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Review

Induction of labour in the developing countries – an overview

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Abstract

Reduction of maternal and infant mortalities is two key targets critical to achieving the Millennium Development Goals. Approximately four million fetuses annually are stillborn after the age of viability. Similarly, more than five hundred women die each year as a result of childbirth. Majority of these deaths occur in the developing and poor resource settings like ours. The prevention of these maternal and neonatal deaths sometimes requires the prompt and early delivery after the age of viability but before the onset of labour. The two interventions at the disposal of the obstetricians when faced with this dilemma is either caesarean delivery or induction of labour. Induction of labour is a common feature of labour ward practice in both developed and developing countries. It is indicated in maternal and fetal conditions in which prolongation of the pregnancy would jeopardize fetal or maternal well-being and in which there are no contraindications to vaginal delivery and caesarean section could still be postponed. Oxytocin and prostaglandins are widely used for induction of labour in the developed countries; oxytocin and lately, prostaglandin analogue (misoprostol) is the mainstay of medical induction of labour in the developing countries. This article delves in details into induction of labour with emphasis on the practice in the developing countries with the objective of improving the standard of practice.

Keywords: Induction of labour, oxytocin, prostaglandins, developing countries.

INTRODUCTION

Ensuring the delivery of a healthy baby to a healthy mother in a contented family is the overall goal of Safe motherhood. Achieving this goal sometimes may require the delivery of the fetus before the spontaneous onset of labour to prevent adverse outcome to the baby and or the mother. Intervention becomes necessary when on critical assessment of the obstetric balance; the benefit of terminating the pregnancy far outweighs the benefit of continuing it (American College of Obstetricians and Gynecologists, 2009). The two available options of terminating the pregnancy at this stage is either induction of labour or caesarean section. The decision on appropriate option depends on the risk assessment of the fetus and the pregnant woman. Over the years, various professional societies have recommended the use of induction of labour in circumstances in which the risks of waiting for the onset of spontaneous labour are judged by the Obstetricians to be greater than the risks associated with shortening the duration of pregnancy by induction of labour (NICE, NHS, 2008).

Induction of labour is defined as the process of artificially stimulating the uterus to start labour after the age of viability and before the spontaneous onset of labour for the purpose of achieving vaginal delivery (NICE, NHS, 2008; Orhue, 1997). The whole process of induction of labour should be to mimic the physiological process as closely as possible (Dujardin et al., 1995). However, this is a difficult goal to attain since the mechanisms controlling the onset of labour are not completely understood.

The incidence of induction of labour is variable and reflects the confidence of the obstetrician in monitoring pregnancy and its complications as well as assessing the gestational age (Orhue, 1997). In developed countries, the incidence of induction of labour is up to 25% (NICE, NHS, 2008). It is lower in developing countries due to a dearth of intra-uterine monitoring devices (Orhue, 1997; Kwawukume, 2002). It is however observed that induction of labour is commonly performed in institutions where there are obstetricians or persons who have had

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further obstetric training and thus is an exclusive practice of the specialty in most countries (Orhue, 1997).

Brief History

One of the earliest mentions of induction of labour in literature was cited about 400 years ago when a pharmacopoeia of Juniper berries, Cinnamon and Castor oil was recommended as an expedient for birth (Calder, 1997). Amniotomy or the English method introduced more than 200 years (1750) ago by Thomas Denman of Middlesex hospital was the first method to be used which had any degree of reliability (American College of Obstetricians and Gynecologists, 2009). A milestone was added to the history of induction of labour when in 1909. Sir Henry William Blair-Bell demonstrated at caesarean section delivery the uterotonic action of a posterior pituitary extract, oxytocin (Zeeman et al., 1997). Intervention with oxytocin during this period was particularly hazardous as the initial preparations contained a lot of impurities with numerous complications (American College of Obstetricians and Gynecologists, 2009). In spite of this, oxytocin has evolved into a safe therapeutic weapon. This is due to isolation of pure oxytocin by Duvigneaud et al in 1953 (American College of Obstetricians and Gynecologists, 2011), synthesis in commercial quantities by Boissonas in 1955 (American College of Obstetricians and Gynecologists, 2009), use of intravenous oxytocin via controlled infusion apparatus and recognition that the sensitivity of oxytocin varies widely between individuals and at differing stages of pregnancy. From this last development evolved the principle of oxytocin titration against uterine response (American College of Obstetricians and Gynecologists, 2009). The last 35 years have however witnessed the introduction of prostaglandins as a very potent and reliable alternative to oxytocin in cervical ripening and induction of labour (Calder, 1997). Despite this, oxytocin with amniotomy remains the most widespread method of induction of labour in developing countries (Escudero and Contras, 1997). The use of Misoprostol, an analogue of Prostaglandin E1 licensed as cytoprotective agent against peptic ulcer is now becoming popular for induction of labour though it has not been licensed for this purpose (Escudero and Contras, 1997; Lotto et al., 2004).

