



UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvenoot • your knowledge partner

How safely can we follow up post-term pregnancy with uncertain gestation using amniotic fluid index measurement?

Candidate

Mohamed, AMM

Registrar, Department of Obstetrics and Gynaecology, Stellenbosch University and Tygerberg Academic Hospital, Cape Town, South Africa

Study leader

Theron, GB

Chief Specialist, Professor and Departmental Chairman, Department of Obstetrics and Gynaecology, Stellenbosch University and Tygerberg Academic Hospital, Cape Town, South Africa

December 2013

A dissertation for the Master of Medicine degree in Obstetrics and Gynaecology
Stellenbosch University

DECLARATION

By submitting this thesis/dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Dr Amenah M M Mohamed

Date: _____ Signature: _____

Acknowledgements

I would like to thank the following people:

Prof Gerhard Theron - Thank you for your kind thoughtful support throughout my training. Your wisdom and experience have guided me every step of the way of my dissertation. I am so very grateful.

Mrs Anneke Theron – Thank you for all the professional guidance and for the all support you have given to me during the dissertation preparation and data collection.

Mr. Justin Harvey – Thank you for your help in statistical analysis and graphs preparation.

My husband **Mohamed Alteer**, Thank you for your continual support and consideration. Last but not least I would like to thank the Libyan government for financing me, and my family in Libya for their support and prayer.

Content

Acknowledgements	3
Abstract	5
Opsomming	7
Introduction	9
Aims	14
Method	14
Sample size	16
Data analysis	18
Ethics approval	18
Results	19
Discussion	30
Conclusion	34
References	35
Appendix	39

Abstract

Background:

Studies about management of prolonged pregnancy dealt with pregnancy with certain gestational age, confirmed with early ultrasound scans.

Objective:

- The primary aim for the study is to review the current management of uncertain gestational age (GA) post term pregnancy in Tygerberg Academic Hospital (TBH).
- Women at 42 weeks with an uncertain GA and an amniotic fluid index (AFI) of ≥ 10 cm as well as reassuring cardiotocographs (CTG) would be assessed to determine whether follow up over one week or two weeks are required.

Method:

A retrospective descriptive study included all patients with an uncertain gestation of 42 weeks referred to TBH.

Results:

A total of 135 pregnant women were studied. Booking fundal height (BFH) was used to determine GA in 99% and last menstrual period (LMP) in 1% of patients. The time interval between first evaluation at 42 weeks and delivery varies between 0 to 46 days (median 10 days); 104 women delivered vaginally (71% spontaneously, 6% after induction of labour (IOL)); 31 women (23%) by caesarean section; 1 elective, 4 due to cephalopelvic proportion (CPD), 5 had failed IOL, 3 poor progress and 18 fetal distress. Out of the total 11 (8%) women with AFI ≥ 10 had caesarean sections for fetal distress

within 2 weeks of the visit at 42 weeks. No neonatal morbidity or mortality was noted in this study.

Conclusion:

Weekly monitoring with AFI and CTG for women at 42 weeks with unsure gestation is safe. A follow-up following 2 weeks cannot be recommended as 8% of women required caesarean sections within less than 2 weeks due to fetal distress.

Opsomming

Agtergrond:

Studies oor verlengde swangerskap handel oor swangerskappe met seker swangerskapsduurte, bevestig met vroeë ultraklank skandering.

Doelwit:

- Die primêre doelwit van die studie is om die huidige hantering van verlengde swangerskap met onseker swangerskapsduurte by Tygerberg Hospitaal (TBH) te beoordeel.
- Vroue wat volgens onseker swangerskapsduurte 42 weke swanger is met 'n amnionvogindeks (AVI) van ≥ 10 en gerusstellende kardiotokegramme (KTG) sal nagegaan word om te bepaal of opvolg oor een of twee weke nodig is.

Metode:

'n Retrospektiewe studie wat alle pasiënte insluit wat na Tygerberg Akademiese Hospitaal verwys word wat 'n onseker swangerskapsduurte van 42 weke het.

Resultate:

'n Totaal van 135 vroue is bestudeer. Die fundale hoogte is gebruik om swangerskapsduurte te bepaal in 99% van gevalle en die laaste menstruasie in 1%. Die tydsinterval tussen die eerste evaluasie op 42 weke en verlossing wissel tussen 0 en 46 dae (mediaan 10 dae); 104 vroue het 'n vaginale verlossing gehad (71% met spontane aanvang van kraam, 6% na induksie van kraam); 31 (23%) is met keisersnitte

verlos; 1 elektief, 4 as gevolg van skedelbekken disproporsie, 5 gefaalde induksies, 3 swak vordering en 18 met fetal nood. Uit die totaal was daar 11 (8%) vroue met 'n AVI \geq 10 wat keisersnitte vir fetale nood binne 2 weke van die besoek op 42 weke gehad het. Geen neonatale morbititeit of mortaliteit het in die studie voorgekom nie.

Gevolgtrekking:

Weeklikse monitering met AVI en KTG vir vroue wat 42 weke swanger is met onseker swangerskapsduurte, is veilig. Opvolg na 2 weke kan nie aanbeveel word nie want 8% het keisersnitte vir fetale nood gehad na minder as 2 weke.

Introduction

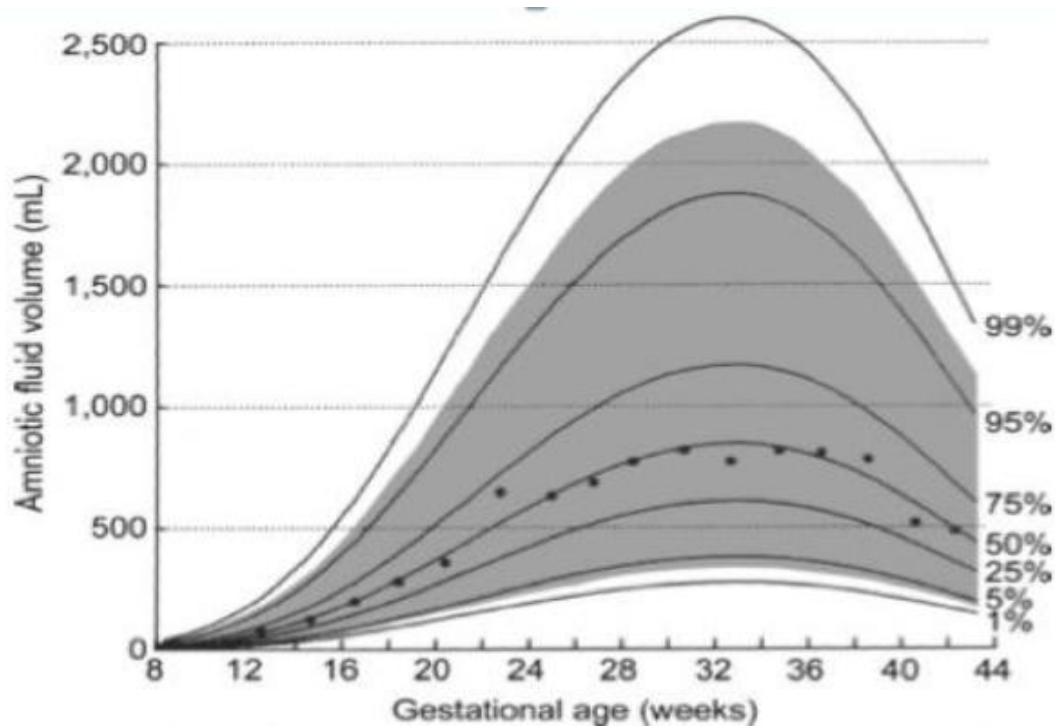
Post term pregnancy refers to a pregnancy that has continued to or beyond 42.0 weeks of gestation from the first day of the last menstrual period.¹⁻³ About 5-10% of all pregnancies would reach a gestational age that could be considered as post term.^{4,5} Despite the fact that advances in neonatal and maternal care have decreased the mortality rate, studies of post term pregnancies have shown an increased risk for both infant and mother. The perinatal mortality rate at 40 weeks is about two to three deaths per 1,000 deliveries, doubling at 42 weeks.^{6,7}

On one hand, the amniotic fluid (AF) in late gestation (3rd trimester) is mainly formed by fetal urine and fetal lung fluids, with a small contribution by secretion from fetal oral-nasal cavities. On the other hand, a major part of AF clearance occurs by fetal swallowing and the intramembranous pathway between AF and fetal blood. A minor source of clearance is by solute exchange between AF and maternal blood through the decidua, the transmembranous pathway.⁸

In normal pregnancies with certain gestation, amniotic fluid volume (AFV) increase gradually till 36 then start to reduce as pregnancy progresses (Figure 1).⁹ This finding is explained by the fact that fetal kidney function at about 36 weeks is mature enough to concentrate urine. Subsequently, oligohydramnios will develop if renal perfusion is diminished. At 42 weeks the range of AFV between the 3rd and the 97th centile is wide and cannot be used to predict post term pregnancies. A decline in amniotic fluid index (AFI) to below five centimeter in uncomplicated post term pregnancies is associated

with a raised incidence of fetal heart abnormalities during labour and a significantly increased caesarean section rate for fetal distress.^{10,11}

Figure 1: Normal Amniotic fluid volume in pregnancy



The major reasons for fetal jeopardy in prolonged pregnancy are related to either placental insufficiency or umbilical cord compression exacerbated by oligohydramnios.¹²⁻¹⁴ The current view is that, prolonged pregnancy is associated with decreased utero-placental exchange, leading to fetal blood flow redistribution and shunting of blood away from the kidneys.¹⁵ Consequently, fetal urine production reduces, causing a decreased AFV.

