of induction include the Bishop score, parity (prior vaginal delivery), BMI, maternal age, estimated fetal weight, and diabetes.

The Bishop score was developed in 1964 as a predictor of success for an elective induction. The initial scoring system used 5 determinants (dilatation, effacement, station, position, and consistency) that attributed a value of 0 to 2 or 3 points each (for a maximum score of 13). Bishop

showed that women with a score of > 9 were equally likely to deliver vaginally whether induced or allowed to labour spontaneously.[8] In 1966, Burnett modified the scoring scheme (still in use and still known as the Bishop score) so that each variable was assigned a maximum value of 2 points (for a maximum score of 10).[9] A favourable pre-induction Bishop score of > 6 is predictive of a successful vaginal delivery. Initial studies were limited to parous women, but the score was later found also to be applicable to nulliparous women (Table 2).

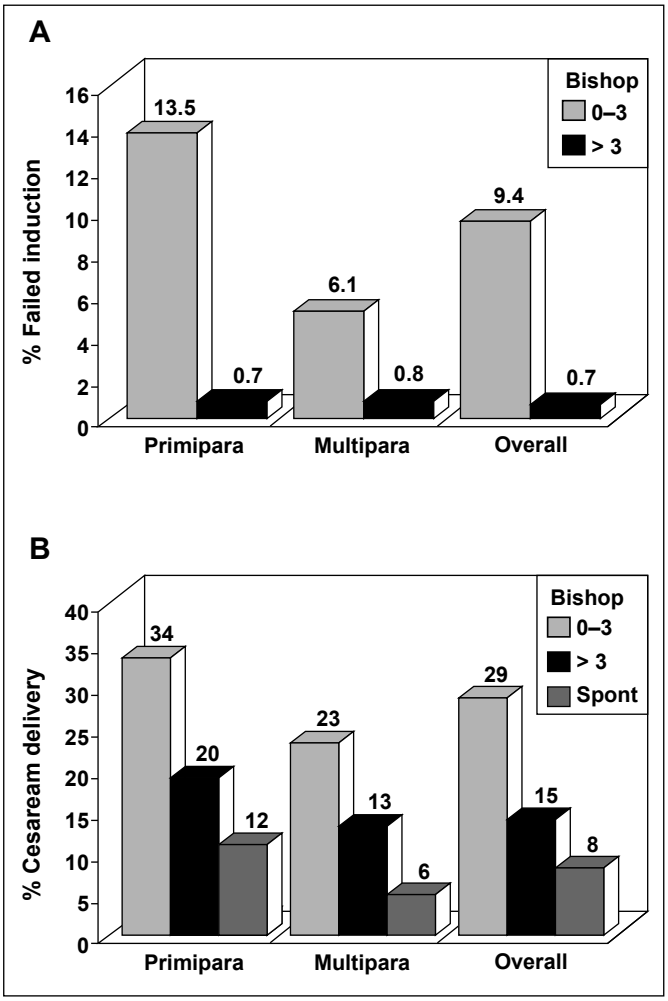
Table 2. Modified Bishop Scoring System[9]

	Score		
Factor	0	1	2
Dilatation, cm	0	1–2	3–4
Effacement, %	0–30	40–50	60–70
Length, cm	> 3	1–3	< 1
Consistency	Firm	Medium	Soft
Position	Posterior	Mid	Anterior
Station	Sp −3 or above	Sp −2	Sp −1 or 0

Assessment of cervical status is fundamental for the clinician to estimate the likelihood of a successful vaginal delivery. Of the Bishop score criteria for predicting successful induction, the most important is cervical dilatation, followed by effacement, station, and position, with the least important being consistency.[10,11]

Several studies have shown an increased rate of failed induction and CS when women are induced with an unfavourable cervix.[12–16] Xenakis's prospective study of 597 pregnancies stratified by low (4 to 6) and very low (0 to 3) Bishop scores found the highest risk of CS in both nulliparous and parous women with scores of 0 to 3 versus those with a Bishop score > 3. Even women with a score of 4 to 6 had a significantly higher risk of CS than those with spontaneous labour (Figure). The rate of failed induction was higher for women with a very low Bishop score (0 to 3) in both nulliparous and parous women.[17]

Rates of failed induction (A) and Caesarean delivery (B) in women undergoing induction and stratified by parity and Bishop score at entry.[17]



Reprinted with permission from Wolters Kluwer Health: Xenakis EM, Piper JM, Conway DL, Langer O. Induction of labor in the nineties: conquering the unfavorable cervix. Obstet Gynecol 1997;90(2):235–9.

The clinician may consider other non-modifiable factors in the pre-induction counselling period with the woman. Elevated BMI (> 40 kg/m^2),[13–15] maternal age > 35 years,[14,15,18] estimated fetal weight > 4 kg,[13,18] and diabetes mellitus[13,18] have been shown to increase the CS rate when labour is induced. The presence of these negative predictive factors for a successful induction may play a role in the mutual decision to delay intervention and to allow for the opportunity of a spontaneous labour. These factors should not be used as a deterrent to vaginal delivery. In studies of women with a favourable cervix, the CS rate of induced pregnancies was equivalent to those managed expectantly.[19–21]

Several studies have compared the ability of the Bishop score to predict successful labour induction with ultrasound assessment of the cervix with conflicting results. Peregrine et al. reported cervical length > 1 cm to be a predictor for CS with induction of labour.[22] In contrast, Hatfield et al. found that cervical length was not predictive of successful labour induction,[23] and Rozenberg et al. reported that the Bishop score was a better predictor of time interval from induction to delivery.[24] Using ultrasound to assess cervical

ripeness, Bartha et al. found that fewer women were induced with PG with no difference in outcomes.[25]

Fetal fibronectin and transvaginal ultrasound have been shown to predict successful induction, but neither have been shown to be superior to the Bishop score.[10]

