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MATERNAL AND FETAL OUTCOMES IN WOMEN WITH PROLONGED 'LATENT PHASE OF LABOUR' AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL.

B Rubushe,[1] MB BCh; Y Adam,[1] B Sc, MBBCh, FCOG (SA)

[1]Department of Obstetrics and Gynaecology, Chris Hani Baragwanath Academic Hospital, University of Witwatersrand, Johannesburg, South Africa.

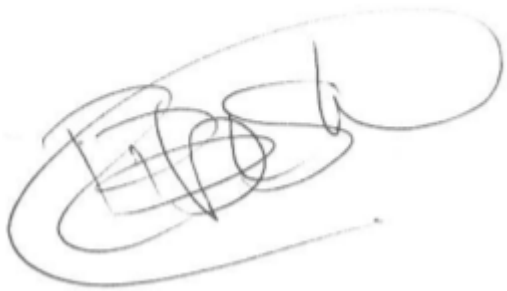


A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment for the degree of Masters in Medicine (Obstetrics & Gynaecology)

Johannesburg 2023

DECLARATION

I, Bongi Rubushe (student nr 0503639G) declare that this research report consists of my own work. It is being submitted for the Degree of Masters of Medicine in Obstetrics and Gynaecology at the University of Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other University.



On this day 15 day of March 2023 in Johannesburg.

Dedication

I would like to dedicate this research report to my mother Lumka Nobuntu Rubushe who showed me in life I can achieve anything. She encouraged me to challenge myself in everything I do. She led by example. I would also like to dedicate it to my husband and children, without them I would never have finished and achieved my goals.

ACKNOWLEDGEMENTS

I would like to thank my amazing supervisor Prof Yasmin Adam for her guidance and her assistance with my raw data. Her amazing work ethic, her persistent encouragement and patience I will forever be grateful for.

My husband, Bonginkosi Ngwenya for his unwavering support and patience.

ABSTRACT

Background

The recommended management of pronged latent phase of labour in South Africa is augmentation or delivery by caesarean section. A retrospective cohort study conducted at Chris Hani Baragwanath Academic Hospital in 2002 showed that prolonged latent phase of labour compared to normal labour was associated with an increase in caesarean sections (29% vs. 6%), and poor neonatal outcome compared to women without a prolonged latent labour. However they were unable to state whether the poor outcome was due to a prolonged latent labour. Recently larger studies have shown that the latent phase of labour may be a long as 24 hours with good maternal and neonatal outcomes.

Objectives:

The main objective of this study was to describe the maternal and neonatal outcomes as well as the labour performance in women with prolonged latent phase of labour at CHBAH.

Methods

The study was a descriptive, retrospective cohort study of pregnant women conducted at CHBAH from June 2016 – May 2017. These were women who were referred to CHBAH with prolonged latent phase of labour. They were term, must have had at least 2 per vaginal exams, <6 cm dilated at admission with a neonatal weight of more than 2000g, a normal foetus and an unscarred uterus.

Results

There were 89 women that were included in the study. The median time to reach full dilatation was 14.4 hours (IQR 9.5 – 23.9). The median time between one cm of dilatation to the next was more than 1 hour. A total of 60 (68.2%) women had a normal vaginal delivery and 28 (31.8%) were delivered by caesarean section, with 75.8% being for foetal distress. Two women had pyrexia and 12 had a tachycardia in the postpartum period. One woman sustained a 4th degree perineal tear and had a PPH requiring admission to ICU. There were no neonates born with an APGAR less than 7 at 5min. Neonatal resuscitation was performed in 6.7% of the neonates and 7.9% of the total neonates were admitted. There were no neonatal deaths.

Conclusion

This study should be considered as a pilot in the study of labour patterns. The caesarean section rate is lower than what is expected at this institution and no neonates were born with an APGAR of less than 7 at 5 minutes. This may be because of better fetal monitoring with better resources in 2016. However, women who have prolonged latent phase of labour should be monitored adequately.

