Review Article

Induction of Labor: A Comparison of Guidelines

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Abstract

Introduction: Induction of labor (IOL) is a commonly performed obstetric procedure that initiates labor prior to its spontaneous onset. It is advised when the benefits of terminating the pregnancy outweigh the risks of ongoing pregnancy.

Aim: This is a review article that compares the most recent international guidelines on IOL by organizations including World Health Organization (WHO), the National Institute for Health and Care Excellence (NICE), American College of Obstetricians and Gynecologists (ACOG), the Society of Obstetricians and Gynecologists of Canada (SOGC), the Federation of Obstetric and Gynecological Societies of India (FOGSI) and Queensland Health. We will also compare these recommendations to the current guidelines set in our institute, King Hamad University Hospital (KHUH) in the Kingdom of Bahrain.

Conclusion: The most notable differences were observed in the Bishop scoring with minor differences in
the methods of induction and management of complications. Improving KHUH guidelines in particular areas would enhance patient care. Regular audits are essential to ensure practice is consistent with the guidelines.

**Keywords:** Induction of Labor (IOL); Vaginal Delivery; Cesarean Section; Guidelines for Inducing Labor; Bishop Score

**Abbreviations:** ACOG: American College of Obstetrics and Gynecology; AF: Amniotic Fluid; APH: Antepartum Haemorrhage; ARM: Artificial Rupture of Membranes; BMI: Body Mass Index; CS: Cesarean Section; CTG: Cardiotocograph; D&C: Dilatation and Curettage; DIC: Disseminated Intravascular Coagulation; DM: Diabetes Mellitus; EFW: Estimated Fetal Weight; FHR: Fetal Heart rate; FOGSI: Federation of Obstetric and Gynecological Societies of India; GA: Gestational Age; GBS: Group B Streptococcus; GDM: Gestational Diabetes Mellitus; HTN: Hypertension; IOL: Induction of Labor; IUFD: Intrauterine Fetal Death; IUGR: Intrauterine Growth Restriction; IV: Intravenous; KHUH: King Hamad University Hospital; LMWH: Low Molecular Weight Heparin; MgSO₄: Magnesium Sulfate; NICE: National Institute for Health and Care Excellence; NICU: Neonatal Intensive Care Unit; NST: Non-Stress Test; NYHA: New York Heart Association; OHA: Oral Hypoglycaemic Agents; PET: Pre-eclamptic Toxemia; PG: Prostaglandin; PGE₂: Prostaglandin E₂; PPH: Post-partum Haemorrhage; PPROM: Preterm Pre-labor Rupture of Membranes; PROM: Pre-labor Rupture of Membranes; RCOG: Royal College of Obstetricians and Gynaecologists; SOGC: Society of Obstetricians and Gynaecologists of Canada; VBAC: Vaginal Birth After Cesarean; VE: Vaginal Examination; WHO: World Health Organization.

### 1. Introduction

Induction of labor (IOL) is the process of artificially stimulating labor prior to its spontaneous onset ultimately achieving vaginal delivery [1-5]. It is the most common obstetric intervention, performed in almost 20% of pregnancies in the United Kingdom and the United States [2, 6, 7]. IOL is performed when the benefits outweigh the risks of continuing pregnancy [1-4, 6, 8]. When compared to spontaneous labor, induced labor is associated with a higher incidence of additional interventions such as fetal monitoring but no increase in instrumental births. And, when comparing IOL to expectant management, there is no increase in neonatal intensive care unit (NICU) admissions or maternal mortality [3].

IOL after 37 weeks leads to improved perinatal outcomes without increasing Cesarean section (CS) rates [9]. However, women are at a higher risk of CS when undergoing IOL compared to spontaneous labor [4]. Nulliparous women, in particular, are twice as likely to deliver through CS [2]. Several factors are found to be associated with the success of IOL including maternal age, parity, body mass index (BMI), pre-existing medical conditions and Bishop score [4, 7, 9]. Age more than 35 years, BMI > 40kg/m², estimated fetal weight (EFW) > 4kg and diabetes mellitus (DM) are associated with a higher risk of CS when labor is induced. In the presence of those unfavourable circumstances, it might be best to delay intervention and allow labor to progress spontaneously [4]. There are many variations in the recommendations proposed by health organizations...
globally, especially in terms of indications and contraindications of IOL, the Bishop scoring system, methods of induction and how patients should be monitored during IOL. We aim to compare several of the most recently updated international guidelines by the World Health Organization (WHO), National Institute for Health and Care Excellence (NICE), American College of Obstetricians and Gynecologists (ACOG), the Society Of Obstetricians And Gynaecologists of Canada (SOGC), the Federation of Obstetric and Gynecological Societies of India (FOGSI) and Queensland Health, along with the current guidelines in our institute (King Hamad University Hospital (KHUH)) on the approach to induction of labor.

2. Induction of Labor: A Comparison of Current Guidelines

2.1 Pre-Induction assessment

Prior to induction, women should be provided with relevant information to allow her to make an informed decision [3, 7, 8]. Such information includes the indication for IOL in her case, the method and its risks and benefits, an overview of the process, the risks of refusing IOL and alternative options [2-4, 7, 8] (Table 1). Women should be given a chance to consider their options and make an informed decision before giving consent [3, 4, 7, 8]. A woman who refuses IOL should have her decision respected and documented [3, 7]. The physician must, in turn, formulate a plan for ongoing care [3].

Treatment should be tailored to a woman’s personal needs and preferences, and so, effective communication and informed decision-making are essential [4, 7, 8]. Patients need to be educated that most women undergo spontaneous labor before 42 weeks. At 38 weeks, they should be taught about the risks of continuing pregnancy beyond 42 weeks and what options are available [7]. Membrane sweeping increases the chance of spontaneous labor, thus reducing the need for formal IOL [4, 7]. The mother’s medical and surgical history must be reviewed. In addition, the indications and contraindications to IOL must be recorded [3, 8]. Several clinical parameters should also be established within the patient’s file. They include physical examination, vital signs, and gestational age (GA) [1-4, 8]. Bishop score [3, 4, 8] and electronic fetal monitoring help to determine the baby’s physical condition before IOL [7, 8] (Table 1). Besides the Bishop score, fetal fibronectin and transvaginal ultrasound have been found to predict successful IOL but are not as effective [4].

2.2 Indications for induction of labor

IOL is indicated for maternal, fetal or pregnancy-related conditions [6]. Maternal conditions include thrombophilia, DM, and renal disease among others [1, 2, 4, 6]. Fetal conditions include intrauterine growth restriction (IUGR) and intrauterine fetal death (IUFD) [1-4, 6, 8]. Pregnancy-related conditions include post-term pregnancy, oligohydramnios, chorioamnionitis or gestational hypertension (HTN) [1-4, 6]. High priority indications include pre-eclamptic toxemia (PET), severe maternal disease not responding to treatment, severe but stable antepartum haemorrhage (APH) and pre-labor rupture of membranes (PROM) with group B streptococcus (GBS) colonization [2, 4, 8] (Table 2). Post-term pregnancy is considered one of the most common indications for IOL [4]. IOL is indicated at 41 weeks in those with an uncomplicated pregnancy, even in patients with only gestational diabetes mellitus (GDM). Inducing labor at this GA, otherwise known
as full term, leads to less perinatal deaths and CS rates [1, 3]. Studies have shown that 73% of patients who are induced for prolonged pregnancy will choose IOL the next time while only 38% of women who chose to wait for labor to start will also choose to wait the next time. Terminating pregnancy before 42 weeks leads to lower perinatal morbidity and mortality but not higher CS rates [4]. Queensland Health does not recommend waiting until after 42 weeks [3].