Indications and contraindications

The indications for induction of labour must be specific and unambiguous. The indications must be to save the life of the fetus and spare the mother of the morbidity and rarely the mortality of caesarean section. Certain obstetric complications carry clear cut fetal risks and induction of labour may be indicated (American College of Obstetricians and Gynecologists, 2011). These include rhesus isoimmunization, diabetes mellitus, intrauterine growth restriction and pre-eclampsia (Orhue, 1997; American College of Obstetricians and Gynecologists, 2011). Prolonged pregnancy is the commonest indication for induction of labour in this environment (Orhue, 1997). Induction of labour in this circumstance is justified to reduce perinatal mortality which increases after 41 weeks of gestation due to deterioration in the function of ageing placenta (Kwawukume, 2002). Other fetal indications for induction of labour include premature rupture of membranes, chorioamnionitis, polyhydramnios, stabilization induction in unstable lie, fetal demise and fetal congenital abnormalities where it is unwise to leave a scar on the uterus (Orhue, 1997; American College of Obstetricians and Gynecologists, 2011). It is rare nowadays to consider labour induction purely in the maternal interest (American College of Obstetricians and Gynecologists, 2011). Nevertheless some maternal diseases such as valvular disorders of the heart, hypertension, renal and liver disease and certain autoimmune disorders if deteriorating may warrant induction of labour in maternal interest.

There are few absolute contraindications for induction of labour (American College of Obstetricians and Gynecologists, 2009; American College of Obstetricians and Gynecologists, 2011). Some of these include situations in which vaginal delivery is hazardous or the fear that the process of labour may endanger the life of the fetus. These include contracted or abnormal pelvis, persistent abnormal lie, pelvic tumors and major placental or vasa praevia, prolapsed umbilical cord with the fetus alive, abnormal presentation like face mentoposterior or brow, two or more lower segment caesarean section scars or a classical caesarean section scar. Others are invasive cancer of the cervix, active genital herpes infection, and previous successful vesico-vaginal fistular repair and when the patient cannot be convinced to give consent (Kwawukume, 2002; American College of Obstetricians and Gynecologists, 2011). Although some obstetric conditions may require special attention, they do not necessarily constitute contraindications to labour induction. These include twin gestation, grandmultiparity, maternal cardiac disease, abnormal fetal heart rate not requiring emergency delivery, severe hypertension, breech presentation, elderly primigravida, bad obstetric history and women with one previous lower segment caesarean section (American College of Obstetricians and Gynecologists, 2011). The intrapartum risk between induced labour and spontaneous labour are comparable as long as uterine activity is monitored closely (American College of Obstetricians and Gynecologists, 2011).

Labour should be induced only after both the mother and the fetus are adjudged to be in satisfactory conditions and patient has given informed consent. The alternative of recourse to caesarean delivery if induction fails should be well explained to the patient. An

assessment of fetal maturity is often important. Contraindications to and precautions for inducing labour should be sought and understood. A midwife or a physician should be on ground to perform cervical assessment in reasonable proximity to the time of cervical ripening or commencement of oxytocin infusion. Personnel familiar with the maternal and fetal effects of uterine stimulating agents should be in attendance. It is essential to monitor uterine activity closely in induced labour and fetal heart rate monitoring similar to that recommended for high-risk patients in active phase labour should be used. A properly rained mid-wife can monitor the induction of labour, but a physician who has the competence to perform caesarean deliveries should be readily available.

Preinduction cervical ripening

The state of the cervix before induction of labour is central to the success of the process. The pre-induction state of the cervix is best assessed using the modified Bishops score proposed by Calder et al in 1974 (Emmanuel et al., 2004; Orhue, 1993). It has a score rating of 0-13 with lower scores corresponding to unfavourable cervix. When the total cervical score exceeds 8, the likelihood of vaginal delivery subsequent to labour induction is similar to that observed after spontaneous labour (Xenakis et al., 1997). Induction of labour with a poor cervical score (1-6) has been associated with failure of induction, prolonged labour and a high caesarean birth rate (Tenore, 2003).

