A RETROSPECTIVE ANALYSIS OF INDUCTION OF LABOUR AT A REGIONAL HOSPITAL IN KWAZULU-NATAL, SOUTH AFRICA

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY
UNIVERSITY OF KWAZULU-NATAL

DURBAN, SOUTH AFRICA

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THESIS FOR PARTIAL FULFILMENT OF MASTER OF MEDICINE; DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY, UNIVERSITY OF KWAZULU-NATAL

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Acknowledgements

The following people made a significant contribution to this study and made it a success.
Professor J Moodley, my supervisor for his valuable contribution from his vast research experience.
Fikile Nkwanyana, the University statistician for her analysis and interpretation of the results.
The Lower Umfolozi District War Memorial Hospital (LUDWMH) registry staff for support in accessing patients files.
Dr N Mayat, Consultant LUDWM hospital for his practical guidance in my research
Dr A Kambaran, for his support and supervision
Dr Sylvia Cebekhulu, for her guidance and support on how to write a research protocol for submission to the University.
Dr X. Pupuma, for his invaluable assistance, before and during the writing of the thesis.

Dedication

I wish to dedicate this work to my children Levis Malende Mugale, Georgina Malende Mugale, George Malende Mugale, Patricia Malende Mugale, Patrick Malende Mugale and their mother Alice Bwalya who have made me a happy and proud father

Content

Graphs and tables for results

Declaration

I, Dr Brenden Malonde hereby declare that this work is original and has not been or will ever be presented to any other institution.

The University of KwaZulu-Natal may use this work to empower others. I'm aware of another study on induction of labour being done in Port Shepstone by Dr Raul Rodriguez Vaquez.

Signed:

Date: 29/08/2012

JJ Goodley
30/08/2012.

Abbreviations

1	LUDWMH	Lower Umfolozi District War Memorial Hospital
2	IOL	Induction of labour
3	Primigravida	Woman in her first pregnancy
4	Multigravid1	Women with parity 1 to 4
5	Multigravid2	Women with parity > 4
6	CTG	Cardiotocography
7	C/S	Caesarean section
8	NICU	Neonatal intensive care unit
9	ENND	Early neonatal death
10	PGE2	Prostaglandin E 2
11	PGF2α	Prostaglandin F2 α
12	NVD	Normal vaginal delivery
13	IUD	Intra-uterine death
14	IUGR	Intra-uterine growth restriction
15	PV	Per vagina
16	ARM	Artificial rupture of membranes
17	HYPITAT	Hypertension and pre-eclampsia intervention trial at term
18	HAART	Highly active anti-retroviral therapy
19	Dual therapy	The use of two anti-retroviral drugs for PMTCT

Approvals

Page

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YAKWAZULU-NATALI

12 October 2011

Professor J Moodley
Department of Obstetrics and Gynaecology
Nelson R Mandela School of Medicine

Dear Professor Moodley

PROTOCOL: "Retrospective analysis of induction of labour at a Regional Hospital, KwaZulu-Natal, South Africa." Student: B Malende, student number: 210552104 (Obstetrics and Gynaecology)

The Postgraduate Education Committee ratified the approval of the abovementioned study on 11 October 2011.

Please note:

- The Postgraduate Education Committee must review any changes made to this study.
- The study may not begin without the approval of the Biomedical Research Ethics Committee.

May I take this opportunity to wish the student every success with the study.

Yours sincerely

Professor M Adhikari
Dean's Assistant: MMed Programme
Postgraduate Education and Research Committee

cc. Dr B Malende

Biomedical Research Ethics Committee
Westville Campus

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27 October 2011

Dr Brenden Malende
Department of Obstetrics and Gynaecology
Nelson R Mandela School of Medicine
University of KwaZulu-Natal

Dear Dr Malende

PROTOCOL: Induction of labour at LUDWM Hospital -3 year retrospective analysis.REF:BE018/11

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 27 January 2011.

The study was provisionally approved pending appropriate responses to queries raised. Your responses dated 17 October 2011 to queries raised on 10 March 2011 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval and may begin as from 27 October 2011.

This approval is valid for one year from 27 October 2011. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/ResearchEthics11415.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

From PHILLIPS, Shelagh <shelagh.phillips@oup.com>
Subject: RE: Request for permission
To: "B. Malende" <mugalc2002@yahoo.com>
Date: Thursday, October 28, 2010, 9:41 AM

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From: B. Malende [mailto:mugalc2002@yahoo.com]
Sent: 27 October 2010 21:26
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Attention Oxford press
Dear sir

Im a student at the University of KwaZu u- Natal, Durban, Student number 210552104. Im studying for Masters of Medicine in Obstetrics. Im currently doing a retrospective analysis of labour Inductions and writing up my literature review. Misoprostol is the drug of choice in these inductions I seek your permission to use the graph showing the different plasma levels of Misoprostol from various routes of administration. This is for purely academic purposes and no other motives.
Looking forward to your response.See attachment
Yours truly Dr B Malende

TITLE: A Retrospective analysis of inductions of labour at a regional hospital, in Kwazulu-Natal, South Africa.

Investigator: Dr Brenden Malende **MP number 0579521, N11/1/37**

Supervisor: Professor J Moodley, UKZN, Durban

Co-Supervisor: Dr A Kambaran, LUDWMH, Empangeni

Date: December 2009 to July 2010 (8 months)

Lower Umfolozi District War Memorial Hospital, Empangeni, Kwazulu- Natal, S/Africa

In conjunction University of Kwazulu-Natal, Department of Obstetrics and Gynaecology

Correspondence to: Dr B. Malende, P.O.Box 896, Empangeni, KZN Phone…076 349 0192
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Abstract:

Background Induction of labour (IOL) is an important obstetrical procedure used to artificially stimulate labour for specific indications. Because IOL may have adverse consequences, there must be clear indications and guidelines on when and how to induce labour in patients with specific risk profiles. At Lower Umfolozi District War Memorial hospital, Kwazulu-Natal, misoprostol is the main agent for induction of labour.

Study Justification: to audit the practice of IOL due to

1. **Increase in prevalence of IOL.**
2. **Potential increase in morbidity for mother and baby.**
3. **Few studies for IOL having been done at regional health centres, serving rural populations.**
4. **Need to improve the practice of medicine**

Methodology

1. Study design

This was a retrospective analysis of 502 patients who underwent IOL for various indications.

2. Method

All patients who underwent IOL and had birth weight of 500 grams or greater, were identified and files were collected, information extracted, entered into Microsoft Excel data sheet and later transferred to SPSS soft ware for analysis.

3. Setting: The Study was conducted at LUDWMH, Empangeni, Kwazulu-Natal.

Results: The induction rate for this study was 8%. There were three main indications for IOL. These were hypertensive disorders of pregnancy (43.6%), postdates (25.9%) and premature rupture of membranes (14.7%). The main modes of IOL were oral misoprostol (63.5%) and vaginal misoprostol (30.3%).

The success rates for IOL were 58.3% (N=293) for normal vaginal deliveries and 1.4% (N=7) for assisted vaginal deliveries. 40% of the patients underwent caesarean section (CS) (N=202) following IOL.

Conclusion: The indications for IOL and induction rate in this study were similar to those reported by Mbele et al in Kalafong hospital, another regional hospital in South Africa(1).

1.0 Introduction

Induction of labour (IOL) refers to the artificial stimulation of uterine contractions to bring about labour after age of viability and before spontaneous onset of labour (2, 3). It is a result of risk benefit analysis, in which it is judged that the delivery of the fetus, in the particular circumstances, would benefit either the pregnant woman or her fetus, as opposed to the continuation of pregnancy(3). Lower Umfolozi District War Memorial Hospital, in the province of Kwazulu-Natal, South Africa has a high volume of patients, and delivers approximately 10 000 women annually.

1.1 Background and literature review:

Induction of labour can be traced to many different cultures. In some ancient cultures, a full term pregnant woman would be approached by a horseman, with a threat to trample her so that labour might be induced (4).In Greece, a couch was used to hasten labour in a pregnant woman by repeatedly lifting and dropping the woman onto the couch(4). Another method was to tie the woman to the couch, turning it upright, and repeatedly allowing it to fall to the ground (4).

Rates of IOL vary from region to region. In England, since 1989, 20% of labours were induced (4). In the U.S, as in many parts of the world, IOL has been rising (5). Factors associated with the rising induction rates include:

- Improvements in assessment fetal well being in pregnancy and labour by ultrasound and electronic fetal heart monitoring.
- The view of many obstetricians that labour should be induced at 41 weeks instead of 42. .because of higher risks of fetal complications after 41 weeks gestational age.

- Patients requesting elective inductions for various reasons, some social and others religious.
- Discovery of new medicines which results in improved rates of successful outcomes of IOL.

Rates of IOL vary based on patient populations and attitude of doctors. Induced labour increases the chance of caesarean sections[C/S], uterine rupture, and premature birth (5-7). Mbele et al, in Kalafong, Pretoria studied 558 women, undergoing IOL with oral misoprostol prospectively, to determine significant predictors of the success of induction. These authors found three main indications for inductions for IOL in their study, namely hypertensive disorders of pregnancy (45%), post dates (22%) and pre-labour rupture of membranes (20.6%). Vaginal deliveries were achieved in 24 hours in 52.4% of patients and C/S rate was 42.1%. The study also identified primigravidity, intact membranes and an unfavourable cervix (poor bishop score) as indicators of an unsuccessful IOL(1). The induction rate for their study was 9.6%.