A biophysical profile (BPP) is a method of antenatal assessment of fetal wellbeing performed to identify babies that may be at risk of poor pregnancy outcome. A BPP includes ultrasound monitoring of fetal movements, fetal tone and fetal breathing,

ultrasound assessment of liquor volume and assessment of the fetal heart rate using non-stress cardiotocography (CTG).¹⁶ A scoring system gives marks of 0 or 2 to each of the five parameters, depending upon whether specific criteria are met (Table 1). The presence of these biophysical variables implies absence of significant central nervous system hypoxemia and acidemia at the time of testing.

A modified biophysical profile (BPP) was developed to shorten the time necessary for testing and simplify the examination by concentrating on those components of the profile that are most predictive of outcome.¹⁷ Assessment of AFV and non-stress testing appears to be as reliable a predictor of short term fetal well being as compared to doing a complete BPP. The rate of stillbirth of about 0.8/1000 women within one week of a normal modified BPP is the same as with the complete BPP.¹⁸

AFI is the technique used to assess the amount of AFV by dividing the pregnant uterus into four quadrants and measuring the deepest pocket of AF in each quadrant. The summation of these four quadrants measurements resulting in the AFI.¹⁹ Compared to other techniques used to measure AFV, AFI is considered more accurate and reproducible.²⁰ Oligohydramnios is defined as an AFI ≤ 5 cm at term, which is associated with a significant increase in the caesarean section rate and low Apgar scores.¹⁹ Therefore, detection of oligohydramnios is suggested to be an indication to deliver the fetus to reduce perinatal morbidity and mortality.^{21,22}

Table1: Criteria for a biophysical profile (modified from reference 13)

Parameter	Normal (2 points)	Abnormal (0 points)
NST/Reactive FHR	At least two accelerations in 30 minutes	Less than two accelerations to satisfy the test in 30 minutes
US: Fetal breathing movements	At least one episode of ≥ 30 s in 30 minutes	None or less than 30s in 30 minutes
US: Fetal activity / gross body movements	At least two movements of the torso or limbs	Less than three or two movements
US: Fetal muscle tone	At least one episodes of active bending and straightening of the limb or trunk	No movements or movements slow and incomplete
US: Qualitative AFV/AFI	At least one vertical pocket >2 cm or more in the vertical axis	Largest vertical pocket ≤ 2 cm

Management of post term pregnancy in the past was controversial. Labour could be induced at 41 weeks or more irrespective of vaginal findings or pregnancy allowed to be continued, called expectant management.^{23,24} Both options are associated with low complication rates in low risk patients.²⁵ Two meta-analyses done recently supported induction of labour in the 41st week but not later than 41 completed weeks rather than expectant management, as a significant lower perinatal mortality rate were found and

no significant increase in the rate of caesarean sections (C/S) in the induction group.^{26,27} However, expectant management could also be considered acceptable to deal with post term pregnancies, using regular antenatal fetal surveillance to monitor fetal wellbeing. A modified biophysical profile including non stress CTG and AFI measurement is regarded an acceptable method to monitor the fetus.^{1,26}

In this review most of the studies regarding the management of prolonged pregnancy dealt with pregnancy with certain gestational age (GA), having had early ultrasound scans.^{1-7,23-26} Early ultrasound dating reduces the number of pregnancies that could be considered post term by 70 percent.²⁸ A study done at Tygerberg Academic Hospital (TBH) two decades ago, evaluated pregnant women with uncertain GA using fundal height or last menstrual period (LMP) to determine GA. Weekly monitoring of Doppler velocimetry of the umbilical artery, CTG and AFV were done. The authors concluded that, in this group of patients expectant management is recommended, providing that CTG is reactive and AFV remain normal. Furthermore, it reported no role for Doppler velocimetry measurement in expectant management, as it is not predictive of fetal or maternal outcome.²⁹ No clear guidelines for management of this group at 42 weeks uncertain GA, commonly encountered in poorer resourced countries, exists.

The current Tygerberg Hospital (TBH) protocol is weekly follow up of patients with a modified biophysical profile from 42 weeks of uncertain gestation. If the AFI is 5 cm or

more and the CTG reactive expectant management continues, otherwise induction of labour (IOL) is required.

In this study women at 42 weeks with an uncertain GA and an AFI of ≥ 10 cm and reassuring CTG would be assessed to determine whether follow up over one week or two weeks are required. The follow-up of these women could possibly be further refined by extending the next visit to over two weeks.

Aims

The primary aim for our study is to:

- Review the current management of post term with unsure gestation at TBH.
- Determine whether weekly or follow up every second week is required if women reach a GA of uncertain 42 weeks and AFI is ≥ 10 cm with a reactive CTG.

Method

A retrospective descriptive study included all patients with possible prolonged pregnancies and with uncertain gestation referred to fetal evaluation clinic (FEC) at TBH from either the hospital's high risk clinic or antenatal clinics in the area served by TBH.

In the context of this study a reactive CTG and a reassuring CTG have the same meaning; likewise a non-reactive and non-reassuring CTG has the same meaning. A pathological CTG will have poor variability with regular decelerations or late decelerations. A pathological CTG was an indication for immediate delivery.

Further analyses were done for those patients on the basis of:

Inclusion criteria:

- AFI ≥ 10 cm
- Uncertain gestation (no ultrasound before 24 weeks)
- Single pregnancy
- Cephalic presentation
- Intact membranes
- Uncomplicated pregnancy
- Reactive CTG

Exclusion criteria:

- Multiple pregnancy
- History of pre-labour rupture of membranes
- Complicated pregnancy (eg pre-eclampsia, diabetes, pregnancy induced hypertension, suspected intrauterine growth restriction, umbilical artery Doppler resistance index $\geq 95^{\text{th}}$ centile)

- Non-reactive CTG
- AFI <10 cm

These patients were followed up with weekly AFI assessments and CTGs until either AFI decreased to less than 5 cm or CTG become non-reassuring. With either of these, IOL or caesarean section was offered to deliver the baby depending on the patient's obstetric history and fetal condition. The data for the study have been retrieved from FEC records, maternal and neonatal medical folders. (Appendix A)

Outcome criteria:

- Mode of delivery
- Fetal distress
- Meconium in liquor
- Apgar score at 1 and 5 minutes
- Neonatal mortality
- Neonatal ICU or high care admission
- Meconium aspiration

Sample size

The calculation of the required sample size was based on the primary objective of the study, which is to determine whether weekly or every two weeks follow-up is required in patients with an uncertain gestational age of 42 weeks and an AFI in equal or in excess

of 10 cm as well as a reactive CTG. The justification of the follow-up period was based on an analysis of the complications associated with labour. The proportion of patients experiencing complications associated with labour occurring between 42 and 43 weeks GA (uncertain) was compared to the proportion that experienced complications associated with labour occurring during week 43 and 44 GA (uncertain). If these two proportions were not significantly different (within clinically meaningful limits) a follow-up period of two weeks instead of weekly intervals can be motivated for the patient population. However, if it was found that the proportion of complications was significantly higher in the 43 to 44 weeks uncertain GA group this would imply that monitoring should remain at weekly intervals. Using this framework the proportions was seen as (clinically) significantly different if they differ by 0.2 (20%) or more. A sample size of 135 achieves an 80% power to detect a non-inferiority margin difference between the group proportions of 0.2000. The reference group proportion was 0.3000. The treatment group proportion was assumed to be 0.5000 under the null hypothesis of inferiority. The power was computed for the case when the actual treatment group proportion is 0.3000. The test statistic used was the one-sided t-test. The significance level of the test was targeted at 0.05. The significance level actually achieved by this design is 0.0443.

Data analysis

MS Excel was used to capture the data and STATISTICA version 9 (StatSoft Inc. 2009 STATISTICA [data analysis software system] www.statsoft.com) was used to analyse the data.

The primary analysis included a comparison of the complication rates due to labour for those patients that went into labour between week 42 and 43 GA (uncertain) and those that went into labour between week 43 and 44 GA (uncertain). Furthermore, the complications that occurred are described using descriptive statistics.