Cervical ripening is a complex process that culminates in physical softening and distensibility of the cervix (Tenore, 2003; Moini, 2003). The understanding of this is traceable to the work of Barcia-Caldeyro on the concept of prelabour (American College of Obstetricians and Gynecologists, 2009). Ripening of a cervix with low Bihops' score can be achieved by either mechanical or pharmacological methods. In the last two decades, many authorities have approved the use of prostaglandin E2 (PGE2) as efficacious and safe, and have superseded the mechanical methods (Hofmeyr et al., 2001). The major setback to the use of Prostaglanding E2 is the exorbitant cost especially in low resource settings like ours (Hofmeyr et al., 2001; Zeiman et al., 1997). Misoprotol is much cheaper and stable under the tropical climate (Escudero and Contras, 1997; Loto et al., 2004). Several trials have shown that misoprostol is efficacious (Escudero and Contras, 1997; Loto et al., 2004; Onah, 2002) for both cervical ripening and induction of labour, but the questions still remain as to the safest and most effective dose (Adewole et al., 1996). It has been used in regimen ranging from a single 50µg or 100µg doses to repeated 25-50µg doses (Adewole et al., 1996). There are still many trials on going to determine the best dose regimen. The use of transcervical extra-amniotic Foley's catheter for cervical ripening has been used extensively since it was introduced into obstetrics practice in 1980 Dare and (Oboro, 2002). Inflation of the balloon just beyond the internal os is associated with local release of prostaglandins. It is more convenient to use than the prostaglandins because it does not cause hyper stimulation but when the cervical score is poor <4, the prostaglandins offer more advantages (Hofmeyr et al., 2001). Osmotic cervical dilators have been used for pre-induction cervical ripening. Examples of osmotic dilators include Laminaria japonicum and various synthetic hygroscopic substances like Dilapan and Lamicel (Ade-Ojo et al., 2011). The reduced need to monitor the uterus and the fetus afterwards results in greater convenience and reduced cost. The major drawback to their use is the increased rate of peripartum infections. Several agents are still undergoing trials to determine their efficacy and safety for cervical ripening. These include relaxin, oestrogen, cytokines, nitric oxide and mifepristone (Moini et al., 2003). Membrane stripping for cervical ripening and induction of labour is a relatively common practice. The potential risks associated with the procedure include pain, infection, bleeding from an undiagnosed placental praevia and accidental rupture of membrane. Studies have shown that membrane stripping is associated with higher frequency of spontaneous labour and decreased incidence of prolonged pregnancy (Goni S et al., 1995).

Oxytocin in induction of labour

A time-tested method of induction of labour is forewater amniotomy and synchronous oxytocin administration. Prostaglandins are widely used in developed countries along with oxytocin. However, oxytocin alone remains the major drug for medical induction of labour in developing countries (Tenore, 2003; Durodola et al., 2005).

Oxytocin consists of nine amino acid residues, of which two are half cystines forming a disulfide bridge between positions 1 and 6 (Cystine-Tyrosine-Isoleucine-Glutamine-Asparagine-Cystine-Proline-Arginine-Glycine). It is synthesized in the hypothalamus in the paraventricular and supraoptic nuclei and stored in the posterior pituitary where it is released by exocytosis. In humans, oxytocin and vasopressin genes are located on the same locus on chromosome 20 (Zeeman et al., 1997). Oxytocin circulates in the blood as a free peptide. Its biological half-life is 3-10 minutes and is shorter when high doses are infused. Steady state concentration in the plasma is reached by 40-60mins (Rouse et al., 2000).

Based on the pharmacokinetics of oxytocin, receptor availability and clinical observations, the interval between increases of oxytocin infusion should not be less than 20 minutes. However, as short as 15 minutes and as long as 60 minutes had been suggested (Xenakis, 1997; Rouse et al., 2000) Recent studies have proven that the 15-minute interval for increasing oxytocin dose after

amniotomy may predispose to rapid oxytocin excess, which is responsible for the complications observed in most reports (Xenakis, 1997; Durodola et al., 2005).

A longer interval for increasing the oxytocin dose will reduce complications and improve outcome (Durodola et al., 2005). It has also been suggested that there are individual differences in sensitivity to oxytocin which may be influenced by parity, gestational age, cervical status and maternal surface area (Orhue, 1997; Zeeman, 1997). Some of the complications of oxytocin infusion may be due to exposure of the myocytes to rapid oxytocin build up creating excessive stimulation of the myocytes (Durodola et al., 2005).