The success of IOL depends on the state of the cervix. A favourable cervix enhances the success of an induction and a scoring system known as Bishop Score was introduced(8). The score is based on five clinical items: dilatation, effacement, station, consistency and position of the cervix (9). The score has since been modified in attempting to improve the predictability of a successful induction(10). A study on cervical assessment using trans-vaginal ultrasound failed to demonstrate any improvement in induction outcome (10, 11). A Bishop score of less than 5 is regarded as unfavourable cervix and one above 5 as favourable for IOL (12, 13). In order to improve the outcomes of induction, cervical "ripening agents or methods" have been developed.

Ripening of the cervix

The process of cervical ripening involves the breakdown of stromal collagen, following increased collagenase activity, and a change in the glycosaminoglycans (GAG) and hydration of ground substance (14, 15).The changes results from the hormonally mediated biochemical events that cause effacement, softening and dilation of cervix. Prostaglandins increase cervical ripening by altering the GAG content of the cervix, inhibiting the collagen synthesis and enhancing collagenase synthesis by macrophages (15, 16). The oestrogen to progesterone ratio changes towards term in pregnancy. Progesterone appears to inhibit cervical ripening, while oestrogen promotes phospholipase activity which promotes local prostaglandin synthesis (15). Prostaglandin F2a appears to be important in relation to contraction of the uterine myometrium and PGE2 is involved in cervical ripening (16).The main source of PGF2a is the decidua and PGE2 is derived from the amnion. Between the decidua and amnion is the chorion, which is a rich source of the prostaglandin degrading enzyme 15-hydroxyprostagladin dehydrogenase (PGDH) (15, 17).

Mediators of inflammation also appear to be involved in cervical ripening. These mediators include interleukin (IL-8) and monocyte chemotactic peptide (MCP-1) (16). PGE2 induces vasodilatation of cervical capillaries and this increases their permeability to neutrophils, which become drawn into cervical stroma, under chemotactic influence of IL-8(16). IL-8 also influences their degranulation within the cervix, thus releasing enzymes that degrade collagen(16, 17).

1.2.1 Induction agents and methods for inducing labour:

There are several methods of cervical ripening, which indicates that there is no single universally acceptable or most effective method for cervical ripening and induction of labour.

1.2.1(a) Misoprostol

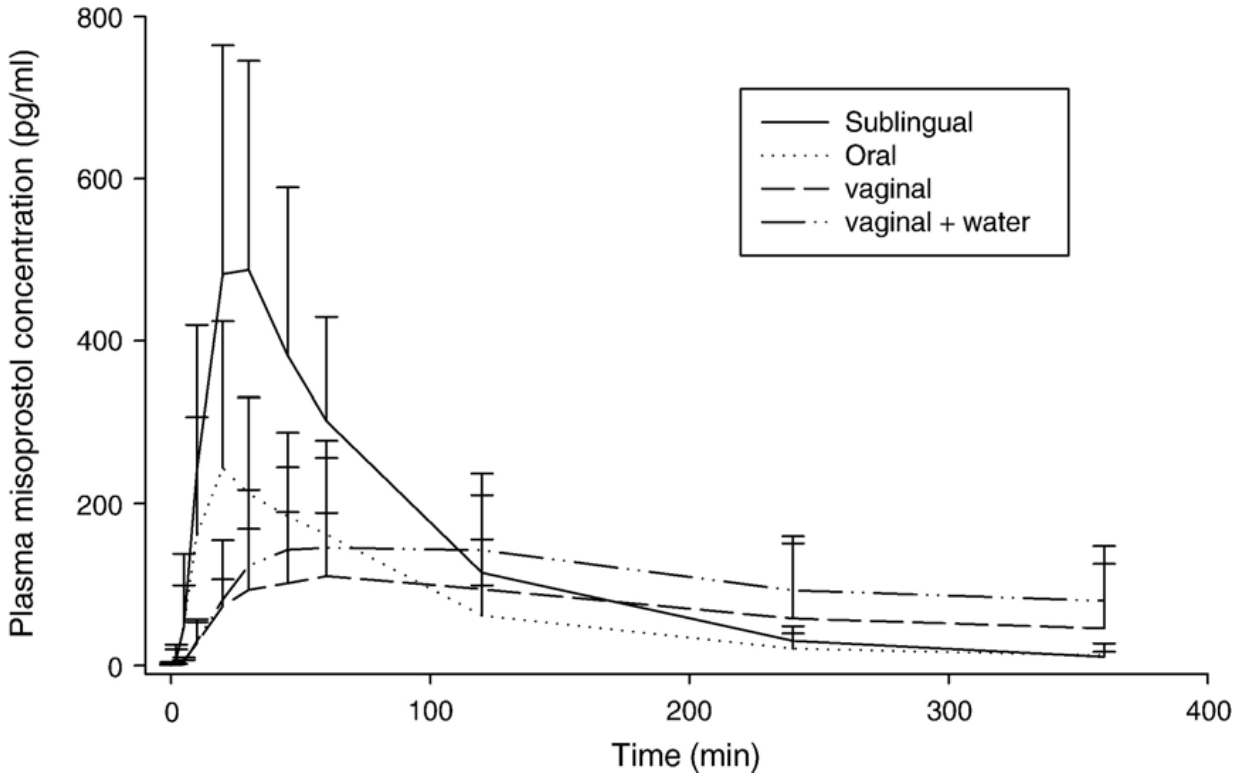
Misoprostol is an agent that was initially designed for the treatment of peptic ulcer disease. As an unlicensed indication, misoprostol is now used in obstetrics and gynaecology for terminations of first and second trimester pregnancies and induction of labour at term(18-20). It is a prostaglandin E1 analogue and has the advantage of being cheap, orally available, and stable at room temperature. In addition, it has a long shelf half life. It is also used for the prevention of postpartum haemorrhage (PPH) (21, 22). More than 45 randomized trials including 5400 women have found vaginal misoprostol to be more efficacious than oxytocin or prostaglandin E2 at effecting delivery within 24 hours(23, 24). There have been no significant differences in the frequency of serious adverse maternal or neonatal outcomes with low dose misoprostol compared with oxytocin or prostaglandin E2(23). Misoprostol can be given orally, vaginally, sublingually, buccally or rectally (25, 26). Misoprostol pharmacokinetics gives an idea of the different bio-availabilities of the drug after various routes of administration. The pharmacokinetic profiles of the various routes of administration of misoprostol have been studied. After oral administration, misoprostol is rapidly and almost completely absorbed from the gastrointestinal tract (26, 27). However, it undergoes rapid and extensive first pass metabolism to form misoprostol acid (27). When given orally it peaks in 30 minutes and declines rapidly after 1 hour. Side effects of misoprostol include nausea, vomiting, diarrhoea, shivering and fever(26).

Some studies show that the oral route of administration is less effective than vaginal in medical abortions and deliveries (26, 27). This is in contrast with Uludag et al, who compared oral Misoprostol (100mcg) and vaginal misoprostol (50mcg) and found no significant differences in the mean induction to delivery interval, intra-partum complications and neonatal outcomes between the two groups (28). Although the peak concentration is higher after oral administration than for vaginal route, the "area under the curve" is higher when administered vaginally (26, 27). This means it has greater bio-availability vaginally and helps to explain why it is more effective for medical abortions. A pharmacokinetic study compared the absorption kinetics of oral, vaginal and sublingual routes of administration of misoprostol (26). It found that sublingual administration has the shortest time to peak concentration, the highest peak concentration and the greatest bio-availability compared to other routes. The study further showed that it takes 30 minutes to reach peak concentration after oral and sublingual administration and 75 minutes for vaginal route. The shape of the absorption curve after rectal administration is similar to the vaginal but its area under the curve is only a third of the vagina administration.

There are several possible regimes for misoprostol for induction of labour that are widely used. There is no evidence that any one of them is better than the other(29). One such regimen for oral misoprostol proposed by Hofmeyr is 20mcg 2hourly x 3 doses increased to 40mcg x 3doses. The solution is made by dissolving 200mcg misoprostol in 200cc of water. This regimen has been adapted for IOL at LUDWMH as will be shown below. A systematic review of randomized trials comparing oral with vaginal routes of administration has found the oral route to be associated with slower labours but fewer C/S (23, 30).

Hofmeyr et al has submitted, after review of the evidence, that there is no certainty as to which route of administration is preferable. Misoprostol tablets as a whole or fractions may be swallowed without having to be dissolved in water for terminations of pregnancy and induction of labour(22). Earlier gestations would require higher doses than term pregnancies for successful inductions and terminations of pregnancy(31).

Graph A



Mean plasma concentration of misoprostol with respect to time.
[Pharmacokinetics of different routes of administration of Misoprostol.]
(***Reproduced with permission from the Oxford University Press***)

Adapted from Tang SO. Misoprostol: Pharmacokinetic profiles, effects on the Uterus and side effects. *Int J Obstet Gynecol* 2007; 99, S160-167

1.2.1(b) Dosage of vaginal misoprostol

There are various regimens for the use of vaginal misoprostol and studies comparing lower doses of 25mcg with 50mcg showed no significant differences in caesarean and operative vaginal deliveries or incidences of tachysystole or hyperstimulation syndromes in the two groups studied (13, 32, 33). Neonatal outcomes were also similar. Use of the 50 mcg dose was reported to be associated with a greater proportion of deliveries within 24 hours, a greater proportion of patients delivering after a single dose, and the less frequent need for oxytocin augmentation(34). Uludag et al compared the safety and efficacy of oral misoprostol 100mcg 4hourly and 50mcg vaginal misoprostol up to 6 doses in 99 patients .There was a low incidence of failed inductions in both groups (4% versus 2.5%) respectively(28).