The following general analysis rules were applied to all other analyses:

Summary statistics were used to describe the variables. Distributions of variables are presented with histograms and or frequency tables. Medians or means were used as the measures of central location for ordinal and continuous responses and standard deviations and quartiles as indicators of spread.

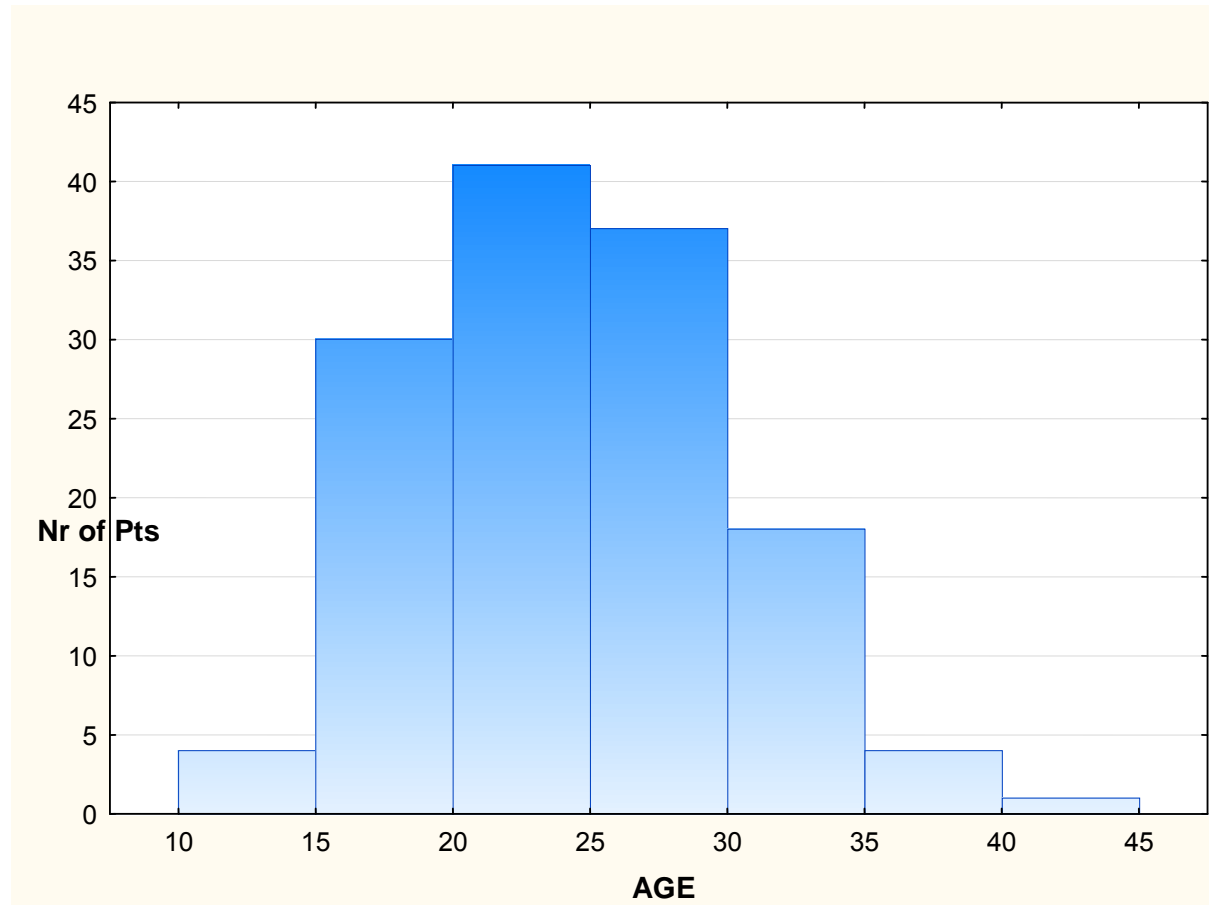
Ethics approval

This study was ethically approved by the Human Research Ethics Committee of the Faculty of Medicine and Health Sciences, Stellenbosch University. The Institutional Review Board number is: IRB0005239.

Results

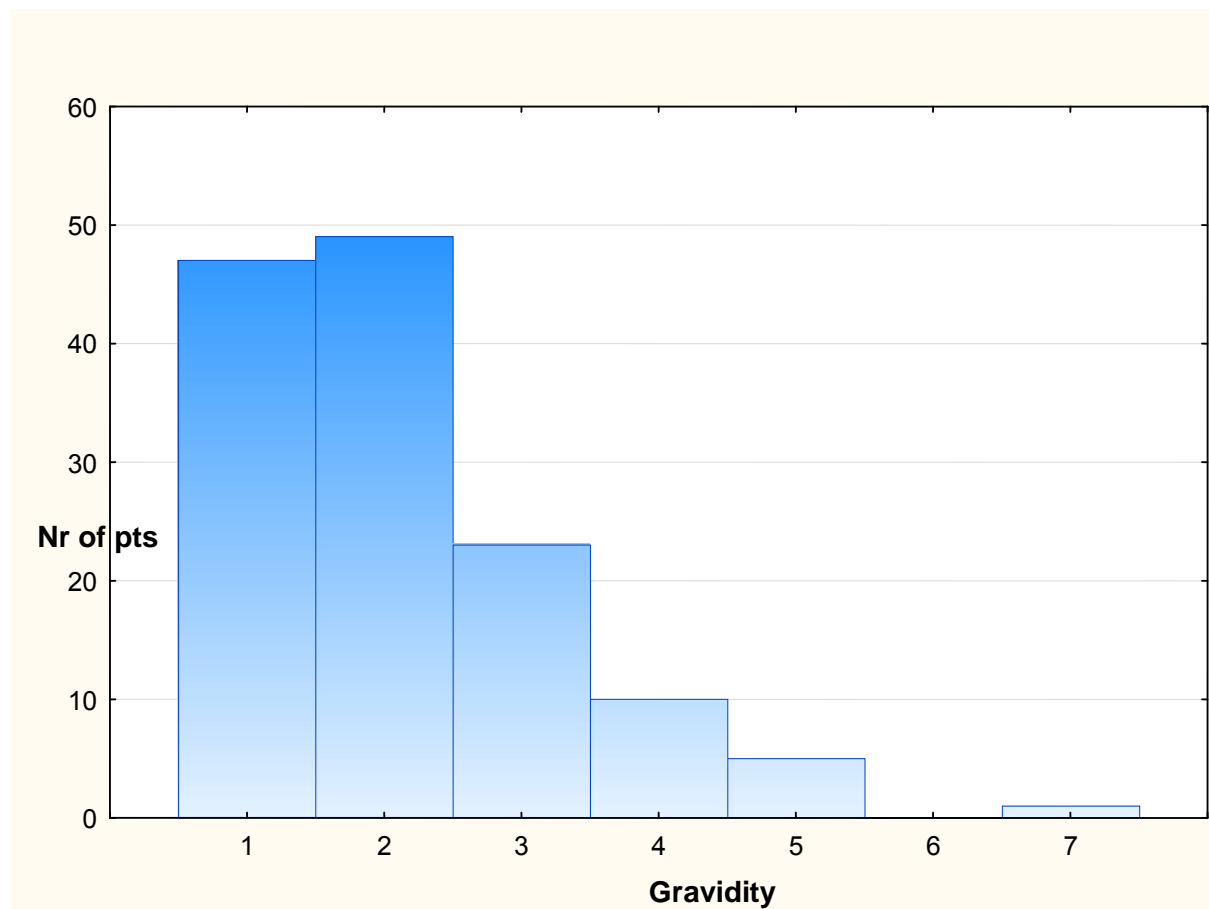
A total number of 135 pregnant women were studied. The average age of subjects was 25 years (Figure 2). Gravidity ranges from 1-7 (median 2), while the parity median is 1 (range 0-5) (Figures 3 and 4).

Thirty seven patients (27%) were infected with Human Immunodeficiency Virus (HIV), however all of them were on treatment either with highly effective antiretroviral therapy (HAART) or PMTCT (prevention of mother to child transmission). Syphilis was diagnosed in three patients and was treated fully. Only one patient in this series had a Rhesus negative blood group.

Figure 2: Age distribution of pregnant women in the study sample

Most of the patients included in this study booked late with an uncertain LMP, therefore booking fundal height (BFH) was used to determine their GA. The median GA at booking was 2 weeks (range to 44). BFH was used in 132 patients (99%), while sure LMP used in one patient to determine GA. The other two patients had a BFH that was equal to LMP. The patients judged to be 44 weeks by BFH measuring 44 cm.

One hundred and fourteen patients (85%) were seen at the FEC at 42 weeks of uncertain gestation, 18 (15%) at >42 weeks at first visit (two patients at 44 and one at 45 weeks respectively) (Figure 5).