Recommendations

5. Health care providers should assess the cervix (using the Bishop score) to determine the likelihood of success and to select the appropriate method of induction. (II-2A)
6. The Bishop score should be documented. (III-B)
7. Care providers need to consider that induction of women with an unfavourable cervix is associated with a higher failure rate in nulliparous patients and a higher Caesarean section rate in nulliparous and parous patients. (II-2A)

PREVENTION OF INDUCTION

Routine antenatal ultrasound for confirmation of expected date of delivery has been shown to reduce induction rates for postdates (> 41+0 weeks) pregnancies after correction of dates (OR 0.68, 95% CI 0.57 to 0.82).[26–28]

There is evidence that routine sweeping (stripping) of membranes promotes the onset of labour and that this simple technique decreases induction rates. It is believed that the technique results in an increase of local production of prostaglandins.[29]

Membrane sweeping involves the insertion of a digit past the internal cervical os followed by three circumferential passes of the digit causing separation of the membranes from the lower segment. In clinical studies when the cervix was closed, a massage of the cervical surface with the forefinger and middle finger for 15 to 30 seconds was performed. The woman should be informed of the discomfort and pain and the possibility of bleeding post-procedure before consent is obtained.

A 2005 Cochrane review including 32 trials found that routine sweeping performed weekly after 38 weeks resulted in a reduced duration of pregnancy beyond 41 and 42 weeks. The number needed to treat to prevent 1 induction at 41 weeks was 8.[30] This procedure has been associated with maternal discomfort during vaginal examination and other minor adverse effects (e.g. bleeding, irregular contractions).

Since the publication of the Cochrane review by Boulvain et al.,[30] several studies have been published evaluating the sweeping of membranes. Yildirim et al. found that women (> 38 weeks' gestation) who underwent sweeping in the case of an open cervix or cervical massage rather than a pelvic exam had more spontaneous labour within 7 days (73.7% vs. 45.5%, OR 0.2 95%, CI 0.18 to 0.46, $P < 0.0001$) and a greater number of women went into spontaneous labour before 41 weeks (90.5% vs. 70.7%, OR 2.46, 95% CI 1.22 to 4.95).[31]

An RCT by de Miranda et al. involving 742 low-risk women showed that sweeping every 2 days starting at 41+0 weeks reduced the number of pregnancies reaching 42 weeks. (NNT = 6).[32]

In the case of a planned VBAC, Hamdam studied 108 women who underwent serial sweeping at term and found there was no significant effect on the onset of labour, duration of pregnancy, induction of labour, or repeat CS.[33]

The effect of coitus on promoting labour is unclear. A 2006 prospective study of 200 women by Tan et al. used patient reported data of sexual intercourse after 36 weeks to estimate effect on gestational age and mode of delivery.[34] Coitus at term was independently associated with earlier onset of labour (reduction of postdates pregnancy and less requirement for induction at 41 weeks). However, a second prospective study of 210 women by the same researcher compared a coitus-advised group to a no-advice group scheduled to have labour induction. The coitus-advised group reported more sexual activity before delivery than the non-advised group, but there was no significant difference in spontaneous labour.[35]

Care provider use of appropriate or inappropriate indications for induction has an impact on resources for performing induction and on the overall CS rate. Lydon-Rochelle et al. reviewed the records of 4541 induced pregnancies and found that 15% of inductions were either not clinically indicated or not documented.[36] Le Ray et al. measured an increase in CS rate (OR 4.1, 95% CI 1.3 to 12.9) when care providers violated guidelines for inductions by inducing labour before 38 weeks or with a Bishop score < 5 without an indication.[37]

Quality improvement programs have been shown to reduce the number of elective inductions and unplanned CS. Several studies have shown a significant reduction in the number of elective inductions after the implementation of an induction committee. The role of the committee was to review each request and enforce the use of proper indications for induction.[38–40]

Institutional factors may play a role in the CS rate of induced labours. Brennan et al. compared CS rates in 10 different groups defined by the Robson criteria. In the group of low-risk women induced at term, the low induction centres had a lower overall CS rate than the higher induction centres (17.7% vs. 27.8%, $P < 0.008$).[41]

Recommendations

8. Every woman should ideally have an ultrasound, preferably in the first trimester, to confirm gestational age. (I-A)
9. Institutions should have quality assurance programs and induction policies, including safety tools such as checklists, to ensure that inductions are performed only for acceptable indications. (II-2B)

POST-DATES INDUCTION

Postdates induction is the leading indication for induction and deserves special consideration. The goal is the prevention of post-term (> 42+0 weeks) pregnancy with its associated increased perinatal morbidity, mortality, and operative delivery rates.[42,43]

The multi-centre study by Hannah et al. published in 1992 compared elective induction to serial monitoring (daily kick counts; non-stress test 3 times per week; amniotic fluid volume 2 to 3 times per week) after 41 weeks in 3407 women with cephalic singleton pregnancies.[44] The induction group had a lower rate of CS for abnormal fetal heart tracing (5.7% vs. 8.3%, $P = 0.003$) with no difference in perinatal mortality and morbidity. Women with a cervix dilated ≥ 3 cm were excluded. The method of induction differed between groups: the induction group was induced with intracervical PG gel, the serial monitoring group was induced with amniotomy or oxytocin, or had CS regardless of cervical status. After publication of this study, the SOGC recommended that induction was preferred for pregnancies completing 41+0 weeks.[45]

A 2006 Cochrane meta-analysis that included 19 trials (7984 women) found that labour induction after 41+0 weeks was associated with fewer perinatal deaths but no difference in CS rate.[28] Individual analysis for inductions done at 41+0 weeks (10 trials; RR 0.25, 95% CI 0.05 to 1.18, NNT = 369) and 42+0 weeks (2 trials; RR 0.41, 95% CI 0.06 to 2.73) revealed a trend towards reduction of perinatal death in each group but was not statistically significant. When the 41-week and 42-week trials were analyzed together, the relative risk reached significance at RR 0.30 (95% CI 0.09 to 0.99, NNT = 339). In trials where induction occurred after 41 weeks, there was a reduced risk of meconium aspiration syndrome (RR 0.29; 95% CI 0.12 to 0.68, 4 trials, 1325 women) but there was no difference in the risk of CS (10 trials at 41 weeks, N = 5755, RR 0.92, 95% CI 0.76 to 1.12; and 5 trials at 42 weeks, N = 810, RR 0.97, 95% CI 0.72 to 1.31), assisted vaginal delivery, or Apgar scores of < 7 at 5 minutes.