1.2.1(c) Complications of misoprostol

A. Uterine hyperstimulation

A systematic review has found vaginal misoprostol in the dosages used to be associated with more uterine hyperstimulation with non-reassuring fetal heart rate changes when compared to the use of PGE2 (26, 27, 35). Misoprostol was also more potent as a uterine stimulant in these trials but it was not established whether the effect was pharmacological or purely dose related(36).

B. Meconium-stained liquor

Meconium-stained liquor is significantly more common with labour induction with misoprostol than with either vaginal or intra-cervical PGE2 (15). It has been postulated that certain myometrial stimulants may cross the placenta to stimulate fetal bowel smooth muscle and cause meconium passage (26). An alternative explanation for the increased meconium passed during misoprostol IOL is that the resistance of misoprostol to placental 15-hydroxyprostaglandin dehydrogenase enables more of the drug to enter the fetal circulation than doses of PGE2 (26).

C. Precipitate delivery

Precipitate delivery (labour <2 hours) has been described as a possible complication of misoprostol induction at term (37). Oyelese et al describes a case of an extensive cervical laceration following rapid misoprostol-induced labour (37). The importance of precipitate delivery is that it may be a marker for excessive uterine response to misoprostol and risk of uterine rupture.

D. Ruptured uterus

There have been isolated reports of rupture of an unscarred uterus following misoprostol labour induction but without a reliable basis of comparison, it is unclear whether the reports of uterine rupture following misoprostol induction is greater or less than with other methods of labour induction (37).

Misoprostol has been used to induce labour in women with previous C/S (38). There have been several reports of uterine ruptures but there is no data from randomized control trials. Most authors recommend that misoprostol should not be used in women with uterine scars (38).

E. Caesarean section

The relationship between misoprostol and C/S is not clear. Reports from studies show a tendency to increased C/S rates due to fetal heart rate abnormalities (6, 37, 39, 40). Despite increases in uterine hyperstimulation, most reviews and trials have shown no significant difference in perinatal outcome following misoprostol versus other methods (41, 42)

1.3.0 Vaginal prostaglandins

Labour induction with prostaglandin F2a was introduced in the 1960s. Subsequently, formulations of prostaglandin E2 were developed which largely replaced the use of F2a in countries such as the UK (31, 43). Prostaglandins in form of pessaries, tablets, gels and suppositories are in use and commonly inserted vaginally. A wide variety of dosages and dosing intervals are in use. A limiting factor for the use of prostaglandin E2 preparations in many countries has been the high cost of the agent (20). A systematic review of vaginal prostaglandin E2 compared with placebo or no treatment showed that prostaglandins were clearly effective in bringing about delivery within 24 hours (44, 45). PGE2 tablets (3 mg 6–8 hourly to a maximum dose of 6 mg) are recommended in preference to PGE2 gel (2 mg for nulliparous women with modified Bishop score of< 4, 1 mg to all others, repeated 6 hourly to a maximum dose of 4 mg(3).

The Royal college of obstetrics and gynaecology (RCOG) recommends the use of intravaginal PE2 irrespective of woman's parity or cervical status. Systematic review of vaginal prostaglandin E2 compared with placebo or no treatment showed that prostaglandins were clearly effective in bringing about delivery [relative risk (RR) of failure to deliver within 24 hours 0.03, 95% CI 0.02-0.05(3)]. Different dosing regimens and intervals are in use and their most important limiting factor is their cost. If oxytocin is used after PGE2, 6 hours should elapse after the last dose of PGE2 to reduce the risk of hyper-stimulation(3).

1.3.1 Intra-cervical Prostaglandins

This involves inserting prostaglandins into the cervix in order to maximize local effect but no clear advantage over vaginal administration has been shown ((46-48).

1.3.2 Extra amniotic Prostaglandins

PGE2 and PGF2a may be injected into the extra amniotic space via a Foley catheter as a solution (49-51). Detailed information about efficacy of this method is limited as there are no randomized controlled trials.

1.3.3 Mechanical methods

These are the oldest methods of induction of labour. They include extra-amniotic Foley catheter and sweeping of the amniotic membranes or stretching of the cervix (50, 52). This results in the release of endogenous prostaglandins from the stimulation of the cervix and lower uterine segment (52, 53). They are associated with fewer incidences of uterine hyperstimulation and fetal heart rate changes and have similar effectiveness with vaginal PGE2. Sweeping membranes is associated with increased circulating prostaglandins and is used by some clinicians in combination with medical agents to curtail pregnancy (54, 55). Cromi at el evaluated maternal and fetal outcomes in a large series of patients undergoing IOL with extra-amniotic Foley catheter (56). The main outcome measures were clinical chorioamnionitis, endometritis, and suspected and culture-proven neonatal sepsis. The study concluded that trans-cervical use of the Foley catheter is safe for pre-induction cervical ripening and the associated risk of maternal or perinatal infections were negligible.

1.3.4 Extra amniotic saline infusion:

The effect of Foley catheter on the cervix may be enhanced by the infusion of saline into the extra-amniotic space at 50ml/h (49, 57). Studies suggest that this method has similar efficacy to vaginal misoprostol 25mcg 4hourly(49)

1.3.5 Amniotomy

Rupturing of the amniotic membranes through the cervix has been documented as a Method of labour induction for over 200 years(16, 58, 59). The presumed mechanism of action is the release of endogenous prostaglandins, which in turn, may result in cervical changes and labour(60, 61). This method has the advantage that the use of exogenous uterine stimulants, with the problems of uterine hyperstimulation, is avoided, and the amniotic fluid may be observed. However there is an increased risk of ascending infection especially in background of HIV infection (62, 63). With unfavourable cervix, amniotomy is often not technically possible(61).

1.3.6 Intravenous oxytocin

Traditionally, the use of oxytocin has been accompanied by amniotomy.

According to Hofmeyr et al, the only trial comparing intravenous oxytocin alone versus placebo or expectant management for women with unfavourable cervix was in women with spontaneous rupture of the membranes. Vaginal delivery was greatly enhanced with oxytocin(64). However, oxytocin without amniotomy is significantly less effective than vaginal PGE2 for labour induction in women with unfavourable cervices (64).

1.3.6(a) Adverse effects of oxytocin

Commonest side effect of oxytocin is uterine hyperstimulation. This may present as tachystole with more than 5 contractions in 10 minutes, contractions of more than 90 seconds duration or an increase in uterine tonus (65). The decreased intervillous blood flow associated with hyperstimulation ultimately leads to decreased oxygen transfer to fetus, with appearance of late decelerations(66).

Uterine rapture is a complication of inappropriate use of oxytocin. Retrospective series of uterine rupture have implicated oxytocin in 4.3% to 12.5% of occurrences (66). To avoid this complication it is advised to avoid use of oxytocin in grand multipara, to use internal uterine pressure monitoring for patients with previous caesarean delivery and avoiding it in obstructed labours(64, 65). Water intoxication is a complication of oxytocin and can be avoided by use of minimum effective dose (67). In this way, the antidiuretic effects of high doses of oxytocin can be avoided.

1.3.7 Acupuncture

This is more common in Asia for cervical ripening. One study demonstrated that acupuncture at points LI 4 (large intestine 4) and SP 6 (spleen 6) induces cervical ripening at term (16, 68). Acupuncture was also shown to decrease interval between estimated date of confinement and the actual time of delivery(68).

2.0 Study Justifications

As noted above IOL is a common obstetric procedure and therefore requires a regular audit. This gives confidence that medical procedures are up to date, helps to modify existing practice or introduce new procedures. It is a form of confidence check and balance to ensure a continued delivery of high quality of health care

Misoprostol is the drug of choice for IOL at LUDWMH. Misoprostol is administered according to the protocol shown on the table below (Table A). Observations (by author) suggested a large number of patients who had repeat IOL and subsequently ended up with operative deliveries. This observation needed to be ascertained in empirical terms to determine its significance. It could modify or change existing practice. Repeat audits of this kind, over years would give an idea of the trends in induction of labour; if they are increasing, remain stable or have decreased.

Table A

Protocol for induction of labour at LUDWM hospital

Gestation	<29/40	29-36/4o	36+/40	
	Unripe Cervix	Unripe Cervix	Unripe cervix	Ripe Cervix
Intrauterine Death	Misoprostol 100mcg PV 12hrly	Misoprostol 50mcg PV 12hrly	Misoprostol 50mcg PV 12hrly	Prostin E2 2mg PV 6hrly
Primigravida	Misoprostol 100mcg PV 12hrly	Misoprostol 50mcg PV 6hrly	Misoprostol 50mcg PV 6hrly	Oral Misoprostol Or Prostin E2 2mg 6hrly
Multi-gravida (Para 1-4)	Misoprostol 50mcg Pv 12 hry	Misoprostol 50mcg PV 12hry	Oral misoprostol	Prostin E2 1mg Pv 6hry
Multi-gravid >4	Oral Misoprostol	Oral Misoprostol	Prostin E2 1mg PV 6hrly	AROM + Oxytocin
Prev C/S	Consult Specialist			

Oral Misoprostol regime consists of 200mcg in 200cc of water. Start with 20mls 2hourly x 3doses then 40mls 2hourly for further 3 doses

Misoprostol Table for Induction from Lower Umfolozi District War Memorial Hospital

STUDY DESIGN

4.0 Definitions

4.1 Induction and failed induction of labour: Induction of labour is a process of artificial stimulation of uterine contractions after age of fetal viability and before spontaneous onset of labour, with the aim of vaginal delivery(2). For the purpose of this study, failed IOL was failure to achieve vaginal delivery. This was the definition used by Chigbu et al (69). However analysis of data took into account the number of patients who delivered within 24 hours of initiation of IOL.