Figure 3: The histogram showing the gravidity of patients in the study sample

All the patients included in this series had reactive CTGs and AFI ≥ 10 cm at their first presentation to FEC (Figure 6). One patient was included in this study with nonreactive CTG at entry, found while reviewing the data, the patient was kept in the study. The median first AFI was 14.8 and the range 10 to 28 cm. Following the FEC first visit 36 patients had an AFI value determined in the second week, 21 in the third week and six in the fourth week. No clear trend was found in AFI measurements in subsequent weeks. The median second week AFI is 12.6 and the range 8 to 26.5 cm. The median third week AFI was 12 and the range 2 to 24 cm. The median fourth week AFI was 10 and the range 6 to 20 cm.

Figure 4: The histogram showing the parity of patients in the study sample

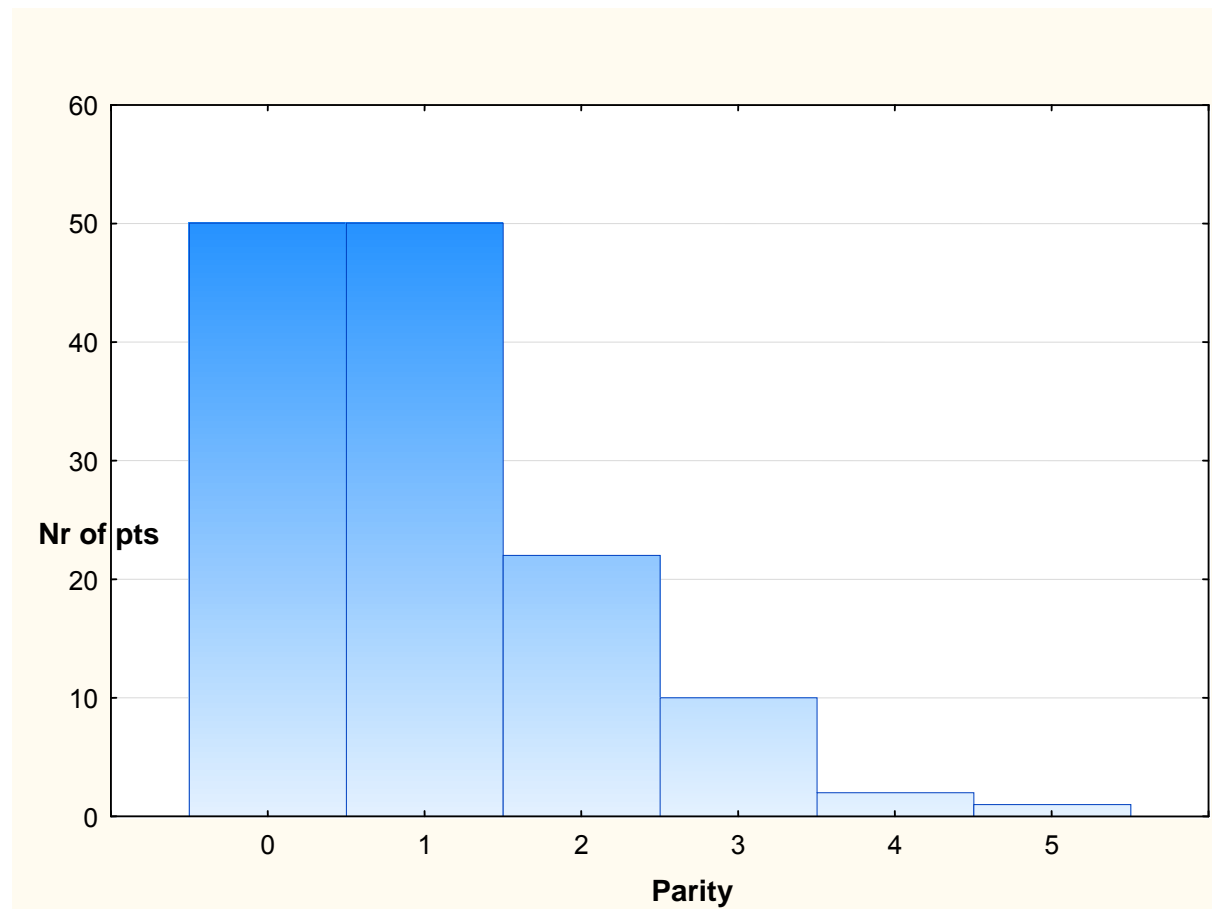
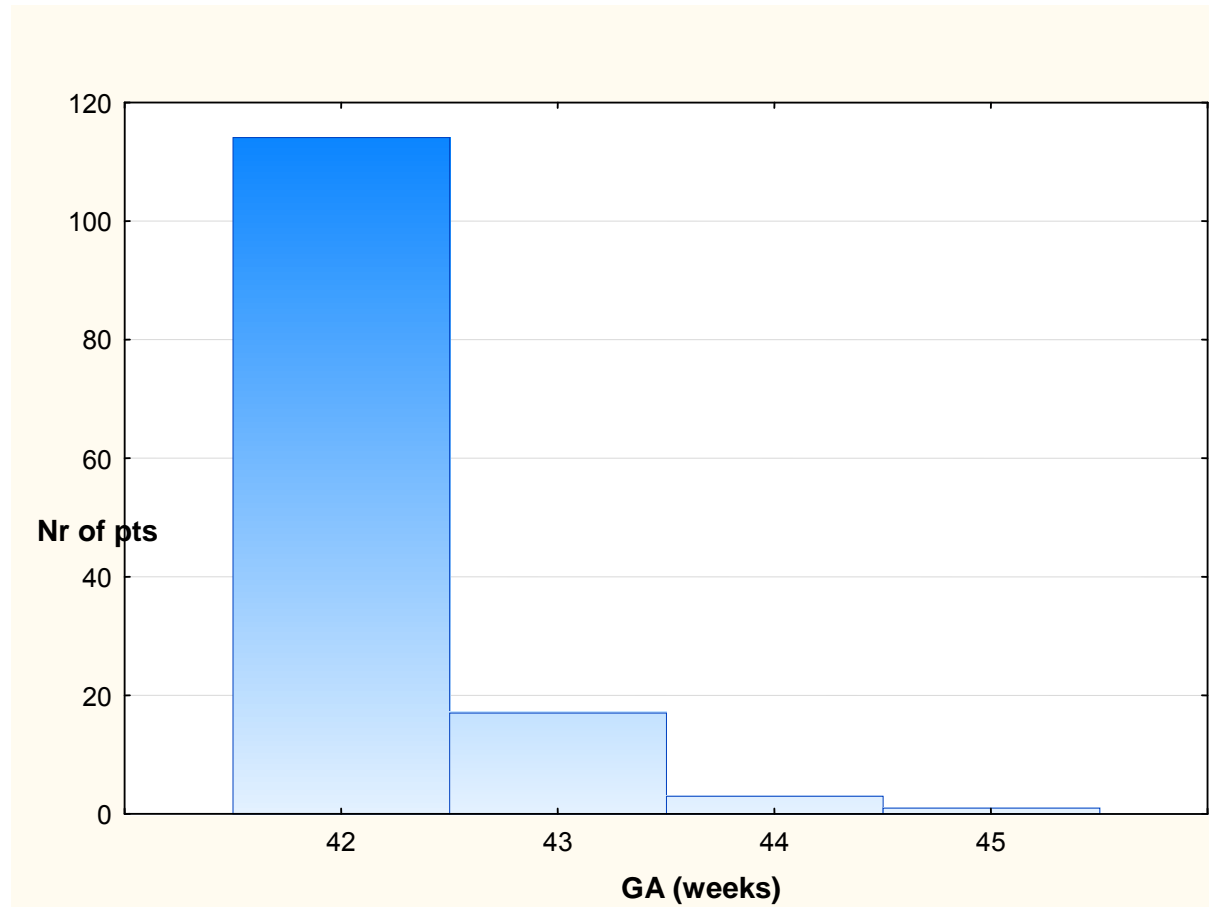
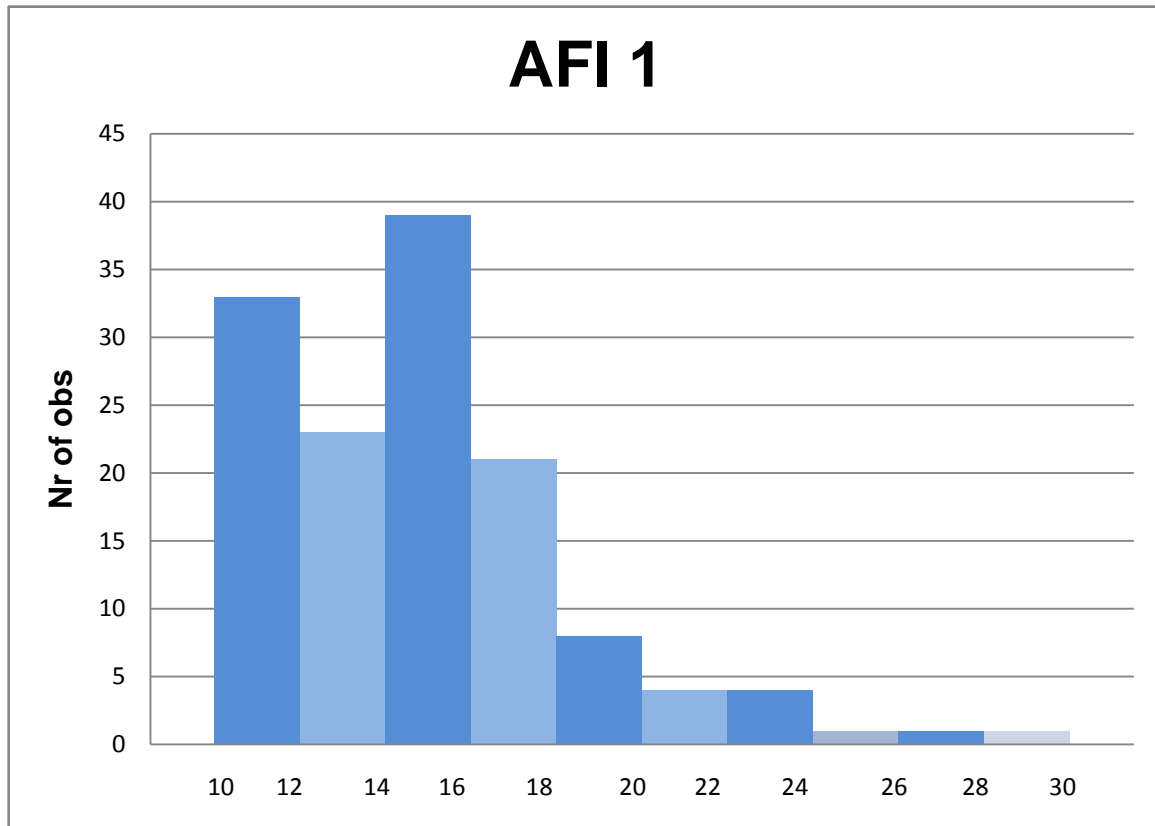