For women with PROM, IOL is indicated after 37 weeks as it is associated with reduced maternal morbidity due to infection and increased maternal satisfaction without increasing operative vaginal delivery, CS rates or NICU admissions [1, 7, 8]. Induction with vaginal prostaglandin E₂ (PGE₂) can be offered at 24 hours after PROM however expectant management is still a feasible option [2, 7]. Although oxytocin is associated with higher CS rates, it is more effective than expectant management to reduce maternal infection and increase vaginal delivery. Planned delivery results in a lower incidence of chorioamnionitis, endometritis, and NICU admissions compared to expectant management [2, 4]. In IUGR, there are pathophysiological factors that impair the growth of the fetus [3]. Induction is indicated for IUGR to prevent stillbirth. Timing depends on the severity, GA and Doppler parameters on fetal monitoring [3, 8]. Increased fetal surveillance is required when adhering to expectant management [3]. Thus, women with IUFD should be provided with support throughout the process. They should be offered the option to be immediately induced or managed expectantly [7, 8]. The method and timing depend on the GA, maternal history and preference [2]. Immediate delivery is indicated in the case of sepsis, placental abruption or PET [7, 8]. Labor starts spontaneously in more than 90% of women within 3 weeks of diagnosis. Disseminated intravascular coagulation (DIC) occurs in 25% of patients with IUFD lasting for more than 4 weeks. However, women should still be tested for DIC twice per week if IOL is delayed for more than 48 hours [8]. Misoprostol can be used between 24 and 28 weeks. Beyond 28 weeks, dilatation and curettage (D&C) is an option but cannot provide information on autopsy [2]. FOGSI recommends the use of PGE₂ and oxytocin for induction [8]. There is an increased risk of uterine rupture in the case of IUFD with previous CS. This implies a reduced dose of vaginal prostaglandin (PG), especially in the third trimester [7].

Furthermore, WHO, NICE, and ACOG do not have any recommendations to induce women with uncomplicated twin pregnancy [1, 2, 7]. FOGSI and Queensland Health, on the other hand, recommend IOL at 37 weeks for uncomplicated twin pregnancy [3, 8]. Contraindications include monoamniotic twins and the first twin being in a non-cephalic presentation [8]. SOGC recommends delivery of uncomplicated twin pregnancy at 38 weeks or onwards [4]. A woman with a previous CS should be informed of the probability of delivering vaginally and the associated risk of uterine rupture. Management of such patients can be in the form of expectant management, CS or IOL with vaginal PGE₂ [7, 8]. More than 60% of IOL in previous CS culminate with vaginal delivery. Amniotomy followed by oxytocin is preferred for a favourable cervix whereas mechanical methods followed by amniotomy and oxytocin are recommended for an unfavourable cervix [8]. In the case of preterm pre-labor rupture of membranes (PPROM), IOL is not advised prior to 34 weeks unless there are certain indications such as chorioamnionitis or fetal
compromise. Induction is indicated if PPROM occurs after 34 weeks. Magnesium Sulfate (MgSO\textsubscript{4}) is advised for neuroprotection if delivering prior to 32 weeks along with the provision of antenatal steroids and antibiotics if necessary. While the steroids take action, tocolysis may be used to delay delivery [8]. NICE recommends IOL with vaginal PGE\textsubscript{2}. However, there remains a risk of sepsis and possible need for CS, both of which must be considered prior to induction [7]. Ultrasound can be used to estimate fetal weight [3]. IOL solely for fetal macrosomia is not a justified indication according to WHO, SOGC and Queensland Health [1, 3, 4, 7]. IOL for obstetric cholestasis is indicated at 37-38 weeks to improve perinatal outcomes. Delivery might be indicated earlier, at 36 weeks, based on the severity of biochemical abnormalities such as jaundice, elevated liver enzymes and compromised fetal state [3, 8].

### 2.3 Contraindications to induction of labor

The contraindications to IOL are the same as those for labor or vaginal delivery [2-4, 8]. Common contraindications include placenta or vasa praevia, abnormal fetal presentation, previous surgeries involving the uterus, prior uterine rupture or invasive cervical carcinoma [4, 8]. IOL is not indicated when it is merely convenient to either the patient or healthcare provider [4, 7, 8]. IOL is not recommended for a baby in breech presentation but can be offered if a woman refuses external cephalic version or elective CS. It is also not recommended for severe IUGR [7].

### 2.4 Setting of induction of labor

Patients who are chosen to undergo outpatient IOL must be carefully chosen based on set criteria [2, 3]. Because IOL places more strain on the labor and delivery room compared to spontaneous labor, IOL is usually performed during the day [7]. This leads to lower operative vaginal deliveries, lower requirements for oxytocin infusions and higher maternal satisfaction [4, 7]. It should be performed in a facility that has the capacity to monitor the wellbeing of both the mother and baby as well as equipped to perform CS [1, 3, 8]. If IOL is performed on an outpatient basis, then balloon catheters are a safer method compared to PG due to the risk of uterine hyperstimulation in the latter [3]. ACOG considers mechanical methods to be more appropriate while PGE\textsubscript{2} gel is also safe [2]. For low-risk pregnancies, continuous electronic fetal monitoring is required 1-2 hours after administering PG and intermittent auscultation is necessary when active labor starts [4]. The process of outpatient IOL must be frequently audited and needs to be further studied with the intention of reducing the time women spend in the hospital [7]. Conversely, WHO does not recommend outpatient IOL [1].

### 2.5 Bishop score

The Bishop score is a pre-labor scoring system that assesses the station, dilation, effacement, position and consistency of the cervix [5, 7]. This helps guide which method(s) to use [2, 3] as well as predict the success of induction [4, 8]. A favourable cervix can either suggest a higher chance of spontaneous labor or higher response to interventions of IOL [3, 7]. The most important criteria are cervical dilation then effacement with cervical consistency being the least significant [4]. Inducing a woman with an unfavorable cervix is associated with higher CS rates and higher failure rates particularly in nulliparous women [4]. As per ACOG, SOGC and Queensland Health, a favourable cervix has a score of 7 or more while
FOGSI considers a score of 6 or more as favourable [2-4, 8]. A score of more than 8 implies that the probability of vaginal delivery after induction is similar to that of spontaneous labor as per NICE guidelines [2, 4, 7] (Table 3).