4.2. Study Population- all patients who underwent IOL and delivered fetus with weight 500grams or more.

4.3 **Study location**; Lower Umfolozi District War Memorial (LUDWM) hospital is a regional hospital that serves as a referral hospital for 17 district hospitals and each of which services 9-14 clinics. All complicated obstetric cases are referred to LUDWM hospital. The monthly deliveries at the regional hospital are between 800 to 950. On average, there were 4 women per day undergoing IOL. Therefore about 960 women undergo IOL per year (9.6%). The hospital had a C/S rate which varies between 35-40% at the time of study.

4.4: Study period: 8 months. The sample was derived from the period December 2009 to July 2010. This is the period that captured the desired number of patients. (See 4.5 below)

4.5 Sample size- All patients undergoing IOL for various indications. The sample size was determined by available resources; with the aim to obtain a large enough sample to allow analysis of the subcategories of inductions of labour. The target was to recruit 500 women

4.6 Sampling strategy- all patients who underwent IOL were included

4.7 Inclusion criteria: All patients who underwent induction of labour in the study period with a fetal weight of 500grams or greater were included.

4.8 Exclusion criteria: Women with clinical signs of infection were excluded because infection is a confounder for adverse fetal outcome. Files without basic essential details for IOL were also excluded.

4.9 Data Collection Methods and Tools. The researcher went through all the files of patients who underwent IOL in the study period. These files were to be analysed by the researcher and the information was entered in a structured data sheet in the Excel computer programme. The researcher analysed data sheets from the Neonatal Intensive Care (NICU) to obtain perinatal outcomes and recorded them into the Excel programme.

5.0 Statistical Planning- The data collected was captured and subsequently analysed using the Statistical Package for Social Sciences (SPSS version 18). Descriptive statistics such as frequencies and proportions was used to summarize data

5.1: Data analysis techniques and statistical analysis: see 5.0 above

5.2 Study limitations

5.2.1: Missing data/missing files; retrospective nature of study-poor documentation of clinical event

5.3 Outcomes

5.3.1 Primary outcomes

- Assess the indications for IOL
- Examine pregnancy outcomes following IOL

Maternal Outcomes

- Number of normal vaginal deliveries (NVD) following IOL
- Number of C/S following IOL
- Number who had repeat IOL

Fetal outcomes

- Neonatal outcomes which include:
  - Apgar score
  - NICU admissions,
  - Resuscitation, intubation, convulsions, etc

5.3.2 Secondary out comes

- To determine induction delivery induction delivery intervals.
- Use of oxytocin for augmentation of labour following induction.

5.4 Regulatory approval

5.5 Ethics Committee: Ethical approval was obtained from the Bioethical Research Committee of the University of KwaZulu-Natal (Ref BE018/11). Patients were not identified by their names but by study numbers. There were no patient identifiers recorded in the data collection sheets and the information obtained was kept in a lockable cupboard. The information was destroyed after data analysis.

5.6 Hospital approval. Approval for the study was provided by the Hospital Chief Executive office

Results

The total number of deliveries during the study period was 6649. The total deliveries included fetuses with weight above 500 grams. 30 files were excluded because of missing essentials details. There were 502 files that were analyzed. The induction rate was 8%.The majority, 51.4 %, were primigravidae and 47% were of parity 1-4. The descriptive characteristics of all patients who had IOL are shown in Table 1(Page 45). The table shows incomplete data documentation such as height and weight which is important for determination of body mass index (BMI) which has a bearing on the success or failure of IOL. The number of deliveries and number of inductions per month over the study period are shown on graph 1(page 41). Graph 2(page 47) shows the gestational age at IOL. Postdates accounted for 25.9% of IOL. Accurate dating by ultrasound scan is important to determine the time for IOL and graph 3[page 48] shows the gestational ages at time of first scan. 59.8% of patients did their first ultrasound after 27 weeks. Only 14.7% had their first ultrasound in the first trimester of pregnancy.

There were three major indications for IOL viz hypertensive disorders of pregnancy (43.6%), postdates (25.9%) and pre-labour rupture of membranes (14.7%) [Table 2, page 49]. Among the hypertensive disorders of pregnancy, gestational hypertension (30.3%, N=152) and pre-eclampsia (13.3%, N=67) were the most common subcategories.

The commonest modes of IOL were oral misoprostol alone (63.5%) and vaginal misoprostol alone (30.3%) [Table 2 , page 49]. Vaginal misoprostol was administered in 56.6% of the

primigravidae (N=146) compared with 2.5% patients of parity 1-4 (N=6). There were 215 patients of parity 1-4 (91.1%) who received oral misoprostol compared with 101 primigravidae (39.1%).

Induction of labour resulted in 58.3% (N=293) of the patients successfully delivering vaginally and 40.2% undergoing C/S .The rest had assisted vaginal deliveries [1.4% (N=7)].

Table 2 [page 49] shows the modes of delivery following the various modes for IOL. 52% of all the patients who had vaginal misoprostol only (N=152) delivered vaginally while 48% had C/S. There was a 61.8 % vaginal delivery rate of all patients who were induced with oral misoprostol only (N=319).

Table 3 [page 50] shows the parity, mode of IOL and mode of delivery in relation to number of cycles of induction. 88.2% (N=443) delivered with one cycle of IOL. 47.8 %(N=240) of the primigravidae delivered with one cycle compared with 39% (N=196) of the multigravid1. There were 47 (9.3%) patients who had two cycles of IOL and 12 (2.3%) received 3 cycles of IOL. Induction with oral misoprostol alone accounted for 15% having repeat inductions (48 out of 319) compared with 3.4% who received vaginal misoprostol (5 out of 147). The repeat inductions were not associated with adverse maternal outcomes [Table6, page 53].

Table 4 [page 51] shows the various indications for C/S. 13.1 % (N=66) had non reactive fetal heart recordings following the initiating IOL and prior to onset of labour and had caesarean delivery. Overall 56% (N=114) of the patients had C/S with associated CTG abnormalities. The table also gives the number of doses of the induction agents that were given. Oral misoprostol had the largest total number of doses administered (N=318) to induce labour compared to vaginal misoprostol (N=151). Primigravidae received a higher total number of doses of misoprostol

(N=249) compared with patients of parity 1-4 (N=228). It must be observed on the second part of table 4 {page 51] that some patients did not complete a full of IOL but only one or a few doses of the full cycle before going into labour , while others went up to three full cycles.

Induction delivery interval is shown in Table 5[page 52]. Delivery within 24hours was achieved in 69.7% of the patient (N=350). Among this group, 63.7% (N=223) had normal vaginal deliveries and 34.8% (N=122) by C/S. There were 53.7% (N=188) primigravidae and 44.9% (N=157) multigravid1 who delivered within 24 hours. The mode of IOL for the patients who delivered within 24 hours was composed of 59.4% (N=208) who received oral misoprostol and 34% (N=120) who received vaginal misoprostol. There were 42.6% (N=149) of patients with hypertensive disorders of pregnancy, 25% (N=88) with post dates and 16% (N=57) with pre-labour rupture of membranes who achieved delivery within 24 hours.

Table 6[page 53] shows maternal outcomes following IOL. Gastrointestinal side effects were documented in only 1% of patients. There were no serious maternal adverse effects directly related to use of misoprostol. 10 women (1.9%) had post partum haemorrhage and had full recovery. One woman (0.2%) had a laparatomy for puerperal sepsis. she had full recovery.

Fetal outcomes are shown in Table 6[page 53]. There were 34 admissions (6.7%) to neonatal ICU (NICU) following IOL. The table also depicts the weight distribution at birth. Their apgar scores were good (see graph 4, page 54). One early neonatal death was documented. The leading causes for admissions to NICU were prematurity (10 =2%), hypoxic ischaemic encephalopathy (HIE) (9=1.8%) and congenital pneumonia (7=1.4%). Convulsions occurred in 4 babies of the 9 admitted to NICU for HIE. One of the 4 babies who convulsed ended up as an early neonatal death (ENND). The ENND was delivered by C/S for fetal distress, but the C/S was delayed for 2 hours due to limited theatre facility at the time. Analysis of the other babies with HIE and convulsions did not reveal avoidable factors. However all recovered and were discharged.

Discussion

Our study shows that rate of IOL at LUDWMH during the study period was 8% (see flow chart). The rate is similar to the one by Mbele et al of 9.6%(1). Our findings are also in keeping with the world wide range for IOL of 3 to 30%(70).

The study showed that hypertensive disorders of pregnancy were an important indication for IOL. 42.2% (N=109) of the primigravidae had hypertensive disorders of pregnancy. The study by Mbele at el showed that women with low cervical scores (<5) having IOL in their first pregnancy have higher C/S rates when compared with multiparous women (1).The overall C/S rate for nulliparous women in the current study was 49.2%.