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ABBREVIATIONS

APL	Active phase of labour
BMI	Body Mass Index
CS	Caesarean Section
CHBAH	Chris Hani Baragwanath Academic Hospital
CPD	Cephalopelvic disproportion
CTG	Cardiotocograph
FD	Foetal distress
GA	Gestational age
HAB	Head above brim
HCA	High Care Area
HCW	Health Care Worker
HIV	Human Immunodeficiency Virus
IQR	Inter-quartal range
LPL	Latent phase of labour
MSL	Meconium-stained liquor
MOU	Midwife obstetric unit
MUAC	Mean upper arm circumference
NICU	Neonatal Intensive Care Unit
RDS	Respiratory distress syndrome
SA	South Africa
SD	Standard deviation
TICU	Trauma Intensive Care Unit
VL	Viral load
WHO	World Health Organisation

Introduction

Labour is a physiological process where the foetus, placenta and membranes are delivered. Labour patterns were first described by Friedman in the 1950's and 1960's. He found that labour progression followed a sigmoid curve (1-3). Philpott and Castle designed the partogram in 1971 after work on primigravid women in labour (4). This then became the standard for recording labour. This partogram was modified by the World Health Organisation (WHO). They introduced the alert and action lines (5). The alert line starts when the cervix is 4cm dilated. This is the dilation at which labour is defined as 'active labour'. A study conducted in 2002 evaluating labour in 1329 nulliparous women showed that the active phase of labour was longer than previously suggested (6).

When comparing labour patterns from a couple of years ago and now, it is postulated that labour patterns may be different because women are older and mothers and babies are heavier (4). The management of labour has also changed, as induction of labour, augmentation, and epidurals for analgesia were introduced as part of standard of care (7). The rising caesarean section (CS) rate has been attributed to a poor understanding of labour patterns (7).

In South Africa (SA), latent phase of labour is diagnosed when there are regular painful contractions and the cervix is less than 4 cm dilated (8). When the latent phase of labour is more than 8 hours in duration it is deemed to be prolonged and an intervention is indicated (8). There is a call to better understand labour and therefore reduce caesarean section rate.

The transition from latent labour to active labour (inflection point) is described as being between 3cm and 6cm cervical dilatation by different authorities (9,10). The WHO partogram defines the inflection point as 3cm dilatation (9). The American College of Obstetrics and Gynaecology has stated that active phase of labour may only begin when the cervix is between 5-6 cm. (10).

Prolonged latent phase of labour may be associated with poor maternal and neonatal outcomes (11). A case control study conducted at Chris Hani Baragwanath Academic Hospital (CHBAH) published in 2002 showed that prolonged latent phase of labour compared to normal labour was associated with an increase in caesarean sections (29% vs. 6%), most of these were for "poor progress" with or without foetal distress (11). There was also an increase in postpartum pyrexia. The APGAR score was less than 7 in 7% of women, and 22% of babies were admitted for neonatal care (11). Asphyxia was the reason for admission in 58% of cases (11). In this study they noted that it was difficult to determine if the complications seen in neonatal outcomes were from the prolonged latent phase itself or the intervention used to expedite labour (11).

Labour management has not changed over the last 2-3decades in SA, but the resources and patient profile may have changed. The definition of prolonged labour is in a flux worldwide. It is therefore important to determine the outcomes in women with prolonged latent phase of labour as well as determining the labour patterns in woman with what was considered a prolonged latent phase of labour. This study was conducted between May 2016 and June 2017 and assessed the maternal and neonatal outcomes as well as the labour performance in women with prolonged latent phase of labour.

Methods

Study Design and Study population: This was a retrospective cohort study of pregnant women at term who presented to CHBAH with prolonged latent phase of labour. Inclusion criteria included having a term pregnancy with a vertex presentation. In addition the woman should have had at least two vaginal examinations, be < 6cm dilatation at admission to CHBAH, and to have delivered a neonate with a birth weight > 2000 g. Women with a scarred uterus, multiple pregnancy or an abnormal foetus were excluded.

Data management: Data was extracted from medical files**.** The information pertaining to the antenatal period was age, parity, gravidity, previous obstetric history, Body Mass Index (BMI), and blood tests at booking. Delivery information that was extracted included gestational age (GA) at delivery, mode of delivery, and any interventions that were performed. In addition the findings at each vaginal examination (time of examination and cervical dilatation) were recorded. Information on the neonate included birth weight, APGAR scores and if the baby was admitted and for what reason.

Data was entered into REDcap (version REDcap 9.4.0 - © 2019 Vanderbilt University) and transferred to STATA version 14.2 (StataCorp, 4905 Lakeway Drive, College Station, Texas, USA) for analysis.

Frequencies and percentages were used to describe categorical variables. Means and standard deviations or medians and inter-quartile range (IQR) were used to describe continuous variables based on the distribution of the variable under review. In addition to reporting the median and IQR, the 95th percentile were reported for duration of labour for each centimetre of dilatation. Time between subsequent examinations were calculated and accumulated and reported as median (IQR and 95th percentile) for up to 10 periods. The cumulative median time from dilatation 1 to time of delivery, with IQR and 95th percentile was also reported. Dilatation 1 is the cervical findings at the time of first examination. Dilatation 1 was the cervical findings at the time of examination at the referral clinic. A box plot of this cumulative time is also reported.