For women who decide to delay induction, fetal well-being should be evaluated. Delaney et al. published a review of the management of this group and recommended measurement of amniotic fluid and conducting an NST.[26] Biophysical profile is another acceptable option.

Recommendations

10. Women should be offered induction of labour between 41+0 and 42+0 weeks as this intervention may reduce perinatal mortality and meconium aspiration syndrome without increasing the Caesarean section rate. (I-A)
11. Women who chose to delay induction > 41+0 weeks should undergo twice-weekly assessment for fetal well-being. (I-A)

OPTIONS FOR CERVICAL RIPENING/INDUCTION: UNFAVOURABLE CERVIX

To increase the success of a vaginal delivery with an unfavourable cervix, several effective cervical ripening methods can be applied that include mechanical and pharmacologic options. Neither amniotomy nor oxytocin are effective cervical ripening agents and should not be used as such.

Mechanical Options

Mechanical options of cervical ripening include balloon devices (Foley catheter with and without extra-amniotic saline infusion) that apply pressure on the internal os of the cervix to stretch the lower uterine segment and increase the release of local PG. Simplicity of use, potential for reversibility, reduction in certain side effects such as excessive uterine activity, and low cost are advantages of these methods.

Balloon Devices: Foley Catheter

For a single balloon catheter, a no. 18 Foley is introduced under sterile technique into the intracervical canal past the internal os. The bulb is then inflated with 30 to 60 cc of water. The catheter is left in place until either it falls out spontaneously or 24 hours have elapsed. Some practitioners apply a small degree of traction on the catheter by taping it to the inside of the leg.[46] Low-lying placenta is an absolute contraindication to the use of a Foley catheter. Relative contraindications to its use include antepartum hemorrhage, rupture of membranes, and evidence of lower tract genital infection.

A 2001 Cochrane review reported mechanical methods resulted in less tachysystole with fetal heart changes than PG and misoprostol but no difference in CS rates. Compared with oxytocin alone in women with an unfavourable cervix, the CS rate was reduced with mechanical methods.[47]

A 2009 RCT of 330 term (pregnancies > 36 weeks) nulliparous women with an unfavourable cervix (Bishop 0 to 4) compared single (16F Foley) and double balloon catheters and vaginal PGE_2.[48] The overall CS rate was high but not significantly different between groups (43% double balloon, 36% single balloon, and 37% in the PGE_2 group $P = 0.567$). The single balloon catheter had the shortest induction to delivery interval (single balloon = 25.8 h, PGE_2 = 25.8 h, double balloon = 30.6 h). Uterine tachysystole occurred in 14% (9% with normal fetal heart tracing; 4% with atypical fetal heart tracing; and 1% with abnormal fetal heart tracing requiring delivery) of the PGE_2 group compared to none in the mechanical cervical ripening group. Cervical ripening with the single balloon catheter was associated with significantly less pain than the double balloon or vaginal PGE_2.[48]

Heinemann et al. systematic review of 30 RCTs showed an increased risk of both maternal infection (defined as pyrexia of 38°C, chorioamnionitis, peripartum infection, or chorioamnionitis and/or endomyometritis), and neonatal infection when all (Foley catheters, hydroscopic dilators, laminaria) mechanical methods were analyzed. Studies limited to Foley catheters compared with pharmacological agents for cervical ripening had similar rates for maternal infection and there was no increased risk of neonatal infection.[49]

The indications and methods of induction should not be altered in the case of women known to be colonized with GBS.[50]

A prospective randomized trial compared in-patient versus outpatient use of a Foley catheter for 111 term pregnancies with an indication for induction of labour. Indications included elective (n = 48), post-dates (n = 44), macrosomia (n = 14), gestational diabetes (n = 3), and chronic hypertension (n = 2). The mean Bishop score was 3 for each group. There was no significant difference in the two groups for change in Bishop score, maximum dose of oxytocin, time of oxytocin, epidural rate, induction time, 1-minute and 5-minute Apgar scores, and cord pH. The outpatient group spent an average of 9.6 hours less in hospital.[51]

The use of a trans-cervical Foley catheter for induction of labour in women who had a previous CS is not associated with an increased risk of uterine rupture.[52] Foley catheters have shown to be efficacious with a shorter induction-to-delivery time than PG for induction of labour with an unfavourable cervix.[53,54] Both agents have similar CS rates, but Foley catheters result in increased need for oxytocin stimulation and there is more tachysystole with PG.[55]

Recommendations

12. Intracervical Foley catheters are acceptable agents (II-2B) that are safe both in the setting of a vaginal birth after Caesarean section (I-B) and in the outpatient setting. (II-2B)
13. Double lumen catheters may be considered a second-line alternative. (II-2B)

Practice Points

- There is an increased need for oxytocin when Foley catheters are used.
- In comparison with prostaglandins, Foley catheters cause much less uterine tachysystole.
- Foley catheters are not associated with increased rates of maternal infection (chorioamnionitis and endometritis) or neonatal infection.
- Use of Foley catheters does not reduce the rate of CS from that of PG.

PHARMACOLOGICAL OPTIONS

Prostaglandins

Prostaglandin E_2 acts on the cervix by dissolving the collagen structural network of the cervix. Prostaglandin E_2, dinoprostone, is available in 3 different preparations as a cervical ripening agent: controlled-release gel 10 mg (Cervidil), intravaginal 1 mg and 2 mg gel (Prostin), and intracervical 0.5 mg gel (Prepidil). Vaginal preparations (Prostin, Cervidil) are easier to administrate than intracervical (Prepidil) preparations. The controlled-release gel preparation (Cervidil) allows easier removal in case of uterine tachysystole with FHR changes and requires only a 30-minute delay before the initiation of oxytocin upon its removal compared with an interval of 6 hours for the gel.