Figure 5: Gestational age at first visit to fetal evaluation clinic

The 36 women, who had a second AFI measurement, had no obvious trend in the values of the second AFI measurements. Some women had an increase, some a decrease and the remaining women the same AFI. Of those with a decrease in AFI, five out of 26 women had a significant drop from > 10cm to < 4cm in the second week. All of them were delivered by caesarean section for fetal distress. Three following IOL and two had spontaneous onset of labour before induction could be commenced.

During the course of pregnancy, six (4%) patients had gestational hypertension and another six (4%) developed preeclampsia. All of them had inductions at the time of diagnosis.

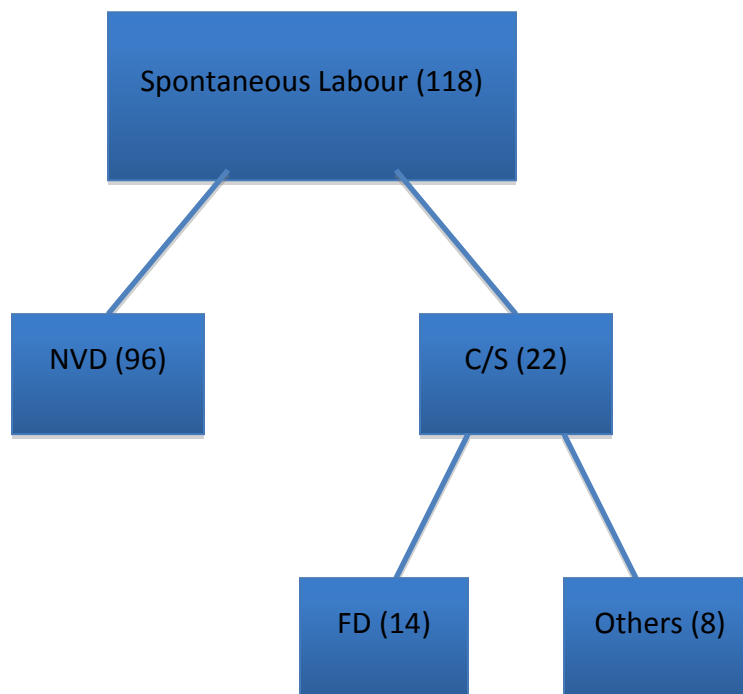
Figure 6: AFI measurements in centimeters at the first visit to the FEC



The patients delivered at different level of care facilities. The majority, namely 62 (46%) gave birth at midwife obstetric units (MOU) while 50 (37%) gave birth at district hospitals (Karl Bremer and Khayelitsha Hospitals) and the remaining 23 (17%) at the tertiary hospital (TBH).

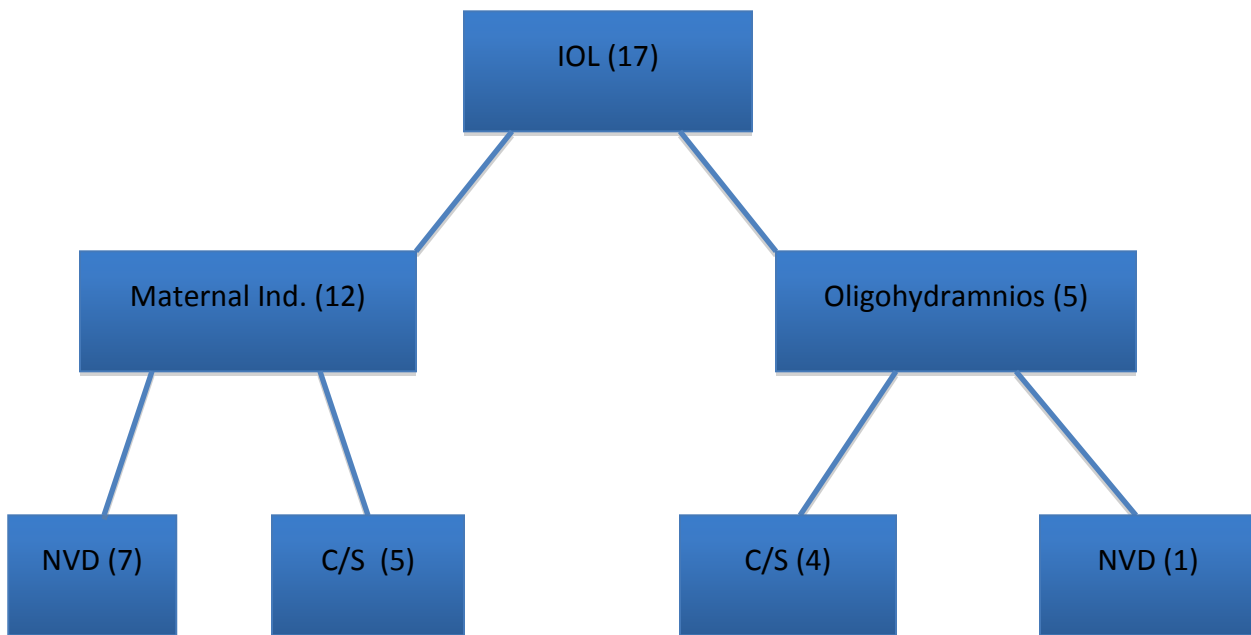
A total number of 118 (89.6%) women went into spontaneous labour, 22 (18.6%) of whom had caesarean sections. Of the 22 women, 14 patients had pathological CTG of which, seven within the first 14 days of first presentation to FEC. Two of the 14, had caesarean sections for fetal distress after 41 and 23 days of first entry respectively. Both of them missed their follow up after the 2nd AFI measurements, which were 10 cm and 10.2 cm respectively. Seven women had cephalopelvic disproportion (CPD) or poor progress during the course of labour resolved by caesarean sections (flowchart 1).

Flowchart 1: The out come for patients with spontaneous labour



Induction of labour was offered to 17 (9.6%) women of whom 12 had pregnancy related complications (as mentioned above) or had an AFI of less than five cm (five patients). Of the five that had IOL for diminished AFI, four patients had caesarean section deliveries for non-reactive CTG within two weeks of entry (flowchart 2).