Ethical approval was obtained from the University of Witwatersrand Human Research Ethics Committee (HREC) with number M180248. Permission to perform the study was obtained from the chief executive officer (CEO) of CHBAH.

Results

There were 300 women with a diagnosis of low abdominal pain, latent phase of labour or early labour, identified in the obstetric admissions register, however only 89 women were included in this study (refer to figure 1).

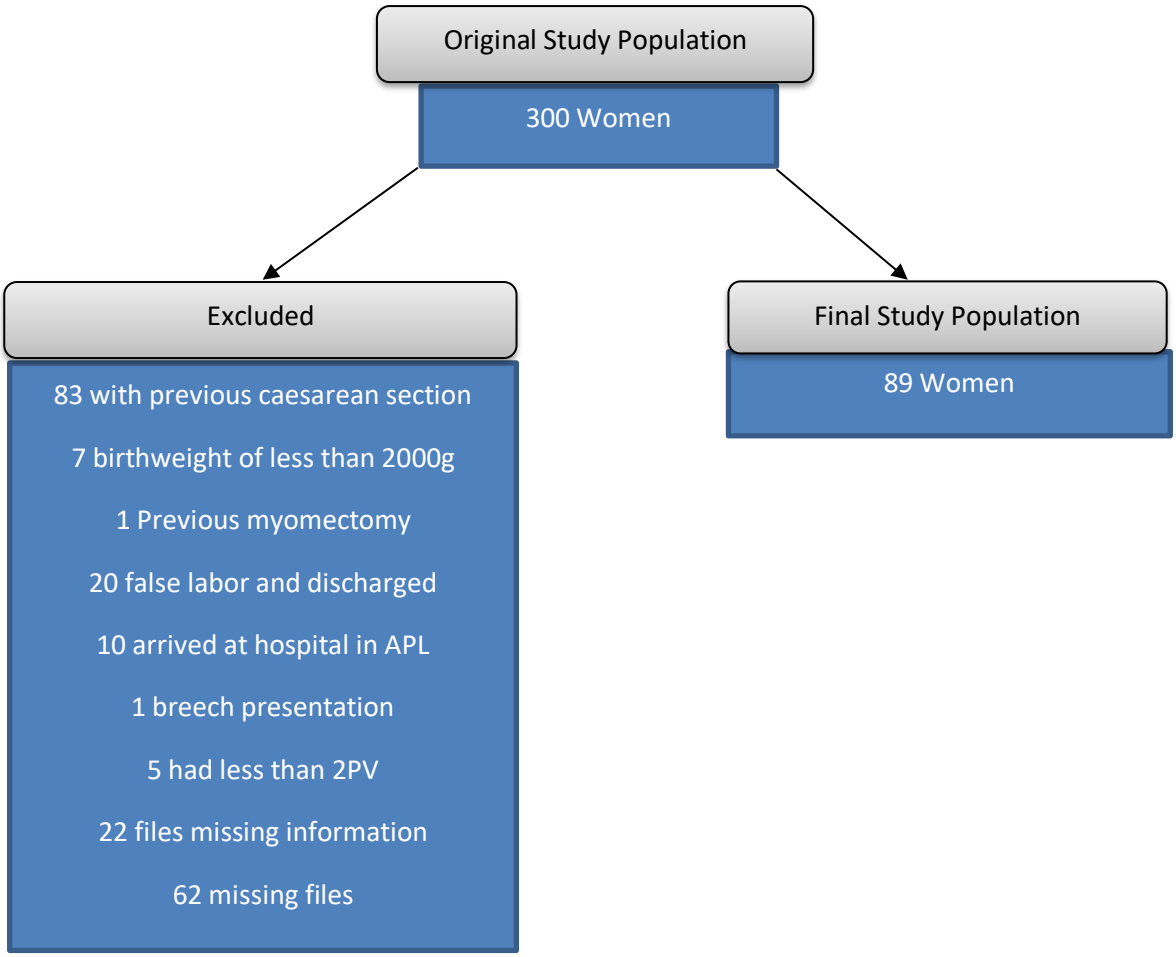

Figure 1: Study population highlighting excluded participants (n=89)

The demographic information of the women is shown in table 1.