The concept of failed IOL is controversial. However, women must be counselled of this possibility and the chances of a C/S. Further, failed IOL must be differentiated from failure to progress in labour and from cephalo-pelvic disproportion or malposition. There are a variety of definitions. In general terms failed IOL means the woman does not enter active labour or the cervical score does not improve or the cervix does not dilate more than 3cm over a 12 hour period of ruptured membranes and good uterine activity(74). This study adopted Chigbu's definition of failed IOL as failure to achieve vaginal delivery (68). It must be noted however that failed IOL is not necessarily an indication for C/S. Each case must be re-assessed clinically and the indications for induction reviewed in relation to harms and benefits to mother and fetus. All being well consideration should be given to repeat attempt of IOL at a variable period of time. Women must be informed of this possibility at primary IOL as this will improve the chances of vaginal birth.

The 3 main indications for IOL were hypertensive disorders of pregnancy (43.6%), postdates (25.9%) and pre-labour rupture of membranes (14.7%). These were also the 3 main indications for IOL found by Mbele et al in their study in Kalafong , South Africa(1).In their study delivery within 24 hours was achieved in 52.4% of patients and the C/S rate was 42.1%. Our study showed a similar outcomes: out of the 502 study patients, 58.3% had normal vaginal birth and 40.2% had C/S. Delivery within 24hours was achieved in 69.7% of the study patients [Table 5, page 52].This group was composed of 45.4%(N=228) who delivered vaginally and 24.3% (N=122) who had C/S. Another 20.3% (C/S=58 and normal birth=44) of the participants delivered after 24hours but within 48hours.

Uncertainty exists over the need to induce labour for patients with mild hypertension/pre eclampsia who have stable maternal and fetal conditions at 34 -37 weeks. However, the HYPITAT study evaluated maternal and neonatal complications in patients with pregnancy induced hypertension/ pre eclampsia at 36 to 40 weeks and the result of this randomised trial revealed that IOL at or after 37 weeks was associated with lower rates of maternal complications without increased C/S rates or neonatal complications(71).

It is reported that 20% of pregnant women will require IOL, which usually requires more than one intervention and will present challenges to clinicians, health care workers and mothers(72). Our study showed that 9.3% (N=47) had 2 attempts at IOL and 2.3% (N=12) had 3.The use of oral misoprostol had the largest number of women who had repeat attempts at IOL compared to vaginal misoprostol [Table 3, page 50]. It has been reported that vaginal misoprostol is more efficacious than oral misoprostol in achieving delivery (23, 24). This is because oral misoprostol is

eliminated more rapidly (2-3hours) than vaginal misoprostol (≥4hours)(24). Other factors which may affect delivery induction interval include maternal ethnicity, maternal weight, body mass index (BMI) and age, gestational age and fetal weight(73). Our study did not analyse these factors. Furthermore, being a retrospective study there was poor or lack of documentation of certain parameters such as bishop score, and maternal height.

There were 13.1% (N=66) of study patients who developed non reactive fetal heart recordings following IOL before active labour and had C/S. The number consists of 41 primigravidae, 24 multigravid1 and 1 multigravid2. Subgroup analysis of this number cannot yield meaningful conclusions and therefore a larger study with more numbers would be required. But non reactive traces call for the need to weigh up risks and benefits for IOL and extensive counselling of patients before embarking on the procedure(3). Other convenient, relatively cheap and safe methods are not used because the induction protocol table 3[page 50] is stuck on the wall in labour at the hospital and readily comes to the mind of health care worker. Only one patient had amniotomy alone for IOL and analysis indicates she was of high parity and caution was exercised to avoid uterine rupture by not administering oxytocin.

The 5 minutes apgar scores for the new born were good [Graph 4, page 54]. There was a 6.7% admission to NICU. There was no serious maternal adverse incident directly associated with IOL [Table 6, page 53]. Side effects of misoprostol of fever, pyrexia and diarrhoea were not observed as reported in literature. Hofmeyr et al report that 30-40% of patients under a controlled trial who undergo IOL will show these side effects of misoprostol(3). In practice these may not be recorded because patients may not take them serious enough to report them.

Summary

1. IOL had a normal vaginal delivery rate of 58.3% and 1.4% assisted vaginal delivery rate during the study period. Delivery within 24hours was achieved in 69.7% (N=350) and a further 20.3% (N=102) within 48hours. There were 202 patients (40.2%) who delivered by C/S for various indications. There were no serious maternal adverse outcomes documented following IOL.

2. There were 47 (9.3%) patients who had two cycles of misoprostol and 12 (2.3%) received 3 cycles misoprostol inductions. More audits required to see the trends in repeat inductions. The repeat inductions were not associated with adverse maternal outcomes.

3. Oxytocin was used to augment labour in 8.2% of participants (N=41). 23 patients were augmented following IOL with oral misoprostol alone, 14 patients following vaginal misoprostol alone and the rest from other modes of IOL.

4. The IOL protocol for LUDWMH was not followed in 17.7% of patients (N=89) and reasons were not documented. These resulted in following:

4.1 One cycle of induction=70

4.2 Two cycles of induction=13

4.3 Three cycles of induction=6

5. There were 34 admissions (6.7%) to neonatal ICU (NICU) following IOL. Their apgar scores were good (see graph 4, page 54) with only one early neonatal death. The leading cause for admissions to NICU were prematurity (10 =2%), hypoxic ischaemic encephalopathy (HIE) (9=1.8%) and congenital pneumonia (7=1.4%). There were 6 babies ventilated in NICU following IOL and were eventually discharged.

Conclusion

The indications for IOL and induction rate in this study were similar to those reported by Mbele et al in Kalafong hospital, another regional hospital in South Africa. The vaginal deliveries and C/S rates were also similar to the Mbele study.

Recommendations

1. More audits required to see trends in IOL.
2. Current methods of IOL must continue. They have a good success rate and have no documented serious adverse maternal or fetal outcomes.
3. Bishop's score should be inscribed in the antenatal cards with all required components so that during IOL, medical officer simply have to enter the scoring numbers. This will be similar to partograph in antennal cards where medical officers simply enter examination findings directly on to the graph. This will improve assessment during IOL.