Advantages of PGE_2 include patient acceptance, a lower operative rate than oxytocin, and less need for oxytocin augmentation when used with an unfavourable cervix (Bishop < 7). Cost savings may be realized by a reduction in operative deliveries and/or lengths of stay. PGE_2 is a bronchodilator and is not contraindicated in women who suffer from asthma. In a prospective study of 2513 women with known asthma and who received PG, none had evidence of an exacerbation of their condition.[56]

A 2009 Cochrane review including 63 studies (10 441 women) reported that compared with placebo vaginal PGE_2 reduced both the likelihood of not achieving a vaginal delivery within 24 hours (18% vs. 99%, RR 0.19, 95% CI 0.14 to 0.25) and the use of oxytocin stimulation (21.6% vs. 40.3%).[57] There was no difference in CS, but there was an increase with vaginal PGE_2 in uterine tachysystole

with FHR changes (4.6% versus 0.51%, RR 4.14, 95% CI 1.93 to 8.90). The tablet, pessary, and gel were equivalent, although the sustained released PGE_2 insert was associated with a decrease in instrumental deliveries.

A 2008 Cochrane review of intracervical gel versus placebo included 28 trials with 3764 women undergoing cervical ripening or induction regardless of membrane status.[58] There were fewer women in the PG group who did not achieve vaginal delivery within 24 hours (RR 0.61 95% CI 0.47 to 0.79). There was a non-significant reduction in the overall risk of CS for all women (RR 0.88, CI 0.77 to 1.00), but there was a statistically significant reduction of CS (RR 0.82, 95% CI 0.68 to 0.98) in women with an unfavourable cervix and intact membranes, suggesting that oxytocin alone can and should be used for induction after term PROM. There was an increased risk of uterine tachysystole without changes in FHR (RR 1.59 95% CI 1.09 to 2.33) but no increase tachysystole with FHR changes.[58]

The same review compared intracervical and intravaginal interventions in 3881 women in 29 trials. The risk of not achieving vaginal delivery at 24 hours was greater in the intracervical group (RR 1.26, 95% CI 1.12 to 1.41) but there were no differences in the risk of CS and tachysystole with or without fetal heart changes.[58]

PGs have been used to induce labour with PROM at term. A 2006 Cochrane review included 12 trials (6814 women, PROM > 37 weeks) and compared planned management with either oxytocin or vaginal prostaglandin with expectant management. Overall, there was no difference for mode of birth; results were similar for CS and vaginal delivery. For women who underwent planned delivery, there was less chorioamnionitis or endometritis and fewer admissions to NICU, but no difference in neonatal infection rates. One trial found that women in the planned group were more likely to perceive the experience as being more positive.[59]

The timing of insertion may have an influence on interventions. One study of 620 women (nulliparous and parous) compared admission in the morning versus the evening and found that morning inductions were less likely to need oxytocin infusion (45% vs. 54%, RR 0.83, 95% CI 0.70 to 0.97). Nulliparous women admitted in the morning had fewer operative vaginal births (16.1% vs. 34.2%, RR 0.47, 95% CI 0.25 to 0.90).[60] Adverse effects with the use of prostaglandin E_2 include uterine tachysystole and maternal effects (i.e. fever, chills, vomiting, diarrhea). Care must be taken to avoid application of the higher dose vaginal preparations into the cervical canal. Rare, idiopathic adverse cardiovascular events may occur, but they almost always occur immediately after the administration of the agent.

In the event of tachysystole, attempts should be made to remove the prostaglandin from the vagina. Intrauterine rescue may be required and use of a tocolytic agent may be considered (intravenous Nitroglycerin 50 mcg given over 2 to 3 minutes and repeated every 3 to 5 minutes to a maximum of 200 mcg). To date, the evidence for safety and efficacy remains inconclusive. Another option is the use of nitroglycerin spray (0.4 mg, 1 to 2 puffs sublingual), which has the advantage of a simple and rapid administration and uptake, although there have been no clinical trials assessing dosing.[61]

Outpatient PG is an attractive option for reducing the use of health care resources. Large studies are lacking to determine their overall safety, in particular for rare but serious adverse effects. A 2003 RCT of 300 women evaluated outpatient versus in-patient induction with Cervidil. Three hundred eligible patients with uncomplicated, low-risk pregnancies and a Bishop score ≤ 6, parity ≤ 5, gestation > 37 weeks, a reactive NST, and singleton cephalic pregnancy with intact membranes. Cervidil was inserted and the patient monitored for 1 hour before being allowed to go home. Use of oxytocin, epidural rate, operative delivery rate, CS rate, and median time to labour and delivery within 24 hours were the same for each group. The outpatient group spent a median of 8 hours at home and reported a higher satisfaction during the initial 12 hours (56% vs. 39%).[62]

Current recommendations for outpatient induction in low-risk pregnancies suggest continuous electronic fetal monitoring for 1 to 2 hours after administration of PG and the use of intermittent auscultation when labour is active.[63]

A 2010 Cochrane review including 28 RCTs with 2616 women who were induced with mechanical and pharmacological methods concluded that the outpatient setting was feasible, but that there was insufficient evidence to recommend which method was most effective and safe.[64]

Sweeping of the membranes during induction of labour increases success rates. Two randomized trials recruited women with term, cephalic, nulliparous and parous pregnancies and intact membranes scheduled for induction with PG vaginal gel if the cervix was unfavourable (Bishop ≤ 4) or with amniotomy if the cervix was favourable (Bishop > 4 or cervix > 3 cm). Both groups were treated according to institutional protocols for active management of labour. Both studies showed that membrane sweeping at the time of induction resulted in shorter induction to delivery time, lower use of oxytocin, and a higher rate of spontaneous vaginal deliveries. Tan et al.[35] benefit applied to both nulliparous and parous women, while