2.6 Methods of induction

There are non-pharmacological, pharmacological or mechanical methods of inducing labor [4, 6]. Cervical ripening is intended to facilitate the process of softening, thinning and dilating the cervix hence reducing both the rate of failed induction and the time from induction to delivery [2, 3]. Cervical remodeling is a normal process of parturition characterized by the breakdown and rearrangement of collagen, changes in glycosaminoglycans, infiltration of white blood cells and increased production of cytokines. If the cervix is unfavourable, as per the Bishop score, then agents for cervical ripening may be used. Using pharmacological methods to ripen the cervix does not increase CS rates [2]. The following interventions are still associated with their respective complications; hence it is crucial to inform the mother in the decision-making process [1, 4].

2.6.1 Membrane sweeping: Membrane sweeping is performed by passing a finger through the cervix, during vaginal examination, and rotating against the uterine wall while separating the chorionic membrane from the decidua thus stimulating local PG production [3, 4, 7]. It improves the initiation of labor and is especially recommended for non-urgent cases since the interval between sweeping and the start of labor is longer than other methods [8]. It can be offered to nulliparous women at 40-41 weeks gestation or to parous women at 41 weeks [7, 8]. If it is difficult to pass a finger through the cervix, massaging around the cervix in the vaginal fornices can result in similar effects [3, 4, 7]. It can reduce formal IOL by up to 33% [1, 4]. It can also be repeated if labor does not start spontaneously [3, 4, 7, 8]. Risks associated with membrane sweeping include discomfort, vaginal bleeding and PROM [1-4, 7].

2.6.2 Amniotomy: Amniotomy is the process of artificially rupturing the membranes to hasten delivery [3]. It is recommended in the case of a favourable cervix [2-4] and can be performed with the use of oxytocin [2-4, 6, 8]. It creates a commitment to delivery but is not recommended as a sole method of IOL [2-4, 8]. Serial membrane sweeping can be done every 2 days. Women are advised to empty their bladder before the procedure [3]. When performing an amniotomy, one must control the flow of amniotic fluid with their fingers, noting the color and amount of fluid [3, 4, 8]. CTG should be performed in the event of abnormal liquor [3]. A rapid flow of fluid leads to sudden decompression of the uterus which in turn can lead to placental abruption [8]. It is contraindicated in the case of placenta or vasa previa and active genital infection [2, 4]. NICE guidelines do not recommend the combination of amniotomy with oxytocin as a primary method of IOL due to the risk of uterine hyperstimulation [7].

2.6.3 Prostaglandin E2: PGE₂ dissolves the structural network of collagen in the cervix [4]. It is recommended for use in patients with an unfavourable cervix and can reduce their risk of CS [3, 4, 8]. Prostaglandins can be administered in the form of vaginal gels/tablets or pessaries [1, 3, 4, 6, 8]. Vaginal preparations are easier to administer than cervical preparations and result in a quicker delivery [4, 8]. However, women should be informed of the
associated risk of uterine hyperstimulation [7]. PGE$_2$ gel is associated with less uterine hyperstimulation compared to tablet form. Starting with a minimal dose of PGE$_2$ decreases the risk of uterine hyperstimulation with FHR changes and NICU admissions compared to a high dose [1]. It should not be given to women with previous CS due to the risk of uterine rupture [3, 4]. Women with ruptured membranes are more susceptible to chorioamnionitis and uterine tachysystole if given PGE$_2$ [3, 8]. PGE$_2$ has the advantage of a lower operative rate compared to oxytocin and a reduced need for augmentation by oxytocin when used in an unfavourable cervix [4]. Vaginal PGE$_2$ pessary can be easily removed in the case of uterine hyperstimulation [2, 3, 8]. It releases PG at a slower rate, of 0.3 mg/hour, than gel and does not require repeat doses [2, 3]. Otherwise, it should be removed after 24 hours or when active labor begins [8]. PGE$_2$ should not be combined with oxytocin due to the fear of uterine hyperstimulation. If three doses of PGE$_2$ gel fail to ripen the cervix, then balloon catheter is recommended. If the PGE$_2$ pessary fails to do so, then either PGE$_2$ gel or balloon catheter are recommended [3]. PGE$_2$ is a bronchodilator but is not contraindicated in patients with asthma [2, 4].

2.6.4 Oxytocin: Oxytocin is a synthetic polypeptide hormone used to stimulate uterine contractions [2, 3]. It is mostly used to induce labor in women with a favourable cervix and ruptured membranes [3, 8]. Patients with lower BMI, higher parity, and GA are more successfully induced with oxytocin [2]. It is associated with less vaginal births that extend beyond 24 hours of IOL, less NICU admissions but higher CS rates when compared to expectant management [1]. Oxytocin can be used with caution in women with previous CS due to the increased risk of uterine rupture [3, 4, 8]. It can be used alone or combined with amniotomy to either induce or augment labor [3, 8]. If PG is unavailable, IV oxytocin can be used alone for IOL [1]. However, NICE guidelines advise against using oxytocin alone for IOL [7]. Oxytocin is administered by slow intravenous (4) infusion thus allowing the control of the dose administered [2, 3, 6, 8]. The unit used to monitor the dose is milliunits per minute (mU/min) [3, 4, 8]. It should not be administered as an IV bolus because even 0.5U can cause hypotension [2, 4]. The physiological dose of oxytocin required to stimulate uterine contractions is 8-12 mU/min [4]. Women react differently to oxytocin depending on the duration of pregnancy and their sensitivity to the drug [2]. Those who are 35 years or older require oxytocin at higher doses over a longer duration for successful vaginal delivery [9]. Oxytocin can be discontinued once labor actively starts with the cervix dilated at 5cm or more. This leads to lower uterine hyperstimulation and FHR abnormalities [3]. There is a low and high-dose regimen for administering oxytocin as per ACOG, SOGC and FOGSI (Table 5). A low-dose regimen can be used for cervical ripening in an unfavourable cervix and is associated with a lower risk of tachysystole. A high-dose regimen shortens the duration of labor but increases the risk of uterine tachysystole with FHR changes [2, 4, 8]. The uterus reacts to oxytocin 3-5 minutes after the infusion starts and its level remains steady in plasma at 40 minutes [2]. If 32 mU/min of oxytocin has been administered and labor has not started, obstetrician review is required [3].

2.6.5 Misoprostol and mifepristone: Misoprostol, a synthetic PGE$_1$ analogue, is effective in ripening the cervix and inducing labor in an unfavourable cervix [2, 4]. It is characterized by its low cost and rapid
onset of action [4]. It can be administered either orally or vaginally and both administrations result in lower CS rates; the former requires more stimulation by oxytocin while the latter is more associated with uterine tachysystole [2, 4]. However, when compared to other PG, vaginal misoprostol can be associated with a higher risk of uterine hyperstimulation with FHR changes. Lowering the dose of vaginal misoprostol can reduce this risk [1, 2, 4]. However, this might increase the need for oxytocin stimulation. When administering oral misoprostol, patients must be told to swallow quickly to avoid sublingual absorption [4]. Queensland Health does not recommend the use of misoprostol for live birth [3]. Both oral and vaginal misoprostol are found to be associated with a lower risk of vaginal birth more than 24 hours after IOL, less CS and less infants with low APGAR score compared to expectant management or IV oxytocin alone [1, 2]. Misoprostol is not for use in patients with previous CS due to the associated risk of uterine rupture [1, 2, 4]. Its use is also associated with meconium-stained amniotic fluid [2, 4]. NICE recommends the use of oral mifepristone followed by either vaginal PGE$_2$ or misoprostol [7]. Misoprostol, oral or vaginal, and mifepristone are recommended as methods of IOL in the case of IUFD [1, 7]. In the case of fetal death, vaginal misoprostol is preferred to oral misoprostol [1].