Flowchart 2: the outcomes of patient with induction of labour

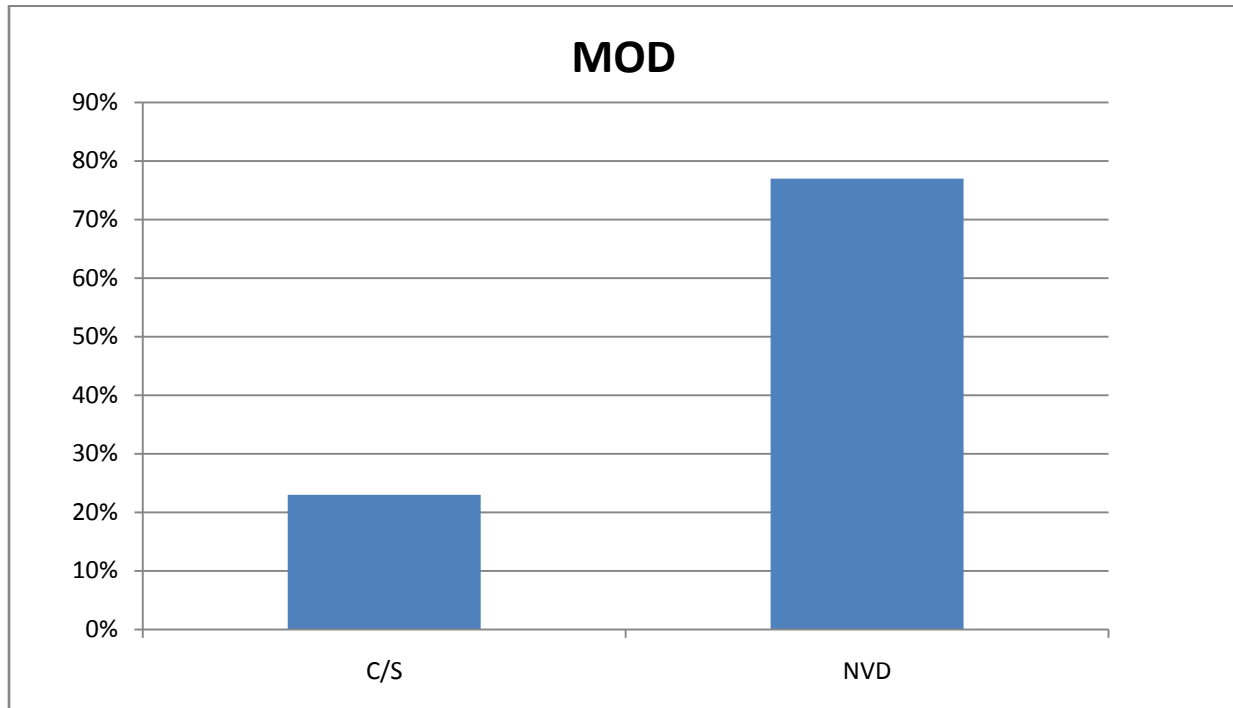


Of the 135 women included, 104 (77%) had normal vaginal deliveries, of whom eight following successful IOL. The remaining 31 (23%) were delivered by caesarean section (Figure 7). The indications were: one elective delivery for fetal macrosomia, 18 for fetal distress, five for failed IOL, four for CPD and three for poor progress.

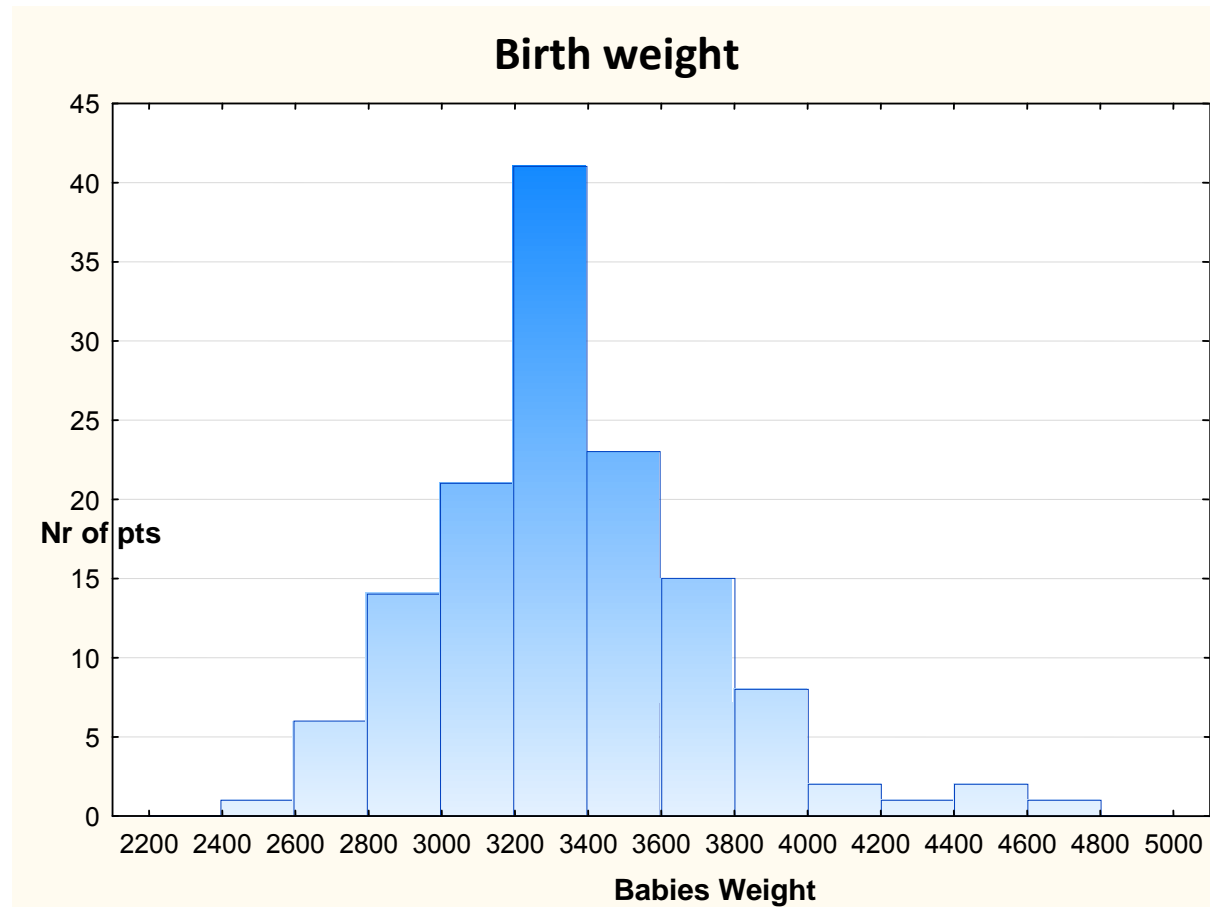
Time intervals between the first visit to the FEC and delivery vary between 0 and 46 days (median 10 days). The women delivered at first presentation to the FEC that had a

caesarean section for a non-reactive CTG was included in the study. Meconium was found in 11 patients, of whom eight had caesarean section for different indications. Fetal distress was reported in four of them.

Figure 7: The histogram showing mode of delivery (MOD)



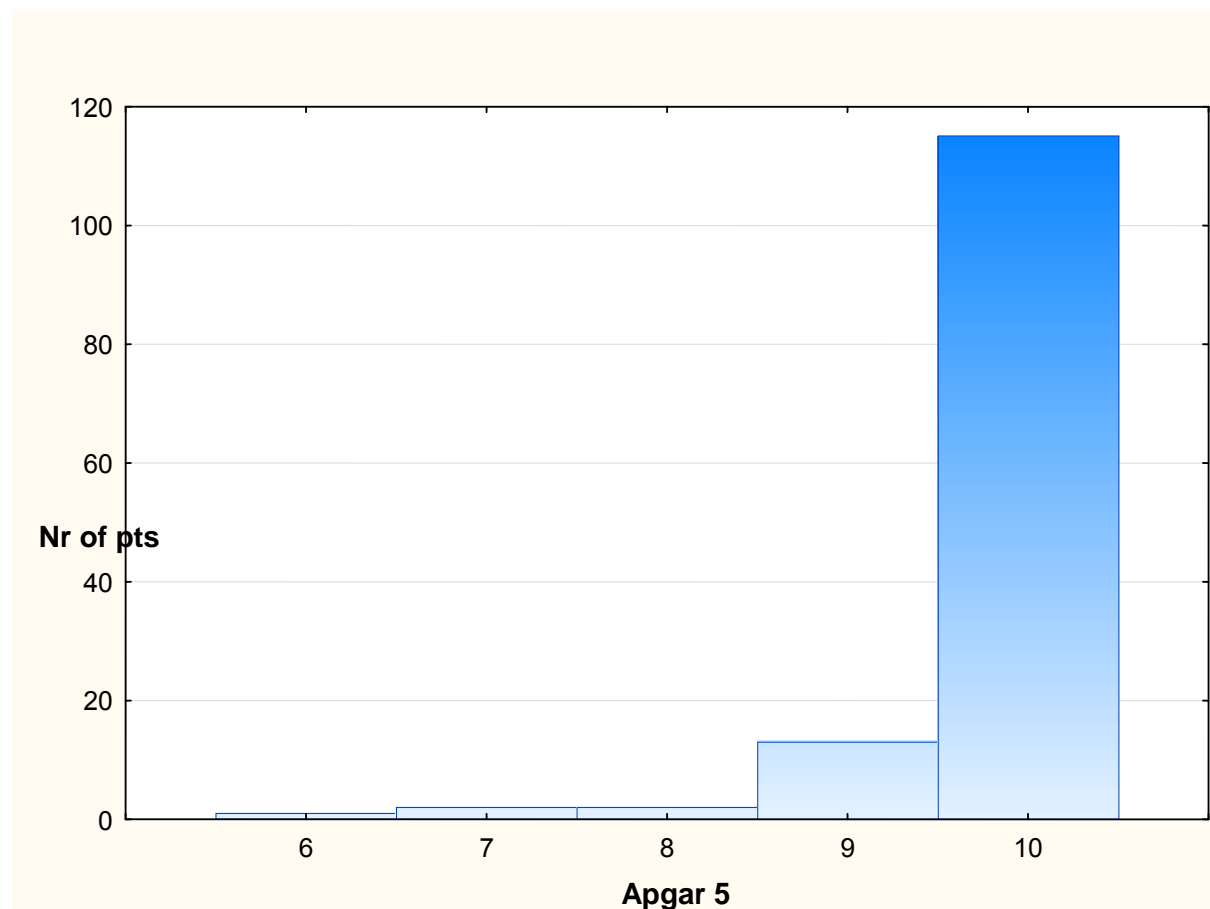
Within the first two weeks of presentation to FEC at TBH, 11 (8%) patients had caesarean sections for fetal distress. Four of the women had AFI measurements that reduced to less than five with CTGs indicating fetal distress following IOL. The remaining seven women went into spontaneous labour three to five days after the last AFI measurement of whom three had meconium in the liquor.

