Review Article

Induction of Labor: A Comparison of Guidelines

Muneera Ahmed AlKhalifa[1], Stephanie Hsu[2], Nusiba ElHassan[3], Basma AlAnsari[3], Rehab Ismael[3], Gulmeen Raza[3], Hosni Malas[4], Mahmoud Samy Ismail[3*]

[1]King Hamad University Hospital (KHUH), Al Sayh, Bahrain

[2]East Kent University Hospitals Foundation, NHS, United Kingdom

[3]Department of Obstetrics and Gynecology, King Hamad University Hospital (KHUH), Al Sayh, Bahrain

[4]Head of Department of Obstetrics and Gynecology, King Hamad University Hospital (KHUH), Al Sayh, Bahrain

[*]**Corresponding Author:** Mahmoud Samy Ismail, OB/GYN Department, King Hamad University Hospital, Building 2435, Road 2835, Block 228, Busaiteen P.O Box 24343, Al Muharraq, Kingdom of Bahrain, Tel: +97335593048

Received: 14 February 2022; **Accepted:** 22 February 2022; **Published:** 10 March 2022

Citation: Muneera Ahmed AlKhalifa, Stephanie Hsu, Nusiba ElHassan, Basma AlAnsari, Rehab Ismael, Gulmeen Raza, Hosni Malas, Mahmoud Samy Ismail. Induction of Labor: A Comparison of Guidelines. Obstetrics and Gynecology Research 5 (2022): 081-106.

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 Socie-ties 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 Heartrate; 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; $MgSO_4$: 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; PGE_2: Prostaglandin E_2; 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 > $40kg/m^2$, 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 Gynecologists 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, oligohydra-mnios, 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 E_2 (PGE_2) 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 PGE_2 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 PGE_2 [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 ($MgSO_4$) 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_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_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 unfavourable 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 decom-pression 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 E_2: PGE_2 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_2gel 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 regi-men 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 signs need to be monitored before IOL, after administering PGE_2 and oxytocin and then hourly and in the case of failed IOL [1-3, 7, 8]. Women can mobilize 30 minutes after PGE_2 administration [2, 3, 8]. Bishop score should be rechecked 6 hours after vaginal PGE_2 gel/tablet or 24 hours after controlled-release pessary [3, 7] (Table 5). Once active labor initiates, closer monitoring is required since IOL is more painful than spontaneous labor [6-8]. Hence the need for preparation of epidural analgesia in advance [6]. Labor in the water can be effective for pain relief [7]. Women should be counselled on the available options and their implications on labor and taught breathing and relaxation techniques [7, 8]. If a woman at more than 42 weeks of gestation refuses IOL, she should be advised to undergo continuous CTG at least twice weekly after being informed of post term risks [3, 4, 7, 10].

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-uterine hyperstimulation occurs, the first step is to stop the oxytocin infusion or withdraw the PGE_2 pessary to reverse uterine tachysystole [2-4, 8]. Continuous fetal monitoring with CTG is necessary [3]. The mother should be kept on her left side and monitored for changes in vital signs [2, 3]. Tachysystole is defined as more than 5 contractions every 10 minutes over 30 minutes; it can also be accompanied by FHR changes [2, 4]. Hypertonus, on the other hand, is defined as excessive uterine contractions that last more than 2 minutes without any changes in FHR [4].