2.6.6 Laminaria tents and balloon catheters:

Mechanical methods of IOL include laminaria tents and balloon catheters [1, 6]. These methods aim to ripen and dilate the cervix to by applying pressure onto the internal cervical os [2-4, 6]. This indirectly increases the secretion of PG, oxytocin or both thus leading to the start of uterine contractions [3, 4, 6]. Laminaria tents and balloon catheters result in a lower risk of uterine hyperstimulation with FHR changes compared to PG [1, 3]. These methods are considered low cost, simple to use, reversible, and associated with less side effects [3, 4]. Balloon catheters result in fewer CS rates than oxytocin and can be used in women with previous CS since they do not increase the risk of uterine rupture [1, 3, 4, 8]. Combining the balloon catheter with oxytocin is a possible alternative if PG is unavailable but that would not shorten the time of delivery [1, 2, 8]. When comparing balloon catheters to PG, the former is associated with shorter induction-to-delivery time but increased the need for further stimulation by oxytocin, whereas PG is more associated with tachysystole while both result in similar CS rates [2-4]. Balloon catheters are absolutely contraindicated in low-lying placenta and relatively contraindicated in APH and ruptured membranes [2-4, 8]. NICE guidelines do not recommend such mechanical methods for IOL [7].

A balloon catheter can be inserted for IOL at term if the cervix is unfavourable [2, 6]. In a balloon catheter, a Foley catheter is inserted into the cervical canal and a balloon is inflated in the extra-amniotic space [3, 4, 6]. The catheter should be placed under tension to pull against the cervical os; taping the catheter to the inside of the thigh can maintain such traction [3, 4, 6, 8]. A possible option is infusing saline into the extra-amniotic space [2, 4, 6]. A double balloon catheter can also be used following a similar concept except with another balloon in the vagina against the external cervical os [2-4, 6]. It can be a second line alternative [4]. With both balloons inflated and squeezing the cervix, cervical ripening occurs due to the local release of PG. Double balloon catheter is associated with lower uterine tachysystole
and less non-reassuring FHR compared to PG gel [6]. The balloon catheter is meant to remain in place for 12-24 hours [3, 8]. It is associated with a lower risk of uterine tachysystole and less non-reassuring FHR compared to PG gel [6, 8]. But it should be deflated and removed if labor begins, membranes rupture, spontaneous expulsion of device occurs or if the fetus is in distress [3, 6-8]. If labor does not start after leaving a balloon catheter for 12 hours, then amniotomy should be performed followed by oxytocin infusion [6]. If the balloon catheter fails in ripening the cervix, then PGE\(_2\) gel or pessary are recommended [3].

### 2.7 Monitoring during induction of labor

Labor progresses differently in IOL compared to spontaneous labor [2]. Both the mother and baby must be closely monitored for fetal distress, uterine hyperstimulation or rupture [1, 3, 8]. FHR needs to be monitored by cardiotocograph (CTG) continuously while receiving oxytocin, for 30 minutes after administering misoprostol, for 30 minutes to 2 hours after administering PGE\(_2\) and during active labor [1-4, 7, 8]. Intermittent auscultation can also be used after discontinuing CTG [7, 8]. FHR should also be monitored before and after artificial rupture of membranes (ARM), after inserting a balloon catheter and during failed induction [2-4, 7, 8] (Table 5). Women receiving oxytocin, misoprostol or PG should not be left unattended [1]. After starting IV oxytocin, infusion rates of oxytocin and subsequent uterine response must be continuously monitored [1-3, 8], as well as complications such as hyponatremia, uterine hyperstimulation, or rupture [3, 8]. Both the mother and fetus need to be monitored after inserting a balloon catheter with non-stress test (NST) right after insertion and 30 minutes after [6]. Maternal vital

### 2.8 Complications of induction of labor

After 42 weeks, the risk of stillbirth and fetal compromise rise by two-thirds compared to 37 weeks [7]. Mothers are at risk of developing chorioamnionitis, uterine rupture [4], and intrauterine sepsis in pregnancies that extend beyond the rupture of membranes [7]. Uterine rupture can occur in women with previous CS but also in an unscarred uterus. It can also occur in cases of multiparity, malpresentation or increased use of uterotonics [4, 8]. When it occurs, the mother and fetus need to be closely monitored and arranged for an emergency CS [3, 7, 8] as it is life-threatening to both the mother and baby. When using oxytocin for IOL, post-partum haemorrhage (PPH) is a risk [3]. Water intoxication due to oxytocin is only associated with high concentrations [2]. Uterine hyperstimulation is defined as uterine contractions of more than 60 seconds or at
least 4 contractions in 10 minutes [1, 4]. It is associated with the use of both oxytocin, especially high-dose regimens, and PGE2 which can lead to uterine rupture or placental abruption [2-4, 7, 8]. When cord prolapse [3]. The risk of cord prolapse may be reduced by assessing whether the fetal head is engaged and palpating for umbilical cord presentation during VE without dislodging the baby’s head [2-4, 7]. ARM should be avoided when the baby’s head is high [3, 4, 7]. It is also important to check for low-lying placenta before membrane sweeping or IOL [7]. Another possible complication of IOL is failed induction; this occurs when labor does not start after one cycle of IOL [1, 4, 7]. At least 12-18 hours after induction should pass before classifying failed induction [2]. When this occurs, it does not immediately indicate CS [1, 4]. It might in fact be failure of progress of labor, rather than failed induction [8]. If IOL is unsuccessful, then a physician must re-evaluate the indication and method then reassess the patient [3, 4, 7, 8]. Patients might be indicated for trial of an alternative method of induction [3, 7, 8]. In terms of delivery, patients might be required to undergo operative vaginal delivery or CS as a last resort [3, 4, 7, 8]. The management of the different complications of IOL is described on Table 6.
### Table 1: Pre-Induction Assessment.

| KHUH | NICE | WHO | ACOG | SOGC | FOGSI | Queensland |
|------|------|-----|------|------|-------|------------|
| **Counseling** | | | | | | |
| -Reason for IOL | -Reason/indication for IOL | -Indication of IOL | | | | |
| -Potential risks and benefits of IOL | -Risk of complications | -Risks/benefits of IOL | | | | |
| -Setting and method | | | | | | |
| -Arrangements for support and pain relief | -Agents and methods for IOL | -Methods of IOL, advantages and disadvantages | -Pain relief | Options available if unsuccessful IOL or refusing IOL | -Consider needs and preferences of patient | |
| -Alternative options if refusing IOL | | | | | | |
| -Subsequent plan if failed IOL | | | | | | |
| **Assessment** | | | | | | |
| -Confirm GA | Assess and document cervical status | NA | | | | |
| -Review antenatal record | | | | | | |
| -Perform clinical examination | | | | | | |
| -Evaluate cervical status | | | | | | |
| -Document indication for IOL | | | | | | |
| | | | | | | |
| -Consider GA (confirmed by ultrasound in 1st trimester) and parity | NA | -Assess membranes | | -Assess fetal wellbeing with CTG | | |
| -Assess pelvis, fetal size and presentation | NA | | | | | |
| -Consider risks to mother or fetus | -Document indication, reason and method of induction | -Review maternal history | -Consider indication and rule out contraindications | | | |
| -Document cervical status | | | | | | |
| Abbreviations: NA: not applicable; IOL: induction of labour; GA: gestational age; CTG: cardiotocograph | | | | | | |