Table 1: A description of the demographic characteristics (n=89)

Variable	**Description**
Age (years)	Mean: 25.7 years (SD 6.51 years; range 15-41)
Parity	Median: 0 (IQR 0-2; range 0-4))
Gravidity	Median: 1 (IQR 1 – 3; range 1 – 5)
Smoking	n= 24 (26.9%)
Alcohol use No alcohol Unknown	n= 6 (6.7%) n= 25 (28.4%) n= 57 (64.0%)
Haemoglobin (g/dl)	Mean: 11.5 (SD 1.7; range 5.1-16.8)
RPR positive	n= 4 (4.49%)
Rhesus status	Positive: n=85 (95.5%) Negative: n=3 (3.3%) Unknown: n= 1 (1.1%)
Height (cm)	Median: 155 cm (IQR 150cm – 163cm; range 141 cm-171 cm)
Weight (kg)	Median: 64.1 kg (IQR 54,7 – 79.3; range 39.4 kg-130 kg)
MUAC (cm)	Median: 27.6 (IQR 25 - 30; range 20 – 40)
BMI (kg/m2)	Median: 26.3 (IQR 22.2 – 32.9; range 17.9-49.4)

There were 28 (31.5%) women who tested positive for HIV. The median CD4 count was 315 (n=18; IQR 231 – 482; range 83-615) the median VL was 42 (n=7; IQR 20 – 487; range 20 - 217 000).

The past obstetrics history of the women in terms of outcomes of pregnancy showed that, there were 3 (3.3%) women who had had a premature delivery, 4 (4.4%) who had undergone a termination of pregnancy and 3 (3.3%) who had had a miscarriage. The following co-morbidities were present during the current pregnancy; Pre-eclampsia 9 (10.1%), Asthma 2 (2.2%), and Anaemia 2 (2.2%).

The median GA was 38.9 (IQR 37.5 - 40.0; range 34.4 - 44.7). The GA was calculated as follows: 37 (41.6%) by ultrasound, 23 (25.8%) by last normal menstrual period, 24 (26.9%) of the women by fundal height, and in 5 (5.6%) women the method was not recorded.

There were 21 (23.5%) women who had meconium-stained liquor (MSL), 67 (75.2%) had clear liquor and in 1(1.1%) the condition of the liquor was not reported. Of the patients that had meconium, 15 (71.4%) had grade 1, 4 (19.0%) had grade 2 and 1(0.4%) had grade 3. In 2 (2.2%) women the liquor was reported to be foul smelling.

Oxytocin was administered to 56 (62.9%) women. The median time they received oxytocin was for 4.5 hours (IQR 3 – 6.3 hours; range 1.15-11).

Sixty-four 64 (71.9%) women received analgesia. Of these 57 (64.0%) received pethidine, 7 (7.8%) had an epidural and in 26 (29.2%) there was no record of analgesia given.

The median number of vaginal examinations was 6 (IQR 5 - 8; range 2 - 14).

A total of 60 (68.2%) women had a normal vaginal delivery and 29 (32.5%) were delivered by CS.

The indication for CS was foetal distress in 22 (75.8%) and in 11 (37.9%) it was labour dystocia. Some women were noted to have more than 1 indication.

Of the women who had a NVD, 20 (33.3%) had an episiotomy, 15 (25.0%) had first-degree and/or second-degree tears, 1 (1.7%) had a third-degree tear and 1 (1.7%) had a fourth-degree tear.

Two of the women developed pyrexia post-partum, 12 had a tachycardia. There was one woman with an obstetrics near miss, she had a 4th degree tear, PPH and had to be admitted to HCA and ICU. The median number of days the women spent in hospital was 2 days (IQR 2 - 3.5; range 1 – 5 days).

The median birth weight was 3120 g (IQR 2735 - 3390; range 2450 – 4079 g). The median APGAR scores at 1 min were 9 (IQR 8 – 9; range 5 - 10). The median APGAR score at 5 min was 10 (IQR 10 - 10; range: 8 - 10)

In terms of neonatal outcome, 6(6.7%) were resuscitated at birth, 12 (13.5%) received supplementary oxygen, 7 (7.9%) needed to be admitted, however there were no early neonatal deaths. This is summarised in table 2.

Table 2: A description of the maternal, labour, and neonatal information in those neonates who required resuscitation and/or admission.

	Maternal Co-morbidities	**liquor**	**CTG * findings**	**Duration of labour*** **	**APGAR at 1 min/ 5 min**	**Reason for admission**	**Neonatal Resuscitation**
1	None	Clear liquor	Pathological	10hrs 30 min	6/8	RDS	Yes
2	Pre-eclampsia	MSL 1	Pathological	CS	5/10	Mild RDS	Yes
3	Pre-eclampsia	Clear liquor	Reactive	8hrs 40 min	6/8	Never admitted	Yes
4	No	MSL 2	Reactive	35hrs	6/9	Never admitted	Yes
5	Gestational hypertension	MSL 2	Reactive	13hrs 45min	6/8	Admitted – no diagnosis stated	Yes
6	HIV	MSL 2	Pathological	CS	5/9	Never admitted	Yes
7	No	MSL 1	Pathological	22hrs 49min	7/?**	RDS	No
8	No	MSL 1	Pathological	22hrs 27min	9/10	RDS	No
9	Gestational hypertensive	MSL 1	Pathological	20hrs 20 min	9/10	Severe vomiting	No
10	Pre-eclampsia	MSL	Reactive	CS	6/?**	Sepsis	No