The use of tocolytics can help reduce the risks of hyperstimulation if there is no improvement in FHR [1, 2, 4, 7, 8]. Options include terbutaline, salbutamol or sublingual nitroglycerin spray [2-4]. Terbutaline demonstrates a lower risk of failure compared to nitroglycerin or $MgSO_4$ [1]. Tocolytics are not indicated if there is no evidence of fetal compromise with excessive uterine contractions. If FHR does not return to baseline, CS might be required [3]. Cord prolapse is associated with ARM [2-4]. Vaginal examination (VE) needs to be performed to rule out dose regimens, and PGE_2 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>
<tr><th></th><th>KHUH</th><th>NICE</th><th>WHO</th><th>ACOG</th><th>SOGC</th><th>FOGSI</th><th>Queensland</th></tr>
<tr><td rowspan="3">Counseling</td><td rowspan="3">-Reason for IOL
-Potential risks and benefits of IOL
-Setting and method
-Arrangements for support and pain relief
-Alternative options if refusing IOL
-Subsequent plan if failed IOL</td><td colspan="3">-Reason/indication for IOL
-Risk of complications</td><td colspan="2">-Indication of IOL
-Risks/benefits of IOL
-Methods of IOL, advantages and disadvantages
-Pain relief
-Options available if unsuccessful IOL or refusing IOL</td></tr>
<tr><td>NA</td><td colspan="2">-Agents and methods for IOL</td><td>-Electronic equipment used for monitoring
-Expected duration of labour
-Support system available during labour</td><td>-Consider needs and preferences of patient
-Allow time for questions and decision-making
-Document discussion including its outcome</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="4">Assessment</td><td rowspan="4">-Confirm GA
-Review antenatal record
-Perform clinical examination
-Evaluate cervical status
-Document indication for IOL</td><td colspan="5">Assess and document cervical status</td></tr>
<tr><td rowspan="3">NA</td><td colspan="3">-Consider GA (confirmed by ultrasound in 1st trimester) and parity</td><td>NA</td><td>-Assess membranes
-Assess fetal wellbeing with CTG
-Consider urgency for IOL</td></tr>
<tr><td>NA</td><td>-Assess pelvis, fetal size and presentation
-Consider risks to mother or fetus</td><td>-Document indication, reason and method of induction</td><td colspan="2">-Review maternal history
-Consider indication and rule out contraindications
-Reliable estimation of GA, presentation and fetal weight
-Record maternal vital signs and abdominal palpation findings to confirm lie, position and engagement
-Assess cervical status
-Document indication, modified Bishop score and GA</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="8">Abbreviations: NA: not applicable; IOL: induction of labour; GA: gestational age; CTG: cardiotocograph</td></tr>
</table>

Table 1: Pre-Induction Assessment.

	KHUH	WHO	NICE	ACOG	SOGC	FOGSI	Queensland
Maternal Conditions	-Hypertensive disorders of pregnancy -Maternal diseases (DM, renal disease, chronic pulmonary disease)	<u>GDM</u> If no other abnormalities, IOL ≥ 41 weeks <u>Other Indications</u> Maternal medical indications (such as hypertension)	NA	-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	<u>Hypertension</u> PET: IOL ≤ 37 weeks Gestational HTN: IOL > 37 weeks <u>Diabetes</u> -Well-controlled: • Diet: IOL > 39 weeks • Insulin/OHA: IOL at 38 weeks -Uncontrolled DM: individualized plan	<u>Advanced Maternal Age</u> (≥40 years): IOL at 39-40 weeks
						<u>Obstetric Cholestasis</u> IOL at 37-38 weeks If severe biochemical abnormalities: IOL < 36 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	NA	-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 PGE_2 or expectant management	-Induce at time of presentation with oxytocin infusion	-Start oxytocin as soon as possible in maternal GBS colonization. -Consider oxytocin/PGE_2 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	-Oral/vaginal misoprostol can be used during third trimester	-Immediate IOL with • oral mifepristone then vaginal PGE_2 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 PGE_2 and oxytocin -Test for DIC twice weekly if IOL delayed for > 48 hours	NA
Twin Pregnancy	No recommendations				-If uncomplicated, IOL at ≥ 38 weeks	-If uncomplicated and no C/I: IOL > 37 weeks	
Other Conditions	-Fetal compromise	-Chorioamnionitis -Vaginal bleeding	PPROM: IOL with vaginal PGE_2 > 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 IOL with vaginal PGE_2 or expectant management	-Placental abruption -Psychosocial indications	-Suspected fetal compromise -IUFD in previous pregnancy	• $MgSO_4$ (if < 32 weeks) • Antibiotics and antenatal corticosteroids as needed Previous CS -Favourable cervix: amniotomy then oxytocin -Unfavourable cervix: mechanical methods	weeks • > 3700g at 37 weeks • >3900g at 38 weeks
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; PGE_2: prostaglandin E_2; 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 points	3-4	2-4	3-4			
3 points	4 <		5-6	NA	5 ≤	4 <
		4 <	0-30	or 3 <	4	3 <
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	

0 points	-3			≤ -3		-3
1 point	-2					
2 points	-1 or 0					
3 points	+1 or +2			NA	+1 or +2	
0 points	Firm					
1 point	Medium	Average	Medium			
2 points	Soft					
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.