Foong et al.[65] found that the benefit of sweeping was limited to nulliparous women with an unfavourable cervix. Tan et al. also found both higher maternal satisfaction in the birth process and higher post-sweeping pain.[35]

Summary Statements

1. Prostaglandins E_2 (cervical and vaginal) are effective agents of cervical ripening and induction of labour for an unfavourable cervix. (I)
2. Intravaginal prostaglandins E_2 are preferred to intracervical prostaglandins E_2 because they results in more timely vaginal deliveries. (I)

Recommendations

14. Prostaglandins E_2 (cervical and vaginal) should not be used in the setting of vaginal birth after Caesarean section due to the increased risk of uterine rupture. (II-2D)
15. Vaginal prostaglandins E_2 may be considered with ruptured membranes at term and can be used in this setting. (I-A)

Practice Points

- PGE_2 reduce CS rates of women with an unfavourable cervix and result in greater maternal satisfaction.
- Oxytocin can be started 30 minutes after removal of a dinpoprostone insert (Cervidil) and 6 hours hours after gel (Prostin, Prepidil).
- PGE_2 in the setting of ruptured membranes had more maternal but no more neonatal infections.
- Care must be taken to avoid the insertion of the higher dose of vaginal PGE_2 (2 mg) into the cervical canal.
- Uterine tachysystole without FHR changes is more common with PGE_2 but does not lead to a higher CS rate.
- Nitroglycerin can be used to treat uterine tachysystole but requires more study.

Misoprostol is a synthetic PGE_1 analog that has been approved and marketed for the prevention and treatment of gastric ulcers associated with the use of non-steroidal anti-inflammatory drugs.[66] Misoprostol has also been found to be an effective agent for cervical ripening and labour induction, and those off-label uses have been widely adopted.

The first study to describe the successful induction of labour in the case of intrauterine fetal demise was published in 1987.[67] Since then, there have been over 100 randomized trials studying the efficacy and safety of induction in viable term inductions.

Benefits of misoprostol include its stability at room temperature, rapid onset of action, multiple potential routes of administration (oral, buccal, sublingual, vaginal, rectal), and low cost. These potential benefits make it an attractive alternative to PGE_2.

Dosing of misoprotol:

- Give 50 mcg orally with a drink of water (ensure that it is swallowed quickly to avoid sublingual absorption) or give 25 mcg vaginally.
- Repeat every 4 hours as long as contractions are absent or non-painful.
- Oxytocin can only be used 4 hours after the last dose.

Serious adverse events with the use of misoprostol are similar to those of other PG and include uterine tachysystole with its potential fetal and maternal effects and meconium staining of liquor. It is generally agreed that it is a potent uterotonic and should not be used in women with a previous CS because it will increase the risk of uterine rupture.[68,69] In general, large studies are required to assess the rare, but life-threatening, uterine rupture that has been reported anecdotally in women with and without a previous CS.[70] A 2010 Cochrane review of vaginal misoprostol for cervical ripening and induction of labour included 121 trials that compared misoprostol to placebo/no treatment or to other methods (vaginal PG, cervical PG, and oxytocin) of induction. Vaginal misoprostol was superior to placebo with a reduced failure to achieve vaginal delivery within 24 hours (RR 0.51, 95% CI 0.37 to 0.71) but increased tachysystole without fetal heart changes (RR 3.53, 95% CI 1.78 to 6.99).[71]

Several studies have compared 25 mcg and 50 mcg doses. Most have found that lower doses of misoprostol resulted in more need for oxytocin augmentation and less uterine tachysystole, with and without FHR changes, compared to higher doses.[7,71] The induction to delivery time was shorter with the higher 50 mcg dose.[66,72] An RCT of 124 women using several different doses (25, 50, 100, 200 mcg) resulted in more vaginal deliveries at 12 and 24 hours, more tachysystole, and less need for oxytocin with each incremental dose.[73] A double-blind RCT of 374 women (> 36 weeks, Bishop ≤ 4) administered either 100 mcg or 200 mcg misoprostol vaginal insert had similar findings with the higher dose resulting in significantly more women achieving vaginal delivery within 24 hours (24% vs. 36%), shorter induction to delivery time (1181 vs. 1744 minutes), and less use of oxytocin (49% vs. 71%), but an increased rate of tachysystole (41% vs. 19.5%). There was a non-significant reduction of CS in the higher 200 mcg dose group (22.9% vs. 32.4%).[74]

A 2006 Cochrane review including 4 trials (474 women) comparing oral misoprostol with placebo found the misoprostol group was less likely to have long labour (RR 0.16, 95% CI 0.05 to 0.49), had less need for oxytocin (RR 0.32, 95% CI 0.24 to 0.43), and had a lower CS rate (RR 0.62, 95% CI 0.40 to 0.96). The author recommended that the oral misoprostol dose should not exceed 50 mcg.[75]

The same Cochrane review included 16 trials (3645 women) and found that women who were given oral misoprostol had a lower incidence of uterine tachysystole without FHR changes (RR 0.37, 95% CI 0.23 to 0.59) and more need for oxytocin (RR 1.28, 95% CI 1.11 to 1.48), but more meconium stained liquor (RR 1.27, 95% CI 1.01 to 1.60) than women given vaginal misoprostol.[75] A prospective RCT of 204 women comparing 25 mcg oral versus 50 mcg vaginal given every 4 hours up to 4 doses found that the lower oral dose had lower incidence of tachysystole with FHR changes (2.2% vs. 5.4%) and a lower CS rate (19.4% vs. 32.4%), but no difference in induction to delivery time or side effects (nausea, vomiting, shivering, or diarrhea) than the higher vaginal dose.[76] An RCT of 120 women that compared 12.5 mcg oral misoprostol with 25 mcg vaginal found no difference in outcomes in terms of mode of delivery, induction to delivery time, need for oxytocin, or complications.[77]