Figure 8: The histogram showing the birth weight distribution

Postpartum maternal complications were reported in 14 (10%) women with one maternal death. Postpartum haemorrhage occurred in four women who delivered normally, one required a massive blood transfusion for a retained placenta and other three had atonic uteruses that responded to uterotonics. One woman that had a caesarean section after failed IOL required a relook laparotomy for hemorrhagic shock, she had massive blood transfusion and uterine arteries were ligated to contain the bleeding. Postpartum eclampsia complicated one pregnancy within three hours from a normal uncomplicated delivery at a midwife obstetric unit. One woman had perineal

repair in theatre under spinal anaesthesia for third degree tear. Postpartum fever from different causes was observed in seven patients; two from septic wounds, one from pyelonephritis and four had pneumonia. One patient from the last mentioned four presented in septic shock four weeks postpartum, did not respond to resuscitation and demised. This patient was HIV positive with an unknown CD4 count, though she was on HAART according to her file.

Figure 9: The histogram of Apgar scores at 5 minutes



The mean birth weight of the babies was 3366g and the range from 2320 to 4730g (Figure 8). The biggest baby was delivered by caesarean section for CPD after 46 days following the first visit to the FEC. This mother had postpartum haemorrhage and a massive blood transfusion.

Mean Apgar scores for all babies at 1 minute were 9 and at 5 minutes were 10 (Figure 9). No neonatal intensive or high care admissions were noted or neonatal morbidity or mortality was reported. There were no differences on comparing the neonatal outcome of the first and second weeks following the first visit to the FEC.

Discussion

This study included patients considered post term by using their BFH. Due to the absence of early ultrasound scans identifying the real prolonged pregnancies reaching 42.0 weeks or beyond from the first day of LMP is indeed difficult. Most studies about post term pregnancy management and surveillance dealt only with certain GA pregnancies. The study is one of very few studies reporting on the management of patients reaching an uncertain gestation age of 42 weeks. The scientific based policy of IOL in or on completion of the 41st week does not apply to this group. A study conducted in Nigeria reported routine IOL for prolonged pregnancy (by sure LMP and early scan) is safe without a significant raise in fetal complications or caesarean section rate.³⁰ This result correlates with other studies that used certain gestation by early ultrasound scans.^{31,32} A limitation is the fact that menstrual cycle length varies significantly in

normal women.³³ In addition, 70% of women that used conception based on the body temperature technique, that completed 42 post menstrual weeks, were found to be at a less advanced gestation by using their ovulation dates.³⁴

In the study population using BFH, the majority of patients will have a gestational age of less than 41 weeks as BFH tend to over-estimate gestational age.³⁵ IOL at or prior to 41 completed weeks will result in more failed inductions and an increase in caesarean section rate. In addition IOL is labour intensive and should be avoided in an overburdened labour ward.

The current TBH protocol to manage this category of patients depends on results of weekly follow up with a modified BPP that start at uncertain 42 weeks. This protocol is based on a study done at the hospital.²⁹ A non-reactive CTG and/or AFI less than five cm are used as cut-off for delivery. Phelan also used an AFI ≤ 5 cm to define oligohydramnios which was associated with adverse neonatal outcome in a review of retrospective studies.^{10,19,36} A prospective study published in 1995 examined serial changes in AFI in a prolonged pregnancy population and reported a large variation. Neither a decrease nor increase in AFI is significant unless values declined to below 5 cm.³⁷

No information is available about the AFI at the time when pathological CTG occurred in this study. A review of more than 10,000 women with longitudinal AFIs done at a single institution, reported that AFI measurements at a confirmed gestational age of 41 weeks

and measuring more than eight cm were related to 0.5% chance to develop oligohydramnios within four days.³⁸ This finding has been confirmed in another study conducted three years later.³⁹

The rate of caesarean section rate in this study is 23% for different indications. This rate is almost equal to the caesarean section rate (20.1%) in Metro East during 2010. The caesarean section rate (35.6%) in TBH is higher compared to Metro East, as the tertiary hospital manages women with highly complicated pregnancies.⁴⁰

The association between variable decelerations on CTGs and reduced AFIs is well known.^{41,42} In post term pregnancy, both a combination of a reduced AFI and a bigger fetus contributes to vulnerability of umbilical cord to impingement or compression. The other common finding with reduced AFV is the presence of meconium, which is associated with more frequent variable decelerations.^{43,44} This finding is confirmed in the current study as meconium was found in the liquor of 8% of patients. In addition, of all patients that had caesarean sections, the indication was CTG patterns suggestive of fetal distress in 58% of cases.

In this study 13% of total sample had caesarean sections for pathological CTGs. Nonetheless, no neonatal morbidity or mortality has been reported. Sarkar concluded that a declining AFI correlates with obstetric and not with neonatal outcome.¹¹ He suggests that this is possibly related to critical levels of AFI (below 3rd centile). These

low levels of AFV are most likely the result of placental insufficiency. The two possible interventions when women are thought to be post term, delivery by caesarean section or IOL backed up by efficient fetal monitoring result in timely interventions preventing neonatal complications.

Concern arises, however, in patients with AFI in or within the lower level of the normal range; these patients are at an increased risk of developing oligohydramnios rapidly. The result of this study is that weekly surveillance must to be continued until AFI <5 cm. Weekly evaluation, nevertheless, may fail to detect prolonged pregnancies resulting in a rapid decrease of AFV⁴⁵ In fact, a border line AFI is considered as an early marker of decreasing placental function that may precede progressive fetal condition deterioration.¹¹

Conclusion

The TBH protocol to follow up post date pregnancy with uncertain gestation is safe and offers benefits in areas of resource constraints and cost containment. A low neonatal morbidity and mortality can be achieved if the management includes the following:

- Monitoring the maternal condition by means of a complete examination at each visit.
- Monitoring the fetal condition, using a modified biophysical profile (AFI + CTG).
- Early detection of complications.

In spite of that, further studies need to be conducted on post term women in the uncertain GA group, as a reasonable percentage of the South African pregnant population is missing both an early booking visit and ultrasound scan. The suggested study should be prospective including a large sample. Study patients need to be monitored twice weekly by a modified biophysical profile to refine the management of patients reaching 42 weeks with an uncertain gestational age. The search for new or possibly softer markers to identify the small but truly post term group within the bigger group need to continue.