	KHUH	**WHO**	**NICE**	**ACOG**	**SOGC**	**FOGSI**	**Queensland**
Non-Pharmacological Methods							
Membrane Sweeping	-Before formal IOL • Nulliparous: at 40-41 weeks • Multiparous:	-Can reduce formal IOL	-Before formal IOL • Nulliparous: at 40-41 weeks • Multiparous:	-Increases chance of spontaneous labour within 48 hours	-Promotes onset of labour -Alternative (if cervix closed) cervical massage in	-Can repeat if labour does not	-Can reduce formal IOL

	at 41 weeks -Alternative (if cervix closed) cervical massage in vaginal fornices		at 41 weeks -Alternative (if cervix closed) cervical massage in vaginal fornices	-Can reduce formal IOL	vaginal fornices	spontaneously start	-Alternative (if cervix closed) cervical massage in vaginal fornices
Amniotomy	<u>After procedure</u>: -Document liquor colour and consistency -Encourage mobilization	-Not recommended alone for IOL	-Can be used in combination with oxytocin if there is a risk of uterine hyperstimulation (where PGE_2 cannot be used)	-Performed as IOL if cervix favourable -Shorter induction to delivery interval if combined with oxytocin	NA	____	
					-Effective when membranes accessible and cervix favourable -Creates commitment to delivery		
					<u>After procedure</u>: -Observe color and amount of liquor and commence oxytocin immediately after amniotomy or 2 hours after based on intensity of uterine contractions		
Pharmacological Methods							
Prostaglandin E_2	-Preferable to use if unfavourable cervix -<u>Forms and Dosing</u>: • 2 doses of 3mg tablet 6 hours apart **OR**	-<u>Forms</u>: gel, tablet, vaginal pessary	-**Preferred method** -<u>Forms and Dosing</u>: Vaginal PGE_2 gel or tablets: • 2 doses every 6 hours • maximum of	-<u>Forms and Dosing</u>: Intracervical gel: • 2.5g/0.5mg PGE_2 every 6-12 hours • maximum	-<u>Forms and Dosing</u>: Intravaginal gel: • 1 or 2 mg Intracervical gel: • 0.5 mg	-<u>Forms and Dosing</u>: Intracervical gel • 3g/0.5 mg PGE_2 every 6-8 hours	-<u>Forms and Dosing</u>: Intravaginal gel • 1mg (multiparous) 2mg (nulliparous) every 6 hours

	• 1 controlled-release vaginal pessary containing PGE_2		2 doses **OR**	of 3 doses in 24 hours **OR**	**OR**	• maximum of 3 doses in 24 hours **OR**	• maximum dose of < 3 mg in 6 hours **OR**
			• 1 controlled-release vaginal pessary containing 10mg PGE_2 once in 24 hours				
			NA		-Caution: do not use in VBAC	NA	
Oxytocin	-Preferable to use if favourable cervix -Perform ARM first if membranes are intact -<u>Dosing</u>: start infusion with 1 mU/min and increase dose every 30 minutes **Do not give oxytocin** < 6 hours after last dose of vaginal PGE_2 -Stop if: • Hypertonic contractions • Increased resting uterine tone • Signs of	-Use oxytocin alone when PG unavailable	**Do not give oxytocin** alone	<u>Dosing</u> (mU/min) Low Dose Regimen			-Perform ARM first if membranes are intact -<u>Dosing</u>: start infusion with 1mU/min and increase dose at ≥ 30 minutes -Stop oxytocin if labour established -Restart infusion if • <30 minutes: half previous rate • >30 minutes: initial rate
				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		-For favourable cervix -Use: • Alone • With ARM	
				• < 6-12 hours after maxi-mum dose of PG	NA		

	fetal compromise			• < 30-60 minutes after removing vaginal pessary **Do not administer bolus**			
						Do not give oxytocin • < 6 hours after administering PGE_2 gel • < 30 minutes after removing PGE_2 pessary	
Misoprostol	NA	-Use only in non-scarred uterus -Dosing: 25 mcg • Orally every 2 hours **OR** • Vaginally every 6 hours -Use for IUFD	To only be used in the case of IUFD	-Uses: cervical ripening and IOL -Dosing: (oral, sublingual or intravaginal): • 25 mcg every 3-6 hours **OR** • 50 mcg every 6 hours	-Dosing: • 25 mcg vaginally every 4 hours **OR** • 50 mcg orally every 4 hours with water **Do not give misoprostol** - If previous CS or < 4 hours after last misoprostol dose	Not approved for IOL by Drug Controller General of India	Not recommended for live birth
Mifepristone		NA		NA		Not recommended	NA
Laminaria	NA	-Can be used	Not recommended	-Osmotic dilator for	NA	Not recommended	