**Used NICE guidelines to interpret the CTG.*
***? No record in the file*
Duration of labour (1st examination to delivery)

The median time of dilatation from cm to cm is illustrated in table 4. The longest time to achieve a one-centimetre dilatation were observed between dilatations 1 to 3 cm each.

Table 3: A description of duration in hours with each centimetre gain in cervical dilatation.

Dilatation (cm)	25th percentile	Median time between dilation	75th percentile	95th percentile
0-1cm	4.0	4.5	8.0	25.0
1-2cm	2.1	3.9	5.9	15.8
2-3cm	2.6	4.0	4.4	7.5
3-4cm	1.5	2.8	4.6	11.6
4-5cm	2.0	2.6	5.3	9.5
5-6cm	0.9	2.0	4.0	6.6
6-7cm	0.6	2.0	3.7	4.5
7-8cm	1.1	2.0	2.9	10.5
8-9cm	1.5	1.9	2.3	2.9
9-10cm	0.9	1.6	2.8	13.0

The duration of labour is shown in table 4 for the women who achieved a vaginal delivery. The median time from admission to 4 cm dilatation was 7.9 hours (IQR 2.9 - 12.0), the median time to reach 6cm dilatation was 12.8 hours (IQR 8.2 - 26.7) and the median time for women to reach 10cm dilatation was 14.4 hours (IQR 9.5 - 23.9). The reason that the median does not increase with every dilatation is because of a smaller number of women who would achieve a particular dilatation as some would have had a CS.

Table 4: Duration of labour for women who had an NVD

	All women who had a NVD			**Nulliparous women who had a NVD**			**Parous women who had a NVD**		
Dilatation (cm)	**25th percentile**	**Median**	**75th percentile**	**25th percentile**	**Median**	**75th percentile**	**25th percentile**	**Median**	**75th percentile**
closed cervix	0.0	0.5	4.0	0.0	2.0	4.0	0.5	0.5	0.5
1	0.0	0.6	12.2	0.0	5.6	12.2	0.0	0.0	11.4
2	0.0	3.5	11.0	0.0	4.1	13.4	0.0	2.0	9.2
3	1.4	6.1	14.0	1.3	6.9	15.6	1.6	4.6	11.3
4	2.9	7.9	12.0	6.9	11.1	13.1	1.4	4.5	6.9
5	4.3	12.1	19.0	10.1	18.6	21.0	3.8	7.3	12.4
6	8.1	12.8	26.7	11.6	13.8	32.0	7.9	9.0	17.0
7	6.2	15.4	26.9	4.5	15.6	28.9	6.5	14.6	17.9
8	5.5	14.5	29.5	4.8	12.8	35.0	5.9	14.5	20.5
9	7.7	15.6	36.0	6.5	15.4	36.0	13.9	21.9	24.2
10	9.5	14.4	23.9	12.2	21.6	44.1	9.5	11.1	20.5

Figure 2: depicts the progression of labour from first examination to delivery for all the women that delivered by NVD.