Due to the fact that oxytocin is secreted in pulses and temporary unavailability of bound oxytocin receptors to more oxytocin, the concept of administering oxytocin in pulses at every eight minutes has been advocated. It has been suggested that administering oxytocin in pulses was as effective as the continuous infusion (Zeeman et al., 1997). It required less total dose of oxytocin and less fluid infusion, and yielded a lower incidence of neonatal hyperbilirubinaemia. The pulse frequency and amplitude (dose in each pulse) of oxytocin administered need further evaluation (Zeeman et al., 1997). There seems to be little difference in clinical outcome between arithmetic and geometric increase in the oxytocin dose when establishing an infusion (Rouse et al., 2000).

The oxytocin titration regimen should be uniform in each unit (Orhue, 1997). The base mixture must be known and may consist of 10i.u. in 1000mls of solution. The best solution used in labour is Ringers lactate solution in order to avoid metabolic complications. Normal saline and 5% Dextrose water can also be used. Caution must however be taken to avoid infusing large volume of 5% Dextrose water to prevent water intoxication and hyponatremia (American College of Obstetricians and Gynecologists, 2009; American College of Obstetricians and Gynecologists, 2011).

The stating dose of oxytocin regimen should be known. The usual starting dose is 1-4mu/min and it is increased either arithmetically or geometrically until satisfactory labour is established or to a maximum of 32mu/min. Minimally effective uterine activity has been defined as three contractions in 10 minutes averaging greater than 25mmHg above baseline. However, adequate contraction may vary from 50-100mmHg and occurring every 2-4.5 minutes in every 10 minutes window, achieving from 95-395 Montvideo units (American College of Obstetricians and Gynecologists, 2009; American College of Obstetricians and Gynecologists, 2011). In induced labour, maximum of three uterine contractions lasting 40-60 seconds is the goal. The number of contraction can increase further on the same dose of oxytocin titration. Therefore uterine contraction greater than three may later predispose to hyper stimulation (American College of Obstetricians and Gynecologists, 2009; American College of Obstetricians and Gynecologists, 2011).

Use of oxytocin may result in uterine hyperstimulation syndrome (tachysystole or hypersystole with fetal heart abnormality-tachysystole->5 contractions in 10 minutes for at least 20 minutes ad hypersystole – a contraction lasting at least 2 minutes) (NICE, NHS, 2008) and uterine rupture. Either uterine hyperstimulation or a resting tone above 20mmHg in between contractions can lead to uteroplacental hypoperfusion and fetal hypoxia (American College of Obstetricians and Gynecologists, 2011). Oxytocin does not cross the placenta, so no direct effects on the fetus have been not cross the placenta, so no direct effects on the fetus have been observed. Hypotension can be a complication of oxytocin infusion but is seen only with rapid intravenous injection; which supports the routine administration of dilute oxytocin. Natural and synthetic oxytocin are structurally similar to antidiuretic hormone, therefore, water intoxication can be a side effect. To avoid this, large quantity of hypotonic solution should not be infused with high concentration of oxytocin (American College of Obstetricians and Gynecologists, 2009; Orhue, 1997; American College of Obstetricians and Gynecologists, 2011). The antidiuretic effect is usually observed after prolonged administration with at least 40mu/min (American College of Obstetricians and Gynecologists, 2011). Rarely, fluid embolism may occur following induction of labour if membranes are left intact after commencement of oxytocin. Iatrogenic prematurity is also a complication if the gestational age before induction of labour is not properly ascertained.

Failure of induction of labour

Failed induction refers to a situation where vaginal delivery cannot be achieved in a parturient on induction of labour and caesarean section has to be performed. Caesarean section may be indicated for a variety of reasons such as failure to achieve active phase of labour despite escalating oxytocin infusion, cephalopelvic disproportion, fetal distress or cord prolapse.

CONCLUSION

Induction of labour is a lifesaving intervention aimed at preventing fetal and or maternal jeopardy which may arise in some conditions where further prolongation of pregnancy has become life threatening. An in-depth knowledge of the dynamics of induction of labour is very important for safe obstetric practice. This article provides a guide for clinicians particularly in the developing countries where the tolls of maternal and infant mortality

are still unacceptably high.

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