Graph 1

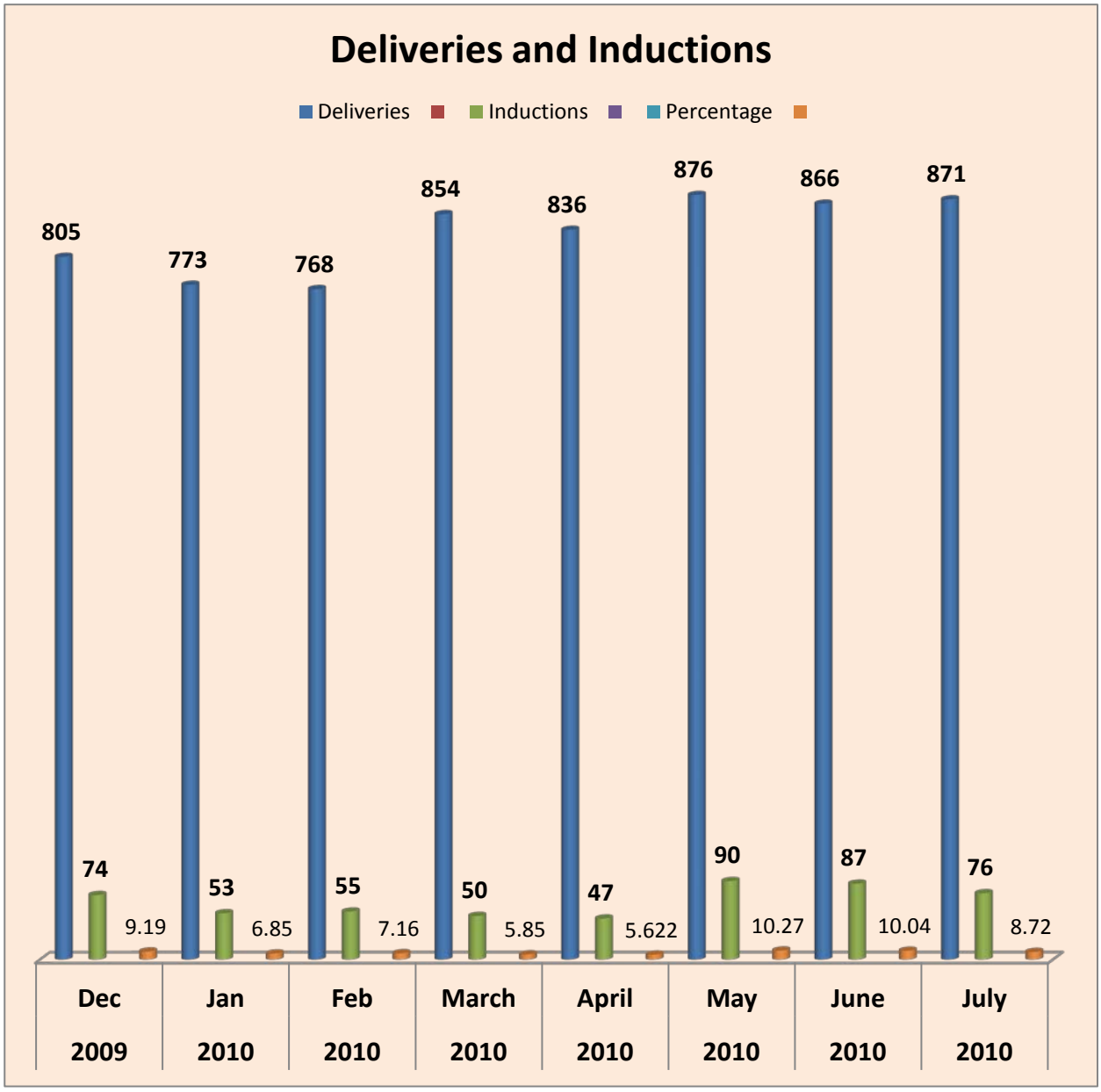
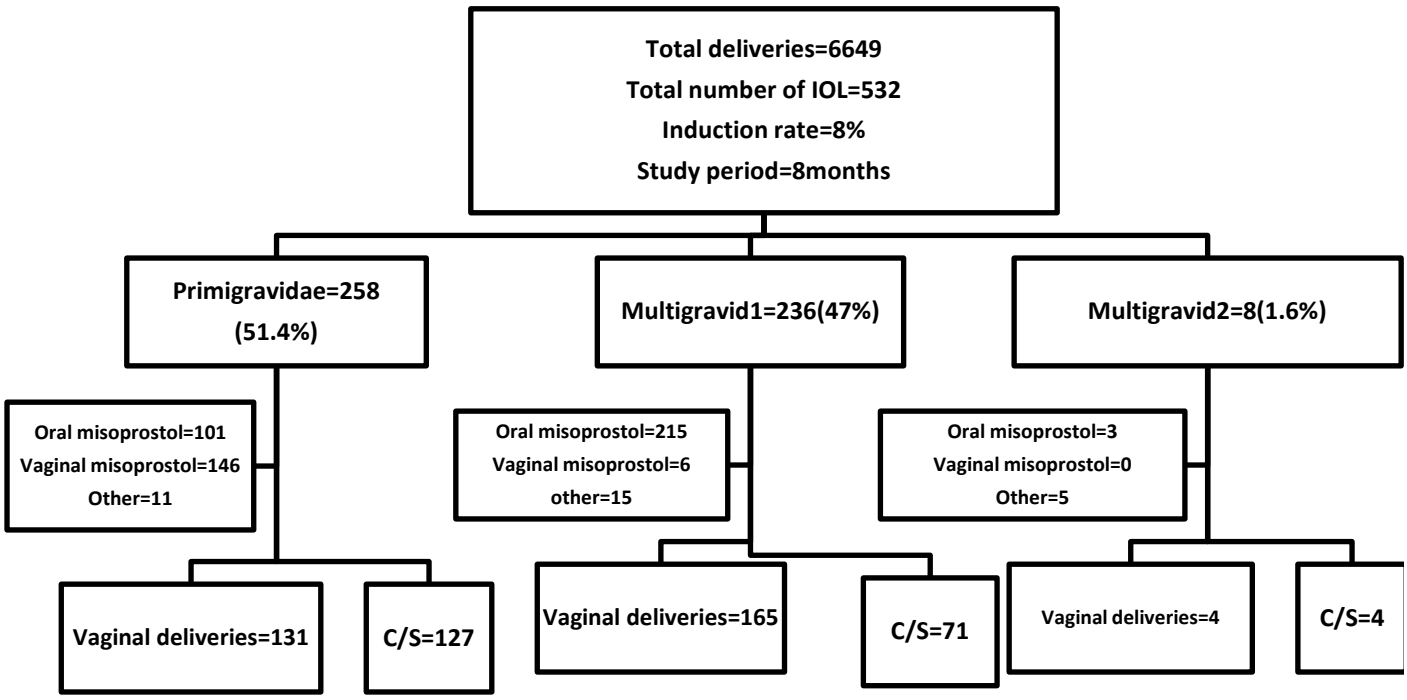

Deliveries and Inductions
Deliveries
Inductions
Percentage
805
74
9.19
773
53
6.85
768
55
7.16
854
50
5.85
836
47
5.622
876
90
10.27
866
87
10.04
871
76
8.72
Dec 2009
Jan 2010
Feb 2010
March 2010
April 2010
May 2010
June 2010
July 2010

Table 1

Descriptive Characteristics of women who had IOL /N=502

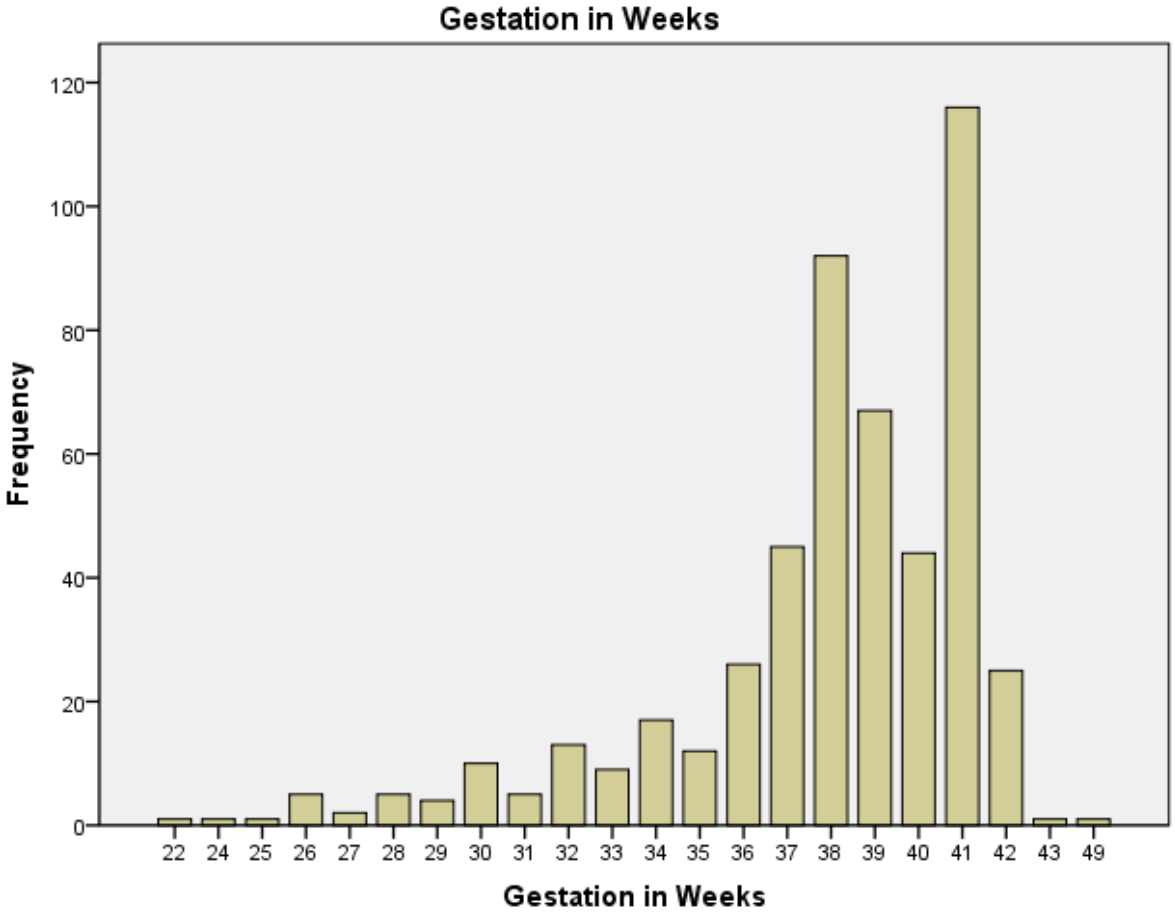
Age in years		*Frequency*	*Percentage*
1	≤20	136	27
2	21-30	264	52.6
3	31-40	92	18.3
4	≥40	10	2
Race			
1	Black	490	97.6
2	Non Black	12	2.4
Parity			
1	Primigravidae	258	51.4
2	Multigravida1(parity 1-4)	236	47
3	Multigravida2(Parity >4)	8	1.6
Weight			
1	Weight documented	498	99.2
2	Weight not documented	4	0.8
Height			
1	Height documented	200	38.9
2	Height not documented	302	60.1
Bishop Score	Documented	0	0
Cervical assessment	Documented	502	100
HIV Status			
1	HIV Negative	338	67.3
2	No data	1	0.2
3	Started HAART	8	1.6
4	On HAART prior to pregnancy	45	9
5	Started Dual therapy	110	21.9