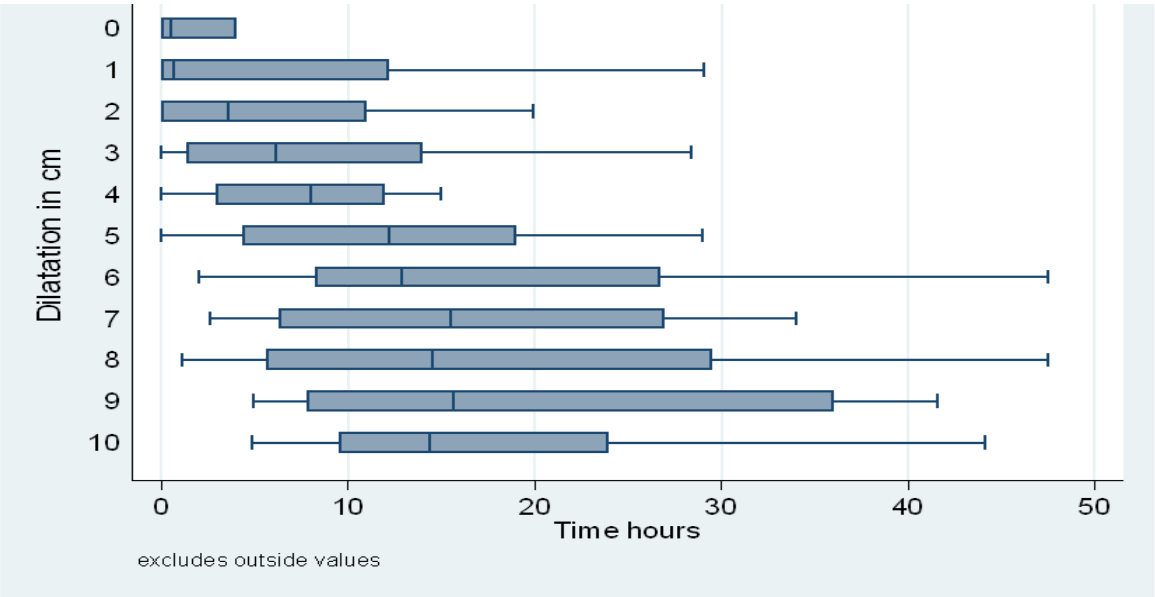

Figure 2: Box- plot showing duration of labour in normal vaginal deliveries (n=60).

Figure 3 is a description of progression of labour from admission to delivery for nulliparous women versus multiparous women.

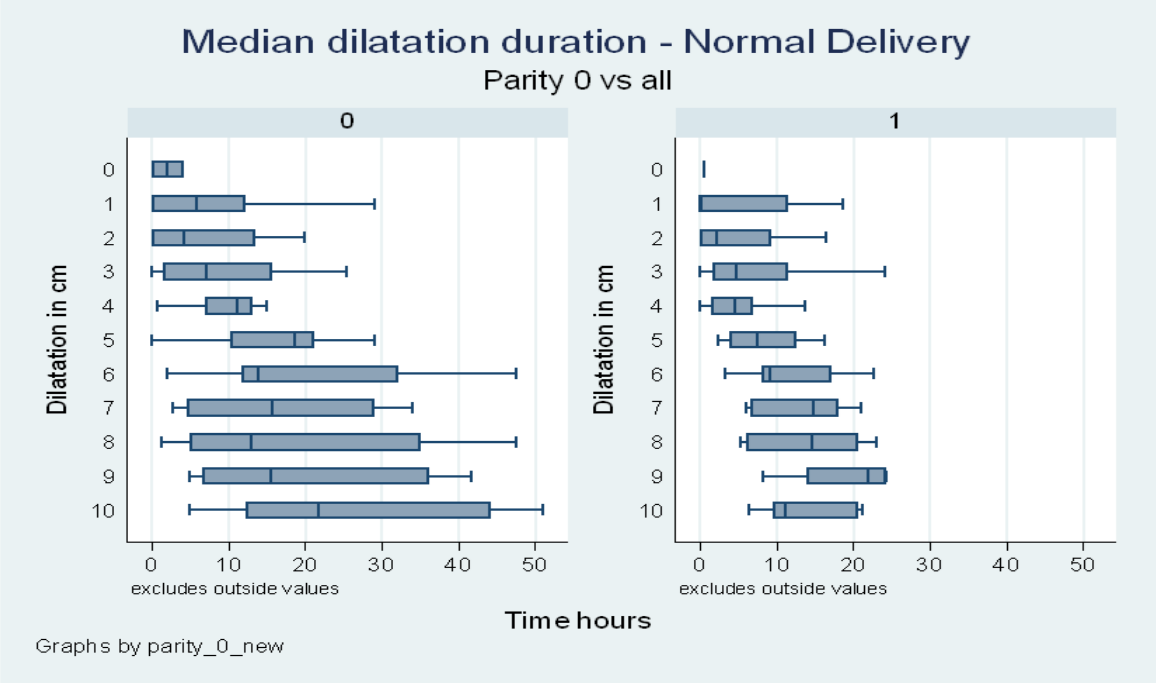

Figure 3: Median duration of labour in normal vaginal deliveries (n=60)- Nulliparous women (0) and Parous women (1)

Discussion

The caesarean section (CS) rate was low at 31.8% compared the rate at this institution of 40% in 2016 and 45% in 2017 (Depart Stats). In the study conducted at CHBAH in 2002 the CS rate was recorded at 29% (11). The CS rate in 2002 at this institution was 25.5% (Depart Stats). Recent studies, including this study, revealed that labour dystocia is the second most common indication for a CS (12, 13, 14, 15). The most common indication for CS was foetal distress. The study conducted at CHBAH in 2002, poor progress was the most common indication at 65% and FD was 23% (12).