Table 1: Pre-Induction Assessment.
| Maternal Conditions | KHUH | WHO | NICE | ACOG | SOGC | FOGSI | Queensland |
|---------------------|------|-----|------|------|------|-------|------------|
| **Maternal Conditions** | -Hypertensive disorders of pregnancy  -Maternal diseases (DM, renal disease, chronic pulmonary disease) | GDM | -Diabetes mellitus -Chronic hypertension -Renal disease -Chronic pulmonary disease -Antiphospholipid syndrome -Gestational hypertension -Pre-eclampsia | -PET ≥ 37 weeks -Significant maternal disease not responding to treatment -Significant and stable APH -DM -Gestational hypertension ≥ 38 weeks | Hypertension PET: IOL ≤ 37 weeks Gestational HTN: IOL > 37 weeks Diabetes -Well-controlled:  -Diet: IOL > 39 weeks  -Insulin/OHA: IOL at 38 weeks -Uncontrolled DM: individualized plan | Advanced Maternal Age (≥40 years): IOL at 39-40 weeks |
| **Post-term Pregnancy** | -IOL indicated at ≥ 41 weeks if GA reliably estimated | -IOL at 41-42 weeks -If refusing IOL > 42 weeks, then start antenatal monitoring (NST and AF volume) twice weekly | -IOL indicated -IOL at 41-42 weeks -If refusing IOL > 42 weeks, then start antenatal monitoring (NST and AF volume) twice weekly | -IOL indicated -IOL at 41-42 weeks -If refusing IOL > 42 weeks, then start antenatal monitoring (NST and AF volume) twice weekly | Obstetric Cholestasis IOL at 37-38 weeks If severe biochemical abnormalities: IOL < 36 weeks | -IOL at 41-42 weeks -If refusing IOL > 42 weeks, then start antenatal monitoring (NST and AF volume) twice weekly |
| Pre-labour Rupture of Membranes | IOL indicated | IOL 24 hours after rupture of membranes with vaginal PGE₂ or expectant management | Induce at time of presentation with oxytocin infusion | Start oxytocin as soon as possible in maternal GBS colonization. Consider oxytocin/PGE₂ before expectant management | IOL > 37 weeks | Induce labour with oxytocin |
|---------------------------------|---------------|---------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------|-----------------------------|
| Fetal Growth Restriction        | NA            | IOL indicated                                                                   | NA                                                | IOL indicated in severe fetal growth restriction                                             | IOL is indicated | -IOL at term; timing depends on GA and severity of growth restriction or deterioration in Doppler parameters |
| Intrauterine Fetal Death        | IOL indicated | Immediate IOL with • oral mifepristone then vaginal PGE₂ or • misoprostol OR expectant management | < 28 weeks: use misoprostol 200-400 mcg vaginally every 4-12 hours OR offer D&C OR high-dose oxytocin infusion > 28 weeks: IOL | IOL indicated                                                                                   | -IOL with PGE₂ and oxytocin | -Test for DIC twice weekly if IOL delayed for > 48 hours |
| Twin Pregnancy                  | No recommendations | -If uncomplicated, IOL at ≥ 38 weeks                                           | -If uncomplicated and no C/I: IOL > 37 weeks      |                                                                                                 |                  | NA                          |
| Other Conditions                | Fetal compromise | - Chorioamnionitis • Vaginal bleeding                                           | PPROM: IOL with vaginal PGE₂ > 34 weeks (unless obstetric complications) | Chorioamnionitis • Risk of rapid labour • Distance from hospital • Isoimmunization • Oligohydramnios | PPROM: IOL > 34 weeks unless other indications (fetal compromise or chorioamnionitis) | Fetal Macrosomia Discuss IOL > 38 weeks if EFW: • > 3500g at 36 |
| Previous CS | -Placental abruption | -Suspected fetal compromise | -IUFD in previous pregnancy | • MgSO₄ (if < 32 weeks) | Antibiotics and antenatal corticosteroids as needed | Previous CS | -Favourable cervix: amniotomy then oxytocin | -Unfavourable cervix: mechanical methods | weeks |
|-------------|----------------------|-----------------------------|-----------------------------|------------------------|---------------------------------|-------------|---------------------------------|---------------------------------|-------|
| IOL with vaginal PGE₂ or expectant management |                         |                             |                             |                        |                                  |             | amniotomy then oxytocin         | mechanical methods              |       |

**Abbreviations:** NA: not applicable; DM: diabetes mellitus; GDM: gestational diabetes mellitus; IOL: induction of labour; PET: pre-eclamptic toxaemia; APH: antepartum haemorrhage; HTN: hypertension; OHA: oral hypoglycaemic agents; GA: gestational age; NST: non-stress test; AF: amniotic fluid; PGE₂: prostaglandin E₂; GBS: group B streptococcus; D&C: dilation and curettage; DIC: disseminated intravascular coagulation; C/I: contraindications; PPROM: preterm pre-labour rupture of membranes; CS: Cesarean section; IUFD: intrauterine fetal death; EFW: estimated fetal weight

**Table 2:** Indications of Induction of Labour.

| KHUH | NICE | ACOG | SOGC | FOGSI | Queensland |
|------|------|------|------|-------|-------------|
| 0 points | < 1 | Closed | 0 | < 1 |
| 1 point | 1-2 | 2-4 | 3-4 | |
| 2 points | 3-4 | 2-4 | 3-4 | |
| 3 points | 4 | 5-6 | NA | 5 ≤ | 4 < |

| | | | | | |
| | | | | | |
| 1 point | 2 | 2-4 | 40-50 | or 1-3 | 2-4 | 2 |
| 2 points | 1 | 1-2 | 60-70 | or <1 | 1-2 | 1 |
| 3 points | < 1 | 80 | NA | < 1 | | |
Station
0 points -3 ≤ -3 -3
1 point -2
2 points -1 or 0
3 points +1 or +2 NA +1 or +2

Consistency
0 points Firm
1 point Medium Average Medium
2 points Soft

Position
0 points Posterior
1 point Central Mid/Anterior Mid-posterior Mid Mid-position Mid
2 points Anterior NA Anterior

Total Score
7 ≤ 8 ≤ 7 ≤ 6 ≤

Abbreviations: NA: not applicable

Table 3: Bishop Score.