A 2008 RCT of 205 women comparing oral (20 mcg every hour for up to 4 doses until 3 contractions in 10 minutes) and vaginal (25 mcg every 4 hours until Bishop > 7) misoprostol found that the oral group had a higher rate of vaginal deliveries at 12 hours (74.4% vs. 25.5%) and a lower rate of tachysystole (0% vs. 11.3%), but more nausea (11% vs. 0%). This study was limited because the staff was not blinded and the average total dose of misoprostol was higher in the oral group (180 mcg vs. 50 mcg).[78]

A 2009 systemic review included 9 studies (2937 women) comparing low-dose oral misoprostol (20 to 25 mcg) to dinoprostone (PGE_2), vaginal misoprostol, and oxytocin. Two of the trials compared oral and low-dose vaginal misoprostol and found that the oral route resulted in less uterine tachysystole with FHR changes.[79]

Misoprostol (PGE_1) versus Dinoprostone (PGE_2)

A 2006 Cochrane review included 9 trials (2627 women) that compared oral misoprostol to vaginal dinoprostone and found that women who received oral misoprostol were less likely to have a CS.[75] However, this only reached significance in women with intact membranes (RR 0.78, 95% CI 0.66 to 0.94). There was more uterine tachysystole in the oral group, but this was not associated with adverse fetal outcomes.

A 2009 systemic review that compared oral misoprostol to vaginal dinoprostone included 5 studies (2281 women), only 1 of which was blinded, and found that women who had oral misoprostol had fewer CS (2% vs. 26%) but their need for oxytocin stimulation, incidence of tachysystole without FHR changes, and maternal adverse effects were similar to those who had vaginal dinoprostone.[79] A similar review found that the CS rate was the same, but that the misoprostol group had a higher rate of vaginal deliveries within 24 hours, a lower rate of oxytocin use, and a trend towards higher meconium staining.[80]

A 2010 Cochrane review concluded that vaginal misoprostol was also superior to other induction agents (vaginal prostaglandin, intracervical prostaglandin, and oxytocin), with less epidural use and fewer failures to achieve vaginal delivery within 24 hours, but more tachysystole with FHR changes.[71]

Several studies have reported on efficacy of sublingual misoprostol to be comparable to the oral route. An RCT of 212 women compared 50 mcg to 100 mcg sublingual doses and reported the higher dose to be more effective but to result in more tachysystole.[81] A double blind RCT of 140 women found that 50 mcg of sublingual misoprostol had a similar efficacy to 25 mcg vaginal misoprostol.[82] A systemic review that included 5 studies (740 women) found no difference between sublingual (25 to 50 mcg every 4 hours) and vaginal misoprostol (25 to 50 mcg every 4 hours) in the rates of vaginal deliveries at 24 hours, uterine tachysystole, or CS.[83] Two studies reported that patient satisfaction was higher using the sublingual route than the vaginal route.[84,85]

A prospective randomized study of 96 patients with an unfavourable cervix underwent cervical ripening with either vaginal misoprostol (50 mcg dose) or Foley catheter. The misoprostol group achieved a favourable cervix (Bishop ≥ 6) faster than the Foley group (98% vs. 69%, $P < 0.001$), although the induction to delivery interval was equivalent. There was lower use of oxytocin in the misoprostol group, part of which could be attributed to the 6-hour wait required before starting oxytocin after the last dose.[86]

Another study of 100 women comparing a higher single dose of misoprostol (100 mcg vaginal) to Foley catheter for cervical ripening found that misoprostol had a shorter induction to delivery time (11.8 h vs. 20.0 h, $P < 0.05$). There were two uterine ruptures, both in the misoprostol group. One occurred in a 39-year-old parous woman with 3 previous deliveries induced at term because of an impaired glucose tolerance that developed persistent fetal tachycardia

7 hours post-insertion without uterine tachysystole. The second woman with uterine rupture was a nulliparous 32-year-old induced because of prolonged pregnancy complicated by second stage dystocia due to cephalopelvic disproportion who developed uterine tachysystole with abnormal FHR changes 11 hours post-insertion. Both infants were delivered with Apgar ≥ 7 at 5 minutes.[87]

Few studies have used misoprostol in the case of PROM. An open RCT of 150 women with PROM at term compared vaginal misoprostol (25 mcg every 6 hours × 4 doses) to expectant management followed by oxytocin induction if labour did not begin. The misoprostol group had a shorter latency time to achieve labour (9.4 vs. 15.8 hours), shorter recruitment to delivery time (18.9 vs. 27.5 hours), a trend towards lower oxytocin use, and lower CS.[88]

An RCT of 758 women compared low dose (25 mcg) oral (Bishop > 6) or vaginal (Bishop ≤ 6) misoprostol to vaginal dinoprostone with rupture of membranes > 34 weeks' gestation. There was no difference in CS and vaginal delivery rates but there was a trend towards the misoprostol group requiring less oxytocin, less epidural use, and less CS for failure to progress. Misoprostol also seemed to be more effective than dinoprostone in the setting of an unfavourable cervix, whereas oxytocin seemed to be more effective than misoprostol in a favourable cervix. Unfortunately, the predetermined sufficient sample size of 1890 women to provide meaningful results could not be reached due to lack of funding. Larger studies with sufficient numbers are required to complete the analysis.[89]

Recommendations

16. Misoprostol can be considered a safe and effective agent for labour induction with intact membranes and on an inpatient basis. (I-A)
17. Misoprostol should not be used in the setting of vaginal birth after Caesarean section due to the increased risk of uterine rupture. (II-3D)
18. Oxytocin should be started no earlier than 4 hours after the last dose of misoprostol. (III-B)

Practice Points

- Misoprostol is more effective than PGE_2 to achieve vaginal delivery and results in less epidural use but more uterine tachysystole.
- PGE_1 and PGE_2 both reduce CS rates in an unfavourable cervix.
- The oral and vaginal routes have a similar reduction of CS rates. The oral route needs more oxytocin stimulation but the vaginal route will have more tachysystole.
- The lower vaginal dose (25 mcg) tends to need more oxytocin stimulation and the higher vaginal dose (≥ 50 mcg) tends to have more uterine tachysystole.
- All doses of misoprostol can cause uterine tachysystole.
- Fetal well-being is required before administration of misoprostol. Electronic fetal monitoring should be performed for 30 minutes after administration of misoprostol and for 60 minutes after any tachysystole.