More recent studies in the same setting show that the indication for CS was foetal distress in 58 – 88% and show that indication for labour dystocia was 26 -36% (14, 15). This could have attributed to the fact that monitoring of foetus with CTG machines improved, allowing health care workers to better diagnose more women with FD.

The term "failure of labour to progress" has become the leading indication for augmentation of labour and subsequent primary CS (16). The term is poorly defined but is widely used and accepted because of the need to expedite birth on the grounds of slow labour, resulting in rapid escalation in global rates of labour augmentation and increases in the number of CS within the last 20 years (16). The use of augmentation of labour with oxytocin was high in this study. This may be because of the protocol for the management of women with prolonged labour. In a study done in 2018, latent phase of labour of 18 hours or more was more likely to receive obstetrics intervention with augmentation of labour (17).

Prolonged latent phase of labour was associated with an increased number of women requiring analgesia such as morphine and epidural. This was illustrated in a few studies (17). The low rate of epidurals may be because we have limited epidural services. A total of 441 epidurals were administered in the same unit in 2016, and 501 epidurals in 2017 (Dept Stats). The epidural services provided in high-income countries such as Sweden is 20% (17).

In this study we did not report on the incidence or prevalence of prolonged latent phase of labour because of the exclusion criteria. The reported prevalence of prolonged latent phase of labour ranges from 5% to 6.5% (17-21). These studies used different definitions for prolonged latent phase of labour as defined by their institutions (17-20).

There were no babies that had an APGAR score of less than 7 at 5 min in this study. In the study done at CHBAH in 2002, 17% of babies had an APGAR score of less than 7 at 5min (11). Their study also highlighted the fact that 22% of the babies were admitted to NICU with 56% of the admission being due to birth asphyxia (11). In our study, 7.9% of the babies were admitted to NICU. This could have been attributed to the fact that there was better monitoring by Health care worker (HCW) and so we may have been able to intervene earlier in distressed foetuses and have better neonatal outcomes.

Prolonged labour is associated with an increase in poor maternal outcomes. However, in this study there was one severe adverse event with one woman who sustained a 4th degree tear, PPH and had a massive blood transfusion. In a study conducted in 1993 that looked at maternal and neonatal outcomes in prolonged latent phase of labour, the percentage of severe perineal tears was 10.5% compared to our study of 2.2% (20).

This is the first study in SA to study labour progress in women with a prolonged latent phase of labour. The median time to reach full dilation in the women who delivered vaginally was 14.4 hours. It was also found that labour was faster in multiparous women (median time to full dilatation was 11.1 hours) compared to primigravida (median time to full dilatation was 21.7 hours). This difference in labour performance has long been recognised (22).

The duration of time to progress from 1cm to the next was longer than 1cm/hour. This is longer than the expectation suggested by the WHO partogram (16). In the CHBAH labour ward the protocol is that we intervene after 8 hours of latent labour, however it may be that that a woman had to wait for a bed in labour ward and progressed without an intervention.

A study in 2019 on contemporary patterns of labour for nulliparous and multiparous women (22) revealed that both groups had accelerated labour after reaching 6 cm cervical dilatation, which was also true for our study. Oladapo et al (2018) found in their study that the median time to advance by 1 cm in nulliparous women took longer than an hour until the woman reached 5cm dilatation. The progress was more rapid than 1cm/hour after 6cm (16).

One of the limitations of this study was the size of the population (N=89). We did not include women who arrived at the institution in advanced labour, and this may have affected our results in that it may be that the median time would have been shorter. We did not evaluate the role of other parameters of labour progress such as descent of the head. Our study was also a retrospective study resulting in a loss of information. Not all women contributed data equally as they were admitted at different dilatations.

Conclusion

This study should be considered as a pilot in the study of labour patterns. The caesarean section rate is lower than what is expected at this institution and no neonates were born with an APGAR of less than 7 at 5 minutes. This may be because of better fetal monitoring with better resources in 2016. However, women who have prolonged latent phase of labour should be monitored adequately.

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APPENDIX 1: Approved protocol

MATERNAL AND FETAL OUTCOMES IN WOMEN WITH PROLONGED "LATENT PHASE OF LABOUR" AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL.

Reseacher: Bongi Rubushe

Department of obstetrics and Gynaecology: Chris Hani Baragwanath Academic Hospital

Supervisor: Prof Yasmin Adam

Background

Labour is a physiological process where the foetus, placenta and membranes are delivered. However, labour may be associated with both foetal and maternal complications. Monitoring of the mother and foetus in labour is important in the prevention of labour complications. The partogram is a graphical chart which is used to document cervical changes such as position, dilation and effacement. It is also used to document foetal attributes such as lie, position and engagement, maternal wellbeing and management of the labour.