| Non-Pharmacological Methods | KHUH | WHO | NICE | ACOG | SOGC | FOGSI | Queensland |
|-----------------------------|------|-----|------|------|------|-------|-------------|
| Membrane Sweeping           | -Before formal IOL -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in | -Can reduce formal IOL -Before formal IOL -Increases chance of spontaneous labour within 48 hours -Promotes onset of labour -Alternative (if cervix closed) cervical massage in |
| Amniotomy                                      | at 41 weeks                                      | at 41 weeks                                      | vaginal fornices | spontaneously start | -Alternative (if cervix closed) cervical massage in vaginal fornices |
|------------------------------------------------|-------------------------------------------------|-------------------------------------------------|------------------|---------------------|---------------------------------------------------------------------|
| After procedure:                               | -Document liquor colour and consistency         | -Not recommended alone for IOL                  | -Can be used in combination with oxytocin if there is a risk of uterine hyperstimulation (where PGE₂ cannot be used) | -Performed as IOL if cervix favourable                             | -Effective when membranes accessible and cervix favourable          |
| -Encourage mobilization                        |                                                 |                                                 |                   |                     | -Creates commitment to delivery                                       |
| Drug: Amniotomy                                | -Not recommended alone for IOL                  |                                                 |                   |                     |                                                                     |
| Drug: Prostaglandin E₂                         |                                                 |                                                 |                   |                     |                                                                     |
| Prostaglandin E₂                               | -Preferred to use if unfavourable cervix        | -Preferred method                               | -Preferred method | -Preferred method    | -Preferred method                                                   |
| -Forms and Dosing:                             | -Forms: gel, tablet, vaginal pessary            | -Forms and Dosing:                              | -Forms and Dosing: | -Forms and Dosing:  | -Forms and Dosing:                                                   |
| -1 dose of vaginal PGE₂ gel or tablets:        |                                                 | -Vaginal PGE₂ gel or tablets:                   | Intracervical gel:| Intracervical gel:  | Intracervical gel:                                                   |
| -2 doses every 6 hours                         |                                                 | • 2.5g/0.5mg PGE₂ every 6-12 hours             | • 1 or 2 mg       | • 3g/0.5 mg PGE₂    | • 1mg (multiparous) 2mg (nulliparous) every 6 hours               |
| OR                                             |                                                 | maximum of                                      | maximum           | maximum             |                                                                     |
| -2 doses of 3mg tablet 6 hours apart OR        |                                                 | maximum of                                      | maximum           | maximum             |                                                                     |
| Pharmacological Methods                        |                                                 |                                                 |                   |                     |                                                                     |
| 1 controlled-release vaginal pessary containing PGE₂ | 2 doses of 3 doses in 24 hours OR OR OR | • maximum of 3 doses in 24 hours OR OR OR | • maximum dose of < 3 mg in 6 hours OR OR OR |
|--------------------------------------------------|-----------------------------------------|------------------------------------------|---------------------------------------------|
| • 1 controlled-release vaginal pessary containing 10mg PGE₂ once in 24 hours | -Caution: do not use in VBAC | NA | NA |

**Oxytocin**

- Preferable to use if favourable cervix
- Perform ARM first if membranes are intact
- **Do not give oxytocin** alone when PG unavailable

- Use oxytocin

| Dosing (mU/min) | Low Dose Regimen | High Dose Regimen |
|-----------------|-------------------|-------------------|
| - Start with 0.5-2 and increase with increments of 1-2 mU/min 15-40 minutes apart | - Start with 1-2 and increase with increments of 1-2 mU/min 30 minutes apart | - Start with 6 and increase with increments of 3-6 mU/min 15-40 minutes apart |
| - Start with 4-6 and increase with increments of 4-6 mU/min 15-30 minutes apart | | |

**Do not give oxytocin**

- < 4 hours after last misoprostol dose
- < 6-12 hours after maximum dose of PG

- For favourable cervix
- Use:
  - Alone
  - With ARM

- Perform ARM first if membranes are intact
- **Dosing:** start infusion with 1 mU/min and increase dose at ≥ 30 minutes
- Stop oxytocin if labour established
- Restart infusion if
  - <30 minutes: half previous rate
  - >30 minutes: initial rate
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|----------------------------------------|
| DOI: 10.26502/ogr081                    |

**fetal compromise**

- Do not administer bolus
- Do not give oxytocin
- Do not give misoprostol

| Misoprostol | Misoprostol | Misoprostol | Misoprostol |
|-------------|-------------|-------------|-------------|
| NA          | - Use only in non-scarred uterus | To only be used in the case of IUFD | Uses: cervical ripening and IOL |
|             | - Dosing: 25 mcg | - Dosing: (oral, sublingual or intravaginal): 25 mcg every 3-6 hours | - Dosing: 25 mcg vaginally every 4 hours OR 50 mcg orally every 4 hours with water |
|             | Orally every 2 hours OR Vaginally every 6 hours | OR 50 mcg every 6 hours | OR 50 mcg orally every 4 hours with water |
|             | - Use for IUFD | - Uses: cervical ripening and IOL | Do not give misoprostol |

| Mifepristone | Mifepristone | Mifepristone | Mifepristone |
|--------------|--------------|--------------|--------------|
| NA           | NA           | NA           | Not recommended |
|              |              |              |               |

| Laminaria    | Laminaria    | Laminaria    | Laminaria    |
|--------------|--------------|--------------|--------------|
| NA           | Can be used  | Not recommended | Osmotic dilator for |
|              |              |              | NA           |

**Mechanical Methods**

- Laminaria
  - Can be used
  - Osmotic dilator for
### Tents

- Recommended for IOL
- Alternative method of IOL if PG unavailable: combine balloon catheter with oxytocin

### Balloon Catheters

**Double balloon catheter** (uterine and vaginal) with traction
- Keep in place for 12 hours
- Deflate and remove device if:
  - Labour begins
  - Device expels spontaneously
  - Membranes ruptured
  - Suspecting fetal distress

**Single balloon catheter**
- For cervical ripening and IOL

**Double balloon catheter**
- Foley catheter: 14-26 Fr with inflation volume of 30-80 ml and traction
- Atad Ripener device
- Extra-amniotic saline infusion with rate of 30-40 ml/hr

**Single balloon catheter**
- Use in scarred uterus and unfavourable cervix with no signs of infection
- Apply small amount of traction on catheter

**Double balloon catheter**
- Second line alternative

**Single balloon catheter**
- Foley catheter: 18 Fr with inflation volume of 30-60 ml and traction

**Double balloon catheter**
- Leave catheter in place until it spontaneously falls after 24 hours

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**Abbreviations:** NA: not applicable; IOL: induction of labour; FHR: fetal heart rate; CTG: cardiotocograph; ARM: artificial rupture of membranes; PG: prostaglandin; CS: Cesarean section; PGE₂: prostaglandin E₂; APH: antepartum haemorrhage; GBS: group B streptococcus; VBAC: vaginal birth after Cesarean; C/I: contraindications; VE: vaginal examination

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**Table 4:** Methods of Induction.