OPTIONS FOR INDUCTION WITH A FAVOURABLE CERVIX

Amniotomy

Amniotomy can be a simple and effective component of labour induction when the membranes are accessible and the cervix is favourable. This intervention creates a commitment to delivery and must be done for convincing and compelling reasons. However, the time interval from amniotomy to established labour may not be acceptable to clinicians or to women, and in a number of cases, after amniotomy alone, labour will not commence.

Contraindications include placenta previa, vasa previa, and active genital infection except for women colonized with GBS. Cord prolapse is a risk of amniotomy, especially in a high presentation or unstable lie. After the membranes are ruptured, the care provider should continue to palpate the presenting part until it rests against the cervix to ensure there has been no cord prolapse. The amount, colour, and consistency of the fluid as well as fetal well-being should be assessed.

There are no studies comparing amniotomy alone to placebo.

Amniotomy can be used for induction when the cervix is favourable, but the onset of labour is unpredictable and often requires oxytocin. A 2007 Cochrane meta-analysis of 17 trials with 2566 women measured the safety of amniotomy and intravenous oxytocin for induction of labour. Amniotomy alone resulted in fewer vaginal deliveries in 24 hours then amniotomy plus oxytocin (RR 0.03, 95% CI 0.01 to 0.49). Amniotomy and oxytocin resulted in fewer instrumental deliveries than placebo (RR 0.18, 95% CI 0.05 to 0.58). However, there was more postpartum hemorrhage (RR 5.5, 95% CI 1.26 to 24.07) and maternal dissatisfaction (RR 53, 95% CI 3.32 to 846.51) with amniotomy and oxytocin than with vaginal PG.[90]

A more recent small RCT of amniotomy and immediate oxytocin infusion versus amniotomy and delayed oxytocin infusion for induction of labour in 123 women at term

found that women in the immediate group were more likely to be in established labour 4 hours post amniotomy, have a shorter amniotomy to delivery interval ($P < 0.001$), and achieve vaginal delivery within 12 hours (RR 1.5; 95% CI 1.2 to 12.6).[91] There was no difference between the groups with regard to mode of delivery or incidence of uterine tachysystole with abnormal FHR recording. Although the study was underpowered to provide an adequate statistical analysis, women in the immediate group were more likely to be satisfied with the induction process (RR 4.1, 95% CI 1.1 to 16.1) and the duration of labour (RR 1.8, 95% CI 1.0 to 3.3).

Recommendations

19. Amniotomy should be reserved for women with a favourable cervix. Particular care should be given in the case of unengaged presentation because there is a risk of cord prolapse. (III-B)
20. After amniotomy, oxytocin should be commenced early in order to establish labour. (III-B)

Practice Point

- Amniotomy creates a commitment to delivery and should be performed when the indication for induction is convincing and the reasons compelling and documented.

Oxytocin

Intravenous oxytocin, available since the 1950s, has been the most commonly used method of induction for women with a viable pregnancy and favourable cervix. Oxytocin is a peptide produced naturally in the posterior hypothalamus that binds to uterine receptors to produce uterine contractions, but it has no direct effect on the cervix. It has a half-life of 5 to 12 minutes,[92] a time to steady plasma concentration of 40 minutes,[93] and a steady-state uterine response of 30 minutes or longer.[94] The uterus is increasingly responsive to oxytocin as pregnancy progresses.[95] Other areas of the body that respond to oxytocin include the breast, vascular smooth muscle, and kidney. At dosages typically used for the induction of labour, there is not a demonstrable effect on renal function or vascular smooth muscle tone. However, IV boluses of as little as 0.5 U can transiently decrease peripheral vascular tone, leading to hypotension.[96] Due to its antidiuretic activity, water intoxication is possible with high doses (> 40 mU/min).

The physiological dose of oxytocin to produce regular uterine contraction is 8 to 12 mU/min. The ideal dosing regimen of oxytocin is not known and there are both low-dose and high-dose protocols. The low-dose regimen begins with 1 to 2 mU/min, increased incrementally by 1 to 2 mU at 30-minute intervals. The high-dose regimen commences with a dose of 4 to 6 mU/min, with dose increments of 4 to 6 mU/min every 15 to 30 minutes. The benefits of the low-dose regimen include less risk of tachysystole and the use of a smaller overall dose. However, the high-dose oxytocin regimen has been shown to reduce the length of labour with no appreciable increase in neonatal morbidity[97]. High-dose oxytocin has been associated with an increase in uterine tachysystole with associated FHR changes.[61] Continuous fetal monitoring is recommended with the use of oxytocin.[98] Because mixing methods vary, the rate of infusion should always be documented in mU/min rather than ml/hour.

Example of low-dose protocol:

Initial dose of oxytocin	1 to 2 mU/min
Increase interval	30 minutes
Dosage increment	1 to 2 mU
Usual dose for good labour	8 to 12 mU/min
Maximum dose before reassessment	30 mU/min

Example of high-dose protocol:

Initial dose of oxytocin	4 to 6 mU/min
Increase interval	15 to 30 minutes
Dosage increment	4 to 6 mU/min
Usual dose for good labour	8 to 12 mU/min
Maximum dose before reassessment	30 mU/min

A 2009 Cochrane review included 61 studies (12 819 women) of the methods of cervical ripening and labour induction.[99] Oxytocin alone versus vaginal prostaglandins was associated with an increase in unsuccessful vaginal delivery within 24 hours (70% vs. 21%). Oxytocin versus intracervical prostaglandins also had fewer vaginal deliveries (51% vs. 35%) and increase in CS rates (19.1% vs. 13.7%). For all women with an unfavourable cervix regardless of membrane status, the CS rates were increased (19.0% vs. 13.1%, RR 1.42, 95% CI 1.11 to 1.82) when labour was induced.[99]

In the case of a favourable cervix, the CS rate was no different whether the pregnancy was induced or managed expectantly.[8,17,21] Osmundson et al. measured a significantly higher rate of oxytocin use in the elective induction group than in the group managed expectantly (99.3 % vs. 30.6 %, $P < 0.001$).[21]

Term PROM

A 2006 Cochrane analysis reviewed the advantages of early intervention with either oxytocin or prostaglandin versus expectant management in the setting of term PROM.[59]

Planned delivery resulted in less chorioamnionitis and endometritis and fewer admissions to neonatal ICU, with no difference in neonatal infection rates or mode of delivery.