Tents				cervical ripening			
Balloon Catheters		-Recommended for IOL -Alternative method of IOL if PG unavailable: combine balloon catheter with oxytocin	**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	- For cervical ripening and IOL **Single balloon catheter** -Foley catheter: 14-26 Fr with inflation volume of 30-80 ml **Double balloon catheter** - Atad Ripener device -Extra-amniotic saline infusion with rate of 30-40 ml/hr	**Single balloon catheter** -Foley catheter: 18 Fr with inflation volume of 30-60 ml and traction **Double balloon catheter** -Second line alternative	-Use in scarred uterus and unfavourable cervix with no signs of infection -Apply small amount of traction on catheter	**Single balloon catheter** Inflate uterine balloon with 30-80 ml **Double balloon catheter** Inflate uterine balloon with 40 ml and vaginal balloon with 20 ml -After removal, perform VE and plan for ARM and oxytocin
					-Leave catheter in place until it spontaneously falls after 24 hours		

Abbreviations: NA: not applicable; IOL: induction of labour; FHR: fetal heart rate; CTG: cardiotocograph; ARM: artificial rupture of membranes; PG: prostaglandin; CS: Cesarean section; PGE_2: prostaglandin E_2; APH: antepartum haemorrhage; GBS: group B streptococcus; VBAC: vaginal birth after Cesarean; C/I: contraindications; VE: vaginal examination

Table 4: Methods of Induction.

	KHUH	WHO	NICE	ACOG	SOGC	FOGSI	Queensland
Fetal Wellbeing	-Perform CTG • Baseline: 30 minutes before IOL	-Monitor fetal wellbeing with CTG:	-Assess fetal wellbeing with CTG: • Before IOL	-Monitor FHR before and after ARM -Continuous CTG: • For 30 minutes to 2 hours after		-Monitor fetal wellbeing:	-Monitor FHR with CTG • ≥ 30 minutes after

	• Immediately after ARM • 1 hour after inserting PGE_2 • If uterine contractions present -Monitor for hypertonic uterine contractions while giving PGE_2	• After PG administration • When using oxytocin	• After inserting vaginal PGE_2 • When contractions start • After insertion of balloon catheter • If failed IOL -Intermittent auscultation after discontinuing CTG	PGE_2		• Before IOL	inserting PG
				• During oxytocin administration	• Before and 30 minutes after misoprostol		
						• Continuously during active labour	
					• For 60 minutes after tachysystole	-Monitor for non-reassuring FHR, if present then perform VE	NA
					-Intermittent auscultation during active labour if CTG unavailable		
Maternal Wellbeing	-Assess for pain <u>If on oxytocin</u> -Hourly assessment of HR, BP and vaginal loss -Check temperature every 2 hours -Target uterine contractions: 3-4,	-Monitor maternal vital signs after administering PGE_2 <u>If on oxytocin</u> -Monitor infusion rate -Monitor uterine response	-Reassess Bishop score 6 hours after inserting PGE_2 tablet/gel or 24 hours after inserting controlled-release pessary -If on outpatient basis, to contact HCP if contractions begin or no contractions	-Record maternal vital signs -Monitor uterine activity: • 30 minutes to 2 hours after PGE_2 administration • During oxytocin infusion -Patient remains recumbent after	NA		
						<u>If on oxytocin</u> -Monitor BP and HR hourly and input /output every 4 hours -Assess cervical status	-Reassess Bishop score > 6 hours after inserting PGE_2 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	PGE_2 administration for ≥ 30 minutes		before oxytocin and repeat after > 4 hours of contractions -Monitor uterine contractions every 30 minutes and with each increase in oxytocin -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; PGE_2: prostaglandin E_2; PG: prostaglandin; FHR: fetal heart rate; VE: vaginal examination; HR: heart rate; BP: blood pressure; HCP: healthcare professional							

Table 5: Monitoring during Induction of Labour.