Flow chart for IOL



Multigravida1=Parity 1-4, Multigravida2=Parity> 5

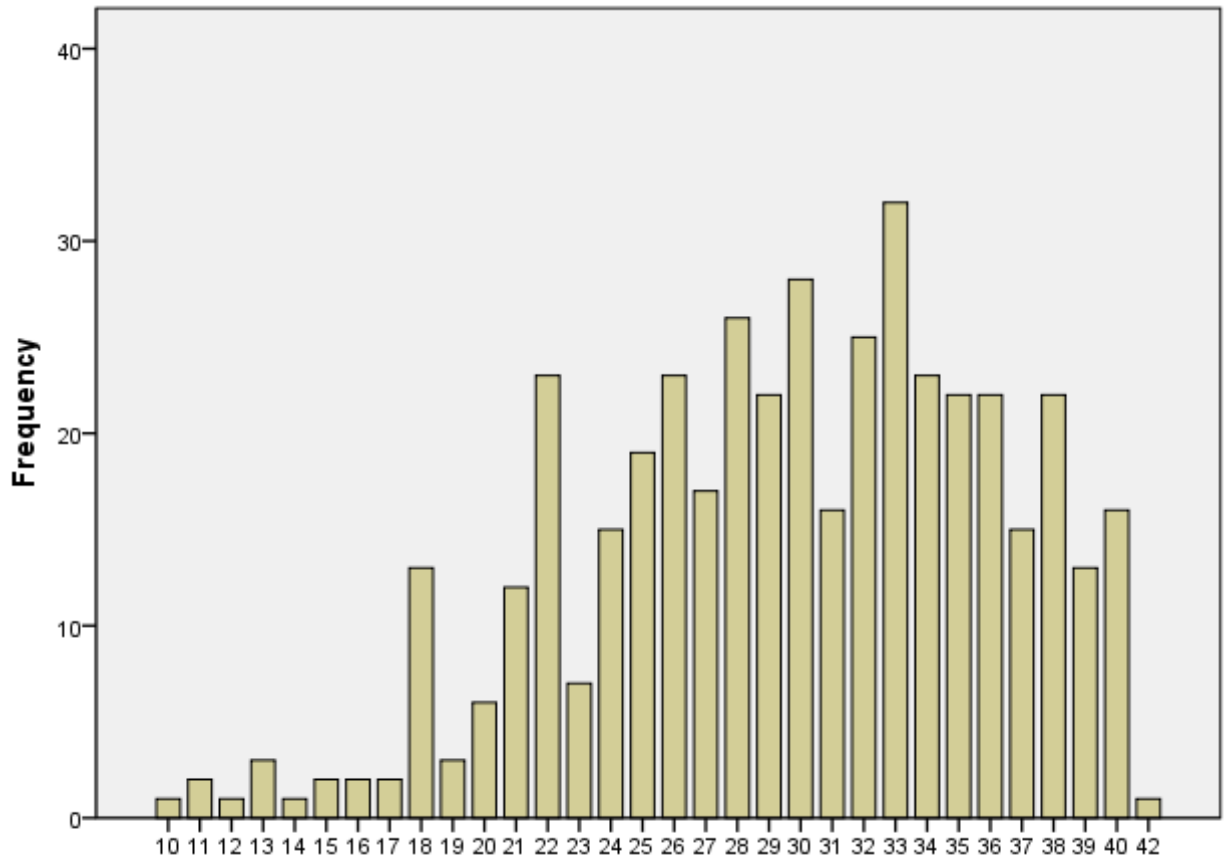
GRAPH 2



Graph showing gestation at time of IOL

GRAPH 3

Gestation in weeks at time of first ultrasound scans



This graph shows how early the participants booked for ultrasound scan as accurate dating by scan is useful for intervention.

Table 2

Indications for IOL, Mode of IOL, Mode of delivery and Parity Cross tabulation

Indications for IOL	Parity			
	Primigravidae	Multigravid1	Multigravid2	Total
Postdate	69 (26%)	61 (25.8%)	0 (0%)	130 (25.9%)
Hypertensive disorders of pregnancy	109 (42.2%)	106 (44.9%)	4 (50%)	209 (41.6%)
Intra-Uterine fetal death	7 (2.7%)	9 (3.8%)	0 (0%)	16 (3.2%)
Prolonged latent phase	14 (5.4%)	9 (3.8%)	1 (12.5%)	24 (4.8%)
Oligohydramnios	8 (3.1%)	5 (2.1%)	2 (25%)	15 (3%)
Decreased fetal movements	1 (0.4%)	2 (0.8%)	0 (0%)	3 (0.6%)
Unclear indication	0 (0%)	1 (0.4%0	0 (0%)	1 (0.2%)
Pre-labour rupture of membranes	39 (15.1%)	35 (14.8%)	0 (0%)	74 (14.7%)
Intra-Uterine growth restriction	7 (2.7%)	4 (1.7%)	0 (0%)	11 (2.2%)
Diabetes Mellitus	0 (0%)	3 (1.3%)	1 (12.5%)	4 (0.8%)
social indications	4 (1.6%)	1 (0.4%)	0 (0%)	2 (0.4%)
Total	258 (100%)	236 (100%)	8 (100%)	502 (100%)
Mode of IOL				
Vaginal misoprostol alone	146 (56.6%)	6 (2.5%)	0 (0%)	152 (30.3%)
Oral misoprostol alone	101 (39.1%)	215 (91%)	3 (37.5%)	319 (63.5%)
ARM followed by oxytocin	5 (1.9%)	4 (1.7%)	0 (0%)	9 (1.8%)
Sweeping membranes followed by oxytocin	0 (0%)	1 (0.4%)	0 (0%)	1 (0.2%)
Foley catheter followed by oxytocin	0 (0%)	1 (0.4%)	0 (0%)	1 (0.2%)
Foley catheter	0 (0%)	19 (8%)	1 (12.5%)	2 (0.4%)
Prostin alone	1 (0.4%)	4 (1.7%)	2 (25%)	7 (1.4%)
Vaginal misoprostol followed by oral misoprostol	2 (0.8%)	0 (0%)	0 (0%)	2 (0.4%)
Oral misoprostol and sweeping membranes	0 (0%)	3 (1.3%)	0 (0%)	3 (0.6%)
Oral misoprostol followed by 200mcg vaginal misoprostol start	0 (0%)	1 (0.4%)	0 (0%)	1 (0.2%)
Oral misoprostol followed by Prostin	0 (0%)	0 (0%)	1 (12.5%)	1 (0.2%)
Oxytocin	3 (1.2)	0 (0%)	0 (0%)	3 (0.6%)
Amniotomy alone	0 (0%)	0 (0%)	1 (12.5%)	1 (0.2%
Total	258 (100%)	236 (100%)	8 (100%)	502 (100%)
Mode of Delivery				
Normal birth	126 (48.8%)	165 (70%)	2 (25%)	293 (58.4%)
C/S	127 (49.2%)	71 (30%)	4 (50%)	202 (40.2%)
Forceps	2 (0.8%)	0 (0%)	0 (0%)	2 (0.4%)
Vacuum	3 (1.2%)	0 (0%)	2 (25%)	5 (1%)
Total	258 (100%)	236 (100%)	8 (100%)	502

Table 3

Mode of delivery, Parity, Mode of IOL and number of Cycles of induction Cross tabulation

	Number of Cycles of IOL			
	One cycle Induction	Two cycles Induction	Three cycles Induction	Total
Mode of delivery	N=443	N=47	N=12	502
1.Vacuum	5 (1.1%)	0 (0%)	0 (0%)	5 (1%)
2.Forceps	2 (0.5%)	0 (0%)	0 (0%)	2 (0.4%)
3.C/S	169 (38.1%)	28 (59.6%)	5 (41.7%)	202 (40.2%)
4.NVD	267 (60.3%)	19 (40.4)	7 (58.3%)	293 (58.3%)
Parity				
1.Primigravidae	240 (54.2%)	16 (34%)	2 (16.7%)	258 (51.4%)
2.Multigravid1	196 (44.2%)	31(66%)	9 (75%)	236 (47%)
3.Multigravid2	7 (1.6%)	0 (0%)	1 (8.3)	8 (1.6%)
Mode of IOL				
1.Oral misoprostol alone	271 (61.2%)	40 (85.1%)	8 (66.7%)	319 (63.5%)
2.Vaginal misoprostol alone	147 (33.2%)	5 (10.6%)	0 (0%)	152 (30.3%)
3.Amniotomy alone	1 (0.2%)	0 (0%)	0 (0%)	1 (0.2%)
4.Oxytocin	3 (0.7%)	0 (0%)	0 (0%)	3 (0.6%)
5.Oral misoprostol followed by Prostin	0 (0%)	0 (0%)	1 (8.3)	1 (0.2%)
6.Oral misoprostol and 200mcg PV Start	0 (0%)	1 (2%)	0 (0%)	1 (0.2%)
7.Oral misoprostol followed sweeping membranes	1 (0.2%)	0 (0%)	2 (16.7%)	3 (0.6%)
8.Vaginal misoprostol followed by oral misoprostol	0 (0%)	1(2%)	1 (8.3%)	2 (0.4%)
9.Prostin alone	7 (1.6%)	0 (0%)	0 (0%)	7 (1.4%)
10.Foley Catheter	2 (0.5%)	0 (0%)	0 (0%)	2 (0.4%)
11.Foley Catheter followed by oxytocin	1 (0.2%)	0 (0%)	0 (0%)	1 (0.2%)
12.Sweeping membranes followed by Oxytocin	1 (0.2%)	0 (0%)	0 (0%)	1 (0.2%)
13.ARM followed by oxytocin	9 (2%)	0 (0%)	0 (0%)	9 (1.8%)
Total	443 (100%)	47 (47%)	12 (100%)	502 (100%)

Table 4

Indications for C/S, Number of doses of induction agents and Parity Cross tabulation