PROM with GBS

The 2009 Cochrane review included women with ruptured membranes. In this setting, there was some evidence of less chorioamnionitis (RR 0.66, CI 0.47 to 0.92) and use of antibiotics in the neonatal period with the use oxytocin alone than with vaginal PGE_2.[99] The authors stated the data should be viewed with caution because the infection had not been not pre-specified. In the setting of term PROM and GBS, the Term PROM trial showed that GBS colonization was predictive of neonatal infection for induction with vaginal PG (OR 5.13, 95% CI 2.54 to 10.37) and in expectant groups (OR 4.12, 95% CI 2.00 to 8.52) but not in the group induced with oxytocin.[100]

VBAC

Oxytocin can be used in women with a previous CS, but caution, care, and diligence should be used as it has been shown to increase the risk of rupture.[69,101]

Recommendations

21. In the setting of ruptured membranes at term, oxytocin should be considered before expectant management. (I-A)
22. Women positive for group B streptococcus should be started on oxytocin as early as possible after ruptured membranes in order to establish labour within 24 hours. (III-B)
23. Both high- and low-dose oxytocin may be considered within a hospital protocol. (III-B)
24. Because of the various concentrations, oxytocin infusion rates should always be recorded in mU/min rather than mL/hr. (III-L)
25. Oxytocin induction maybe considered in the hospital setting of vaginal birth after Caesarean section. (II-3B)

Practice Points

- With PROM, oxytocin stimulation is more effective than expectant management to reduce maternal infection and increase vaginal deliveries within 24 hours, but it may increase CS rate.
- In the setting of PROM, women preferred oxytocin induction over expectant management.

The care provider should maintain a higher level of vigilance for uterine dehiscence and rupture when using oxytocin in an attempted VBAC.

UTERINE RUPTURE

Uterine rupture is a rare but potentially devastating complication for both mother and fetus. Uterine rupture is possible during induced labour in the absence of a scarred uterus, and is usually associated with aggressive use of uterotonic agents in the presence of obstructed labour (e.g. brow or posterior presentation). A population-based study in the Netherlands comparing induced and spontaneous labour found 210 cases of uterine rupture with an incidence of 5.9 per 10 000 pregnancies. Ruptures occurred in both scarred and unscarred uteri. The overall relative risk of uterine rupture with induction of labour was 3.6 (95% CI 2.7 to 4.8) with an absolute risk of 1 in 629. For women with a previous CS, PG conferred the greatest risk for rupture of all uterotonic agents.[69] Lydon-Rochelle et al. also reported the greatest risk of rupture in women with a previous CS when PG were used, with an incidence of 24.5 per 1000 (RR 15.6, 95% CI 8.1 to 30.0).[36] Oxytocin is considered a safe uterotonic agent for use in the presence of a scarred uterus, but it should be used with due care and diligence.[102]

INDUCTION OF LABOUR AND ADVANCED MATERNAL AGE

Advanced maternal age (35 years or older) now accounts for 17% of all pregnancies and 17.44% all live births in Canada.[103] It has been well documented that these women are at risk of several adverse outcomes in pregnancy including stillbirth. Rates have been stated to be 1/116 in women 40 and older from 37 weeks' gestation and greater. Population-based studies showed higher perinatal mortality rates among women aged 35 to 39 and those 40 years or older than in women aged 20 to 24.[104–106] Given the increased risk of stillbirth in women with advanced maternal age some experts suggest that women ≥ 40 years of age be considered biologically post-term at 39 weeks' gestation and that delivery be considered at this gestation.[107]

A single study was found comparing induction of labour with misoprostol to oxytocin in women of advanced maternal age (≥ 35) with an unfavourable cervix (Bishop < 6). The results were consistent with other studies showing the benefit of PG over oxytocin in an unripe cervix.[108]

INDUCTION OF LABOUR AND ARTIFICIAL REPRODUCTIVE TECHNOLOGIES

ART has been shown to be associated with adverse outcomes in pregnancy including gestational hypertension, gestational diabetes, placenta previa and placental abruption, stillbirth, neonatal death, preterm delivery, low

and very low birth weight, small for gestational age, and NICU admission as illustrated in a recent SOGC-CFAS guideline.[109] A prospective database review by the FASTER Research Consortium showed an adjusted OR (95% CI) of 2.1 (1.3 to 3.6) for fetal loss or demise (> 24 weeks).[110] Many women undergoing ART are older, which increases their risk of the adverse perinatal outcomes listed above. Until there is more evidence available, induction should be considered on an individual basis.

SUMMARY

The rate of labour induction has increased significantly since the early 1990s and continues to involve a significant percentage of pregnancies, removing women from the advantageous natural process of labour. While there are indications to recommend induction, postdates pregnancies remain a large contributor to the induction rates. Practitioners need to apply clinical judgement and evidence-based medicine to justify that induction is superior to continuation of pregnancy. The benefit of induction over the continuation of a pregnancy is not always clear, but the clinician has some tools to evaluate the likelihood of a successful vaginal delivery. The clinician should consider all of the tools available to optimize a safe process towards achieving a successful vaginal delivery.

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