	KHUH	**WHO**	**NICE**	**ACOG**	**SOGC**	**FOGSI**	**Queensland**
Uterine Rupture	-Associated with PGE_2 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 multiparity, malpresentation, unsupervised or aggressive use of uterotonics	-Associated with: • Oxytocin • Balloon catheter

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>• Use of PGE_2 in VBAC</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">-Deliver by emergency CS when suspected</td></tr>
<tr><td rowspan="3">Uterine Hyperstimulation</td><td rowspan="3">-Associated with use of oxytocin</td><td rowspan="3">-Use betamimetics</td><td rowspan="2">-Associated with PGE_2</td><td colspan="3">-Remove vaginal PGE_2 pessary</td></tr>
<tr><td>-Associated with PGE_2 and misoprostol use
-Reduce/stop oxytocin infusion, turn patient to side
-CS or terbutaline if abnormal FHR</td><td rowspan="2">-<u>Tocolytics</u>:
• 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</td><td></td></tr>
<tr><td colspan="2">-Consider the use of tocolytics if persisting</td><td>-Use tocolytics if no cardiac disease.</td><td>-Turn mother to left lateral position and monitor vital signs.
-<u>Tocolytics</u>:
• Terbutaline: 250 mcg SC or 5 ml IV over 5 mins
• Salbutamol 100 mcg slow IV inj
• Sublingual GTN spray 400 mcg</td></tr>
<tr><td rowspan="3">Failed Induction</td><td rowspan="3">Options:
-Allow patient to rest
-Reassess then restart IOL
-IOL with oxytocin</td><td rowspan="3">NA</td><td rowspan="3">-Discuss with patient considering her circumstances and provide support
-Consider CS</td><td rowspan="3">NA</td><td>-Re-evaluate indication and method of induction</td><td>-Differentiate between failed IOL and failure to progress</td><td></td></tr>
<tr><td colspan="2">-Consider delivery via CS or operative vaginal delivery</td></tr>
<tr><td>NA</td><td colspan="2">-Consider another attempt at IOL with different method</td></tr>
</table>

	-Deliver via CS					
Amniotomy	<u>To reduce risk of cord prolapse</u> • Before ARM: Perform VE to exclude cord presentation and determine fetal head station • After ARM: Perform VE to ensure no cord prolapse	-Risks: vaginal bleeding, discomfort	<u>To reduce risk of cord prolapse</u> -Palpate for umbilical cord presentation during VE and avoid dislodging baby's head -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	<u>To reduce risk of cord prolapse</u> -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
Abbreviations: NA: not applicable; PGE_2: prostaglandin E_2; 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 PGE_2, 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 F_2 alpha should not be given to women with asthma due to the associated risk of bronchospasm. However, PGE_1 or PGE_2 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]. PGE_2 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 PGE_2. 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.

Financial Disclosure

The authors received no funding to perform this study.

Declaration of Conflicts of Interest

The authors report no conflicts of interest.

References

1. World Health Organization. WHO Recommendations: Induction of Labor at or Beyond Term (2018).
2. ACOG Practice Bulletin No. 107: Induction of labor. Obstet Gynecol 114 (2009): 386-397.
3. Queensland Health. Induction of labor. [Queensland]: Queensland Health (2017).
4. Leduc D, Biringer A, Lee L, et al. Induction of labor. J Obstet Gynaecol Can 35 (2013): 840-857.
5. KHUH Hospital Policy on Induction of Labor
6. National Institute for Health and Care Excellence. Insertion of a double balloon catheter for induction of labor in pregnant women without previous caesarean section. NICE (2015).
7. National Institute for Health and Care Excellence. Inducing labor. [Manchester]: NICE (2008).
8. Indian College of Obstetricians and Gynaecologists, The Federation of Obstetric and Gynaecological Societies of India. Induction of labor: Good clinical practice recommendations. [Mumbai]: FOGSI-ICOG (2008).
9. Royal College of Obstetricians and Gynaecologists. Induction of labor at term in older mothers. [London]: RCOG (2013).
10. National Institute for Health and Care Excellence. Intrapartum care for women with existing medical conditions or obstetric complications and their babies. [London]: NICE (2019).