|                  | KHUH                           | WHO                               | NICE                             | ACOG                          | SOGC                           | FOGSI                          | Queensland                      |
|------------------|--------------------------------|----------------------------------|----------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|
| **Fetal Wellbeing** | - Perform CTG                 | - Monitor fetal wellbeing with Baseline: 30 minutes before IOL | - Assess fetal wellbeing with CTG: | - Monitor FHR before and after ARM | - Continuous CTG: | - Monitor fetal wellbeing: | - Monitor FHR with CTG |
|                  | •                               | •                                | •                                | •                             | •                              | •                              | •                              |
|                  |                                 |                                  | Before IOL                        |                               | For 30 minutes to 2 hours after |                                 | ≥ 30 minutes after |
|                  |                                 |                                  |                                  |                               |                                 |                                 |                                 |
| Time Points | Actions |
|-------------|---------|
| Immediately after ARM | - Assess for pain |
| 1 hour after inserting PGE<sub>2</sub> | - Hourly assessment of HR, BP and vaginal loss |
| If uterine contractions present | - Check temperature every 2 hours |
| - Monitor for hypertonic uterine contractions while giving PGE<sub>2</sub> | - Target uterine contractions: 3-4, |
| After PG administration | - Monitor maternal vital signs after administering PGE<sub>2</sub> |
| When using oxytocin | - Monitor infusion rate |
| After inserting vaginal PGE<sub>2</sub> | - Monitor uterine response |
| When contractions start | - Reassess Bishop score 6 hours after inserting PGE<sub>2</sub> tablet/gel or 24 hours after inserting controlled-release pessary |
| After insertion of balloon catheter | - If on outpatient basis, to contact HCP if contractions begin or no contractions |
| If failed IOL | - Record maternal vital signs |
| - Intermittent auscultation after discontinuing CTG | - Monitor uterine activity: |
| PGE<sub>2</sub> administration | - 30 minutes to 2 hours after PGE<sub>2</sub> administration |
| - During oxytocin administration | - During oxytocin infusion |
| - Before and 30 minutes after misoprostol | - Patient remains recumbent after |
| Before IOL inserting PG | - Monitor for non-reassuring FHR, if present then perform VE |
| - Continuously during active labour | - Intermittent auscultation during active labour if CTG unavailable |
| For 60 minutes after tachysystole | - Monitor maternal vital signs, uterine activity, fetal activity and bleeding after inserting PGE<sub>2</sub> immediately and hourly for 4-6 hours |
| Must remain in left lateral or recumbent position for 30 minutes after insertion of PGE<sub>2</sub> | - Monitor BP and HR hourly and input/output every 4 hours |
| If on oxytocin | - Assess cervical status |
| Maternal Wellbeing | - Reassess Bishop score > 6 hours after inserting PGE<sub>2</sub> gel and > 12 hours after inserting pessary |
each lasting 40-60 seconds, in 10 mins

-Review patient every 2 hours

within 6 hours of insertion

-If failed IOL, reassess woman’s vital signs and re-examine

PGE2 administration for ≥ 30 minutes

before oxytocin and repeat after > 4 hours of contractions

-If failed IOL, reassess woman’s vital signs and re-examine

PGE2 administration for ≥ 30 minutes

-If failed IOL, reassess woman’s vital signs and re-examine

before oxytocin and repeat after > 4 hours of contractions

Watch for maternal hyponatremia, uterine hyperstimulation and uterine rupture

-If failed IOL, then reassess maternal wellbeing

Monitor maternal vital signs, uterine activity and vaginal loss after ARM

Abbreviations: NA: not applicable; CTG: cardiotocograph; IOL: induction of labour; ARM: artificial rupture of membranes; PGE2: prostaglandin E2; PG: prostaglandin; FHR: fetal heart rate; VE: vaginal examination; HR: heart rate; BP: blood pressure; HCP: healthcare professional

| KHUH | WHO | NICE | ACOG | SOGC | FOGSI | Queensland |
|------|-----|------|------|------|-------|------------|
| **Uterine Rupture** | -Associated with PGE2 and oxytocin use | NA | -If suspected, deliver through emergency CS | -Associated with use of misoprostol in women with previous CS or major uterine surgery | -Associated with: • Aggressive use of uterotonic agents in obstructed labour | -Associated with: • Oxytocin • Balloon catheter |

**Table 5:** Monitoring during Induction of Labour.
| Uterine Hyperstimulation |  |  | -Use of PGE<sub>2</sub> in VBAC -Deliver by emergency CS when suspected |
|-------------------------|-----------------|-----------------|-------------------------------------------------------------------|
| -Associated with use of oxytocin | -Use betamimetics | -Associated with PGE<sub>2</sub> | -Remove vaginal PGE<sub>2</sub> pessary |
|  |  | -Associated with PGE<sub>2</sub> and misoprostol use | |
|  |  | -Reduce/stop oxytocin infusion, turn patient to side | |
|  |  | -CS or terbutaline if abnormal FHR | |
|  |  | -Consider the use of tocolytics if persisting | |
|  |  |  | -Tocolytics: |
|  |  |  | 1. IV nitroglycerin 50mcg over 2-3 mins every 3-5 mins, max dose 200 mcg; |
|  |  |  | 2. Alternative: 1-2 puffs of nitroglycerin spray 0.4 mg sublingual |
|  |  |  | -Use tocolytics if no cardiac disease. |
|  |  |  | -Turn mother to left lateral position and monitor vital signs. |
|  |  |  | -Tocolytics: |
|  |  |  | 1. Terbutaline: 250 mcg SC or 5 ml IV over 5 mins |
|  |  |  | 2. Salbutamol 100 mcg slow IV inj |
|  |  |  | 3. Sublingual GTN spray 400 mcg |

| Failed Induction | Options: | -Discuss with patient considering her circumstances and provide support -Consider CS | -Re-evaluate indication and method of induction -Differentiate between failed IOL and failure to progress |
|------------------|----------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| -Allow patient to rest | NA |  | -Consider delivery via CS or operative vaginal delivery |
| -Reassess then restart IOL | NA |  | |
| -IOL with oxytocin | NA |  | |
|  |  |  | -Consider another attempt at IOL with different method |

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Uterine Hyperstimulation

- Associated with use of oxytocin
- Use betamimetics
- Associated with PGE<sub>2</sub>
- Remove vaginal PGE<sub>2</sub> pessary
- Associated with PGE<sub>2</sub> and misoprostol use
- Reduce/stop oxytocin infusion, turn patient to side
- CS or terbutaline if abnormal FHR
- Consider the use of tocolytics if persisting

Tocolytics:
- IV nitroglycerin 50mcg over 2-3 mins every 3-5 mins, max dose 200 mcg;
- Alternative: 1-2 puffs of nitroglycerin spray 0.4 mg sublingual

Failed Induction

Options:
- Allow patient to rest
- Reassess then restart IOL
- IOL with oxytocin

- Discuss with patient considering her circumstances and provide support
- Consider CS

- Re-evaluate indication and method of induction
- Differentiate between failed IOL and failure to progress
- Consider delivery via CS or operative vaginal delivery
- Consider another attempt at IOL with different method
| Amniotomy | -Deliver via CS | -Risks: vaginal bleeding, discomfort | To reduce risk of cord prolapse | -Palpate for umbilical cord presentation during VE and avoid dislodging baby’s head | -Assess engagement of presenting part before ARM | To reduce risk of cord prolapse | -Caution when performing ARM in unengaged presentation and do not remove finger from vagina until presenting part rests against cervix | -Assess engagement of presenting part before ARM | -Avoid amniotomy if head high | -Palpate for umbilical cord presentation during VE and avoid dislodging baby’s head |
|-----------|---------------|-----------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|           | To reduce risk of cord prolapse | -Before ARM: Perform VE to exclude cord presentation and determine fetal head station | -After ARM: Perform VE to ensure no cord prolapse | -Assess engagement of presenting part before ARM | -Avoid amniotomy if head high | -Risks: chorioamnionitis, umbilical cord compression or rupture vasa previa, displacement of presenting part |