References

1. ACOG Practice Bulletin #55: Management of Postterm Pregnancy. *Obstet Gynecol* 2004;104:639
2. WHO: recommended definitions, terminology and format for statistical tables related to the perinatal period and use of a new certificate for cause of perinatal deaths. Modifications recommended by FIGO as amended October 14, 1976. *Acta Obstet Gynecol Scand* 1977;56:247
3. Federation of Gynecology and Obstetrics (FIGO). Report of the FIGO subcommittee on Perinatal Epidemiology and Health Statistics following a workshop in Cairo, November 11-18, 1984. London: International Federation of Gynecology and Obstetrics 1986;54
4. Olesen AW, Westergaard JG, Olesen J. Perinatal and maternal complications related to postterm delivery: a national register based study, 1978-1993. *Am J Obstet Gynecol* 2003;189:222-7
5. Sanchez-Ramos L, Olivier f, Delke I, Kaunitz AM. Labor induction versus expectant management for postterm pregnancies: a systematic review with meta-analysis. *Obstet Gynecol* 2003;101:1312-8
6. Hollis B. Prolonged pregnancy. *Curr Opin Obstet Gynecol* 2002;14:203-7
7. Rand L, Robinson JN, Economy KE, Norwitz ER. Post-term induction of labor revisited. *Obstet Gynecol* 2000;96:779-83
8. Brace, RA, Ross, MG. Amniotic fluid volume regulation. In: *Fetus and Neonate - Volume 4: Body fluids and kidney function*, Brace, RA, Hanson, MA, Rodeck CH (Eds), Cambridge University Press 1998:88
9. Moore TR. Amniotic fluid dynamics reflect fetal and maternal health and disease. *Obstet Gynecol* 2010;116(3):759-65
10. Phelan JP, Platt LD, Yeh S, Broussard P, Paul RH. The role of ultrasound assessment of amniotic fluid volume in the management of the postdate pregnancy. *Am J Obstet Gynecol* 1985;151:304-8
11. Sarkar PK and Duthie SJ. The clinical significance of reduced amniotic fluid index in post term pregnancy a retrospective study. *J Obstet Gynecol* 1997;17(3):274-275
12. Vorherr, H. Placental insufficiency in relation to postterm pregnancy and fetal postmaturity. Evaluation of fetoplacental function; management of the postterm gravida. *Am J Obstet Gynecol* 1975;123:67
13. Shime, J, Librach, CL, Gare, DJ, Cook, CJ. The influence of prolonged pregnancy on infant development at one and two years of age: a prospective controlled study. *Am J Obstet Gynecol* 1986;154:341
14. Mannino, F. Neonatal complications of postterm gestation. *J Reprod Med* 1988;33:271

15. Low JA. The current status of maternal and fetal blood flow velocimetry. *Am J Obstet Gynecol* 1991;164:1049-57
16. Manning FA, Platt LD, Sipos L. Antepartum fetal evaluation: development of a new biophysical profile. *Am J Obstet Gynecol* 1980;136:787-95
17. Nageotte MP, Towers CV, Asrat T, Freeman RK. Perinatal outcome with the modified biophysical profile. *Am J Obstet Gynecol* 1994;170:1672
18. Miller DA, Rabello YA, Paul RH. The modified biophysical profile: antepartum testing in the 1990s. *Am J Obstet Gynecol* 1996;174:812
19. Phelan JP, Smith CV, Broussard P, Small M. Amniotic fluid volume assessment with the four quadrant technique at 36-42 weeks gestation. *J Reprod Med* 1987;32:540-2
20. American College of Obstetrician and Gynecologists. Ultrasonography in pregnancy. Washington: the College; 1993. Technical Bulletin No: 187
21. Rutherford SE, Phelan JP, Smith CV, Jacobs N. The four quadrant assessment of amniotic fluid volume: an adjunct to antepartum fetal heart rate testing. *Obstet Gynecol* 1987;70:353-6
22. Sarno AP, Ahn MO, Brar HS, Phelan JP, Platt LD. Intrapartum Doppler velocimetry, amniotic fluid volume, and fetal heart rate as predictors of subsequent fetal distress: an initial report. *Am J Obstet Gynecol* 1989;161:1508-4
23. Alexander JM, McIntire DD, Leveno KJ. Forty weeks and beyond: Pregnancy outcomes by week of gestation. *Obstet Gynecol* 2000;96:291
24. Menticoglou SM, Hall PF. Routine induction of labour at 41 weeks gestation: nonsensus consensus. *Br J Obstet Gynaecol* 2002;109:485
25. A clinical trial of induction of labor versus expectant management in postterm pregnancy. The National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *Am J Obstet Gynecol* 1994;170:716
26. Gulmezoglu AM, Crowther CA, Middleton P. Induction of labour for improving birth outcomes for women at or beyond term. *Cochrane Database Syst Rev* 2006:CD004945
27. Caughey, AB, Sundaram, V, Kaimal, AJ, et al. Systematic review: elective induction of labor versus expectant management of pregnancy. *Ann Intern Med* 2009;151:252
28. Mongelli M, Wilcox M, Gardosi J. Estimating the date of confinement: ultrasonographic biometry versus certain menstrual date. *Am J Obstet Gynecol* 1996;174:278-81
29. Brand E, Norman K, Rossouw M, Theron AM. Fetal evaluation and neonatal outcome in post dates pregnancy at Tygerberg Hospital. Proceeding of the twelfth Conference on Priorities in Perinatal Care in Southern Africa, Mont-aux-Sources, Drakensberg; March 9-12:1993

30. Otoide V O, Okonofua F E. Outcome of prolonged pregnancy revisited in a Nigerian tertiary centre. *J Obstet Gynecol* 2001;21(3):261-265
31. Hannah M E, Hannah W J, Hellmann J, Hewson S, Milner R. and William A. Induction of labour as compared with serial antenatal monitoring in post term pregnancy. *New Eng J Med* 1992;326:1587-1592
32. Crowley P. Elective induction of labour at 41 weeks gestation. In: *Oxford Database of Perinatal Trial*, Chalmers I (editor). Oxford , Unity Press. 1991
33. Munster K, Schmidt L, and Holm P. Length and variation in the menstrual cycle - a cross sectional study from a Danish country. *Br J Obstet Gynecol* 1992;99:422-429
34. Boyce A, Magaux M J and Schwartz D. Classical and true gestational post maturity. *Am J Obstet Gynecol* 1996;125:911-917
35. Geerts L, Poggenpoel E, Theron GB. A comparison of pregnancy dating methods commonly used in South Africa:a prospective study. *S Afr Med J* 2013;103:552-556.
36. Phelan JP, Ahn MO, Smith CV, Rutherford SE, Anderson E. Amniotic fluid index measurements during pregnancy. *J Reported Med* 1987;32:601-4
37. Divon MY, Marks AD, Henderson CE. Longitudinal measurement of amniotic fluid index in postterm pregnancies and its association with fetal outcome. *Am J Obstet Gynecol* 1995;172:142-6
38. Lagrew DC, Pircon DA, Nageotte M, Freeman RK, Dorchester W. How frequently should the amniotic fluid index be repeated? *Am J Obstet Gynecol* 1992;167:1129-33
39. Wing DA, Fishman A, Gonzalez C and Paul RH. How frequently should the amniotic fluid index be performed during the course of antepartum testing? *Am J Obstet Gynecol* 1996;174:33-6
40. Gebhardt GS. Western Cape Government, Department of Health. Provincial delivery data [Personal interview], 10 September; Cape Town; 2012 (Unpublished).
41. Gabbe SG, Ettinger BB, Freeman RK, Martin CB. Umbilical cord compression associated with amniotomy. Laboratory observation. *Am J Obstet Gynecol*.1976;26:353-5
42. Miyazaki FS, Taylor NA. Saline amnio-infusion for relief of variable or prolonged decelerations. A preliminary report. *Am J Obstet Gynecol* 1983;146:670-8
43. Phelan JP, Platt LD, Yeh SY, Trujillo M, Paul RH. Continuing role of the nonstress test in the management of postdates pregnancy. *Obstet Gynecol* 1984;64:624-8.
44. Sarno AP, Ahn MO, Phelan JP. Intrapartum amniotic fluid volume at term: association of ruptured membranes, oligohydramnios and increased fetal risk. *J Reported Med* 1990;35:719-23

45. Clement D, Schifrin BS, Kates RB. Acute oligohydramnios in postdates pregnancy. *Am J Obstet Gynecol* 1987;157:884-6

Appendix A

Data capture sheet

Study number

Residential area

- Age gravidity parity miscarriages ectopic TOP
- Previous C/S
- Previous pregnancy complications

Present gestational history

- Syphilis serology
- Rh group
- HIV status CD4 count medication
- MSU urine culture
- Pregnancy complication
- Medical complication
- Gestational age at booking
- Method used to determine GA
- Date of first FEC visit
- FEC visits

	First visit	Second visit	Third visit	Fourth visit
AFI				
ECG				

- Date of delivery
- Method of delivery

Spontaneous

IOL

C/S

- Reason of C/S

Fetal distress

failed IOL

Others

- Post partum complication

- Neonatal outcome

Birth weight

Apgar scores

1 min

5 min

Meconium in liquor

Meconium aspiration

Neonatal ICU admission

Duration of stay

Reasons

Neonatal high care admission

Duration of stay

Reasons

Duration of stay at hospital

Neonatal mortality