Indication for C/S	*Parity*			
	Primigravidae	Multigravida1	Multigggravida2	Total
CTG abnormality but not in labour	41 (32%)	24 (33.8%)	1 (25%)	66 (32.7%)
Fetal distress/CT G abnormalities in labour	43 (33.8%)	11 (15.5%)	0 (0%)	54(26.7%)
Development of eclampsia	3 (2.4%)	0 (0%)	0 (0%)	3 (1.5%)
Development of pre-eclampsia	0 (0%)	3 (4.2%)	0 (0%)	3 (1.5%)
Failed IOL				
1.One cycle IOL	3 (2.4%)	7 (9.9%)	2 (50%)	12 (6%)
2.Two cycle IOL	4 (3.1%)	6 (8.5%)	0 (0%)	10 (5%)
3.Three cycle IOL	1 (0.8%)	3 (4.2%)	0 (0%)	4 (2%)
CPD	24 (18.9%)	5 (7%)	1 (25%)	30 (15%)
Poor cervical dilatation despite oxytocin	6 (4.7%)	7 (9.9%)	0 (0%)	13 (6.4%)
Other indications for C/S	2 (1.6%)	5 (7%)	0 (0%%)	7 (3.5%)
Total	127 (100%)	71 (100%)	4 (100%)	202 (100%)
Number of doses of induction agents(Excluding Foley catheter &Oxytocin)				
1	16 (6.4%)	3 (1.3%)	1 (16.7%)	20 (4.1%)
2	63 (25.3%)	13 (5.7%)	0 (0%)	76 (16%)
3	50 (20%)	25 (11%)	2 (33.3%)	77 (16%)
4	51 (20.5%)	26 (11%)	0 (0%)	77 (16%)
5	3 (1.2%)	19 (8.3%)	0 (0%)	22 (4.6%)
6	45 (18%)	96 (42%)	2 (33.3%)	143(29.6%)
7	1 (0.4%)	2 (0.9%)	0 (0%)	3 (0.6%)
8	2 (0.8%)	2 (0.9%)	0 (0%)	4 (0.8%)
9	2 (0.8%)	2 (0.9%)	0 (0%)	4 (0.8%)
10	1 (0.4%)	2 (0.9%)	0 (0%)	3 (0.6%)
11	1 (0.4%)	0 (0%)	1 (16.7%)	2 (0.4%)
12	12 (4.8%)	29 (12.7%)	0 (0%)	41 (8.4%)
13	1 (0.4%)	1 (0.4%)	0 (0%)	2 (0.4%)
14	0 (0%)	1 (0.4%)	0 (0%)	1 (0.2%)
17	0 (0%)	3 (1.3%)	0 (0%)	3 (0.6%)
18	1 (0.4%)	3 (1.3%)	0 (0%)	4 (0.8%)
19	0 (0%)	1 (0.4%)	0 (0%)	1 (0.2%)
Total	249 (100%)	228 (100%)	6 (100%)	483 (100%)

CTG: Cardiotocography, C/S: caesarean section, CPD: cephalo-pelvic disproportion, IOL: induction of labourMultigravidae1+parity 1-4, Multigravidae2+ Parity > 4

Table 5

Induction delivery interval

	Time			
Parity	***≤24hours***	***24.1-47.9hours***	***≥48hours***	***Total***
Primigravidae	188(53.7%)	49(48%)	21(42%)	258
Multigravida1	157(44.9%)	53(52%)	26(52%)	236
Multigravida2	5(1.4%)	0(0%)	3(6%)	8
Total	350(100%)	102(100%)	50(100%)	502
Mode of IOL				
Oral misoprostol alone	208(59.4%)	75(73.5%)	36(72%)	319
Vaginal misoprostol alone	120(34.2%)	25(24.5%)	7(14%)	152
Other modes of IOL	22(6.3%)	2(0.2%)	7(14%)	31
Total	350(100%)	102(100%)	50(100%)	502
Indications for IOL				
Hypertensive disorders of pregnancy	149(42.6%)	47(46%)	23(46%	219
Post dates	88(25%)	28(27.4%)	14(14%)	130
Pre-labour rupture of membranes	57(16.2%)	13(12.7%)	4(8%)	74
Other indications for IOL	56(16%)	14(13.7%)	9(18%)	79
Total	350(100%)	102(100%)	50(100%)	502
Mode of delivery				
Normal birth	223(63.7%)	43(42.2%)	27(54%)	293
C/S	122(34.8%)	58(56.8%)	22(44%)	202
Vacuum	3(0.9%)	1(0.1%)	1(2%)	5
Forceps	2(0.6%)	0(0%)	0(0%)	2
Total	350(100%)	102(100%)	50(100%)	502

C/S: Caesarean section, IOL: induction of labour, Multigravida1=Parity 1-4, Multigravida2=Parity > 4

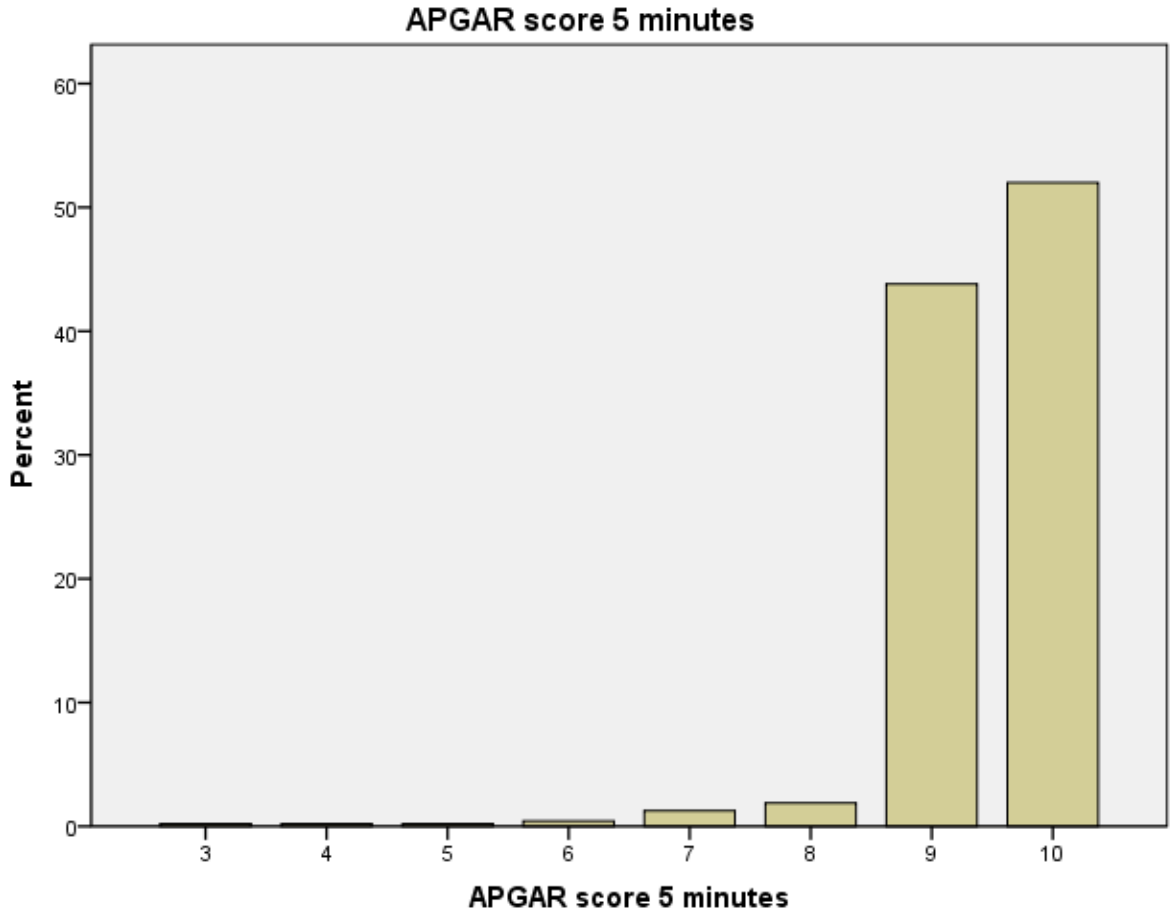
Table 6

Maternal and fetal outcomes following IOL/ N=502

Maternal outcomes	Frequency	Percentage
1.Pyrexia	2	0.4
2.Shivering	2	0.4
3.Nausea/Vomiting/diarrhoea	5	1
4.Primary PPH	8	1.6
5.Secondary PPH	2	0.4
6.Perineal tears	51	10.2
7.Episiotomy	79	15.7
8.Puerperal sepsis	3	0.6
9.Laparatomy	1	0.2
10.Retained Placenta	5	1
11.Ruptured Uterus	0	0
12.Maternal death	0	0
Fetal outcomes		
1.Neonatal ICU admissions	34	6.7
2.Recession	1	0.2
3.Cyanosis	1	0.2
4.Meconium exposed	1	0.2
5.Low APGAR	5	1
6.Congenital pneumonia	7	1.4
7.HIE (4 Convulsions, 1 ENND)	9	1.8
8.Prematurity	10	2
Fetal weight(grams)		
500-1000	11	2.2
1001-1499	10	2
1500-2499	73	14.5
2500-3499	305	60.5
3500-4499	102	20.3
≥4500	1	0.2

1. ENND=Early neonatal death 2.HIE=Hypoxic ischaemic encephalopathy 3.PPH=Postpartum heamorrhage
4. CPAP=Continuous positive airway pressure 5.PPH: post partum heamorrhage

Graph 4


APGAR score 5 minutes
Percent
60
50
40
30
20
10
0
3
4
5
6
7
8
9
10
APGAR score 5 minutes

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