Abbreviations: NA: not applicable; PGE₂: prostaglandin E₂; CS: Cesarean section; VBAC: vaginal birth after Cesarean; FHR: fetal heart rate; IV: intravenous; IOL: induction of labour; VE: vaginal examination; ARM: artificial rupture of membranes

Table 6: Complications of Induction of Labour.
3. Summary of Current Guidelines

3.1 WHO guidelines

The WHO does not provide recommendations for counseling during the pre-induction assessment or mention any contraindications to IOL. Moreover, there are no specifications regarding the Bishop scoring system and preferencing of a favourable or unfavourable cervix to help determine the method of IOL. The WHO recommends the use of betamimetics for women with uterine hyperstimulation in IOL. There is no advantage to adding amniotomy to IV oxytocin and amniotomy alone is not recommended for IOL [1].

3.2 NICE guidelines

Healthcare professionals must explain the following to women undergoing induction [7, 10]:

- Reasons for offering IOL
- When, where and how IOL will be performed
- Options for pain relief and support
- Risks and benefits of IOL
- Options for failed IOL or refusing IOL

NICE does not mention any contraindications to IOL; they do, however, mention when not to perform IOL such as in breech presentations, severe fetal growth restriction or maternal request. NICE recommends allowing women with uncomplicated pregnancies to undergo spontaneous labor before inducing them in post-term pregnancies. They consider vaginal PGE₂, in the form of gel, tablet or controlled-release pessary, as the preferred method of induction (Table 4). Non-pharmacological methods such as herbal supplements, acupuncture, hot baths and sexual intercourse are not recommended as methods for IOL [7].

With regards to women with pre-existing medical conditions, NICE recommends particular guidelines pertaining to some diseases. For women with mechanical heart valves, IOL or CS are indicated. When using low-molecular weight heparin (LMWH), aim to deliver as close as possible to 12 hours from the last injection. When using unfractionated heparin, delivery is aimed as close to 4-6 hours after stopping the infusion. CS is indicated for women with any disease of the aorta, pulmonary arterial hypertension or New York Heart Association (NYHA) class III/IV heart disease. For women with chronic kidney disease, IOL is indicated before 40 weeks in those with stages 1-4 with stable renal function and between 34 and 38 weeks in those with stage 5 or deteriorating disease. Dialysis can be offered to help prolong pregnancy until 34 weeks at least. According to NICE, prostaglandin F₂ alpha should not be given to women with asthma due to the associated risk of bronchospasm. However, PGE₁ or PGE₂ can be used to induce women with asthma [10].

3.3 ACOG guidelines

When inducing a woman with IUFD, the method of IOL depends on the timing. If it occurs prior to 28 weeks of gestation then options include misoprostol, D&C or high-dose oxytocin infusion. If IUFD occurs after 28 weeks, then IOL according to the hospital’s policy is indicated. In patients with uterine hyperstimulation, CS or terbutaline are recommended if CTG demonstrates Category III tracing and one or more of the following: recurrent late or variable decelerations or bradycardia [2].

3.4 SOGC guidelines

SOGC does not consider amniotomy and oxytocin as effective methods of cervical ripening. Methods and indications of IOL do not change in the presence of GBS colonization. There are no recommendations on
the use of laminaria tents but single or double balloon catheters can be used. Quality assurance programs can help to ensure that the indications for IOL are acceptable [4].

3.5 FOGSI guidelines
FOGSI recommends IOL at 39 weeks GA onwards in low-risk pregnancies. On the other hand, the timing of IOL differs depending on maternal conditions such as DM and hypertension. IOL for DM is indicated after 39 weeks if the condition is well-controlled on diet and at 38 weeks if managed on insulin or oral hypoglycemic agents (OHA). Women with uncontrolled diabetes should be managed on a case-by-case basis. Those with hypertensive disorders can benefit from reduced complications and the need for antihypertensive therapy if induced. Induction is indicated before 37 weeks in PET and encouraged to continue beyond 37 weeks in gestational HTN [8]. FOGSI modifies the Bishop score by adding a point for PET and each previous vaginal delivery and subtracting a point for post-dates, nulliparity and PPROM. The Drug Controller General of India does not approve the use of misoprostol for inducing labor. FOGSI does not approve the use of laminaria tents, mifepristone, hyaluronidase or relaxin for IOL [8].

3.6 Queensland health guidelines
The Royal College of Obstetricians and Gynaecologists (RCOG) and Queensland Health recommends inducing labor in women 40 years and older at 39 to 40 weeks to help prevent late stillbirth [3, 9]. Maternal ethnicity is not an indication for IOL by itself, but it can guide the timing of induction. For instance, South Asian women are 2.4 times more likely than Australian women to develop stillbirth and twice as likely to have low birth weight. There is insufficient evidence regarding the use of laminaria tents, acupuncture, homeopathy, breast stimulation or sexual intercourse for inducing labor [3].

3.7 KHUH guidelines
Prior to inducing labor, the patient’s antenatal records must be reviewed and they need to be examined clinically. Baseline NST and cervical status must be documented before commencing IOL. The physician must explain the indications for undergoing IOL and the associated risks and benefits. IOL is indicated when the benefits of terminating the pregnancy outweigh the risks of continuing it. Such indications include post-term pregnancy, maternal medical conditions and fetal compromise. The contraindications to IOL are the same as those suggested by ACOG. Membrane sweeping can be offered to women during vaginal examination and massaging the cervix in vaginal fornices can be an alternative. Amniotomy is not recommended alone, so it is best when combined with oxytocin. Cord presentation and high head must be ruled out before attempting an ARM. Both mother and fetus must be monitored following an amniotomy and oxytocin can be initiated [5]. PGE₂ is recommended for IOL for an unfavourable cervix while oxytocin is preferred in women with a favourable cervix. Patients might require repeat dose(s) of PGE₂. When administering oxytocin, patients need to be closely monitored for uterine contractions and abnormalities on CTG. KHUH does not mention any recommendations on the use of misoprostol, mifepristone or mechanical methods for IOL. There are also no suggestions on how to manage patients who develop uterine hyperstimulation or uterine rupture during IOL [5].
4. Conclusion
Comparing international guidelines elucidates the areas of improvement that are essential in enhancing patient care during IOL at KHUH. Such areas include recommendations on the timing of IOL according to the indication, alternative methods of IOL and proposals on how to manage particular complications associated with IOL. The practice of IOL in KHUH must be monitored as well to ensure the practice in our institute is consistent with both locally and internationally set guidelines to provide the optimum care to patients. This must also be frequently audited to confirm that IOL was indicated for valid reasons.

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Declaration of Conflicts of Interest
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