Labour patterns were first described by Friedman in 1955(2,3) He conducted a study on 500 primigravid women to look at the relationship between the duration of labour and cervical dilatation (6). It is a sigmoid curve that has the latent and active phase of labour which is followed by the second stage of labour (7). Latent phase of labour was described as the establishment of labour up to 3cm dilated lasting 8 – 10 hours. The active phase was described as an acceleration of labour from 3cm to 10cm. The active phase of labour is then further divided into the acceleration phase (phase of maximum slope), and the deceleration phase (7). Friedman's definitions of labour arrest have been widely used.

In 1969, Hendricks's described a labour curve, demonstrating a difference between primigravid and multiparous women (8). This difference was described particularly in the active phase of labour looking at the rate of cervical dilation. He disputed Friedman's theory that a deceleration occurred at the end of the action phase (11).

Philpott and Castle designed the labour record or the partogram in 1971 (9) after extensive work on primgravid women in labour (11). The partogram was initially suggested for Central and Southern Africa (10,11). It gained popularity and was introduced as the partogram that soon became the standard means of documenting labour. When Philpott modified the partogram he introduced the concept of the alert line and the action line. The alert line represents the mean rate of the slowest progress of labour as measured by cervical dilatation. The action line was to show when an appropriate intervention should be taken. The partogram included the recording of foetal head engagement into the pelvis.

The definition of latent phase of labour varies. Williams' textbook defines latent phase of labour by Friedman's definition of where a woman reports regular uterine contractions with a

cervical dilation between 3 – 5 cm. Latent phase of labour is said to last for 8 hours (15). In South Africa latent phase of labour is diagnosed when there are regular contractions, and the cervix is less than 4 cm dilated (12). When the latent phase of labour is more than 8 hours it is deemed to be prolonged. An intervention is then initiated at this point to either augment the labour or to deliver by caesarean section (12). The WHO partogram defines the inflection point from latent labour to active phase as 3cm - it also only allows a latent phase of labour of 6 cm. The American College of Obstetrics and Gynaecology has recently stated that the onset of active phase of labour may not be until 5-6 cm and that when women and their foetuses are well there should be shared decision making on the management. Similarly, the Australian and New Zealand Obstetrics & Gynaecology Society are also basing their management on the consortium of safe labour support with individualizing labour management and allowing women to have a longer latent phase of labour.

Prolonged latent phase of labour is associated with different maternal and neonatal outcomes. A study conducted at CHBAH in 2002 showed that prolonged latent phase of labour was associated with an increase in caesarean sections with or without foetal distress, with postpartum pyrexia. In this study 7% of neonates had an APGAR of less than 7% and 22% were admitted for neonatal care. Of the neonates requiring admission, 58% were due to asphyxia (13). An important point they made was that with the neonatal outcomes noted it was difficult to determine if the complications were from prolonged latent phase itself or the intervention conducted to expedite labour (13).

There has been a major departure from the traditional management of labour based on 1cm/hr minimum progress to individualizing labour management. A systemic review which looked at published and unpublished observational studies reporting cervical dilatation over time for low-risk women with spontaneous labour and normal perinatal outcomes found that in nulliparous women, dilatation was longer than 1cm in 1hour until 5cm. It showed a median dilation of 1.09cm per hour. They also looked at the transition to a more rapid process that started between 5 to 6 cm but only after 6 cm was the dilatation doubled.

The management of labour has also changed over the decades. Induction of labour with chemical and mechanical methods, oxytocin use and epidurals for analgesia has also changed the labour process (5). Zhang et al described a pattern of labour which appeared to progress slower than the Friedman curve had indicated. The reason for this is that with the increase in maternal age and maternal and foetal body size labour has become a challenging process (5).

The rising caesarean section rate has been attributed to a poor understanding of labour (4). A study on labour in both nulliparous and multiparous women found a difference in their labour progress that were never previously described. The transition from latent labour to active labour is described as the inflection point. This was different in nulliparous and multiparous women. They found that women entered active phase of labour at different times (4).

Literature review

When describing maternal outcomes associated with prolonged latent phase of labour, a study was done in South Africa. They described the maternal outcomes that showed a 29%

caesarean section rate in the study group compared to a caesarean section rate of 6% in the control group. The patients who had caesarean sections, the majority indication was poor progress which was either associated with foetal distress or without foetal distress (13). They also included maternal pyrexia and puerperal sepsis which they found to be more frequent in the study group than in the control group (13).

In the same study they also described neonatal outcomes. They included all neonates that had an apgar score of less than 7 at 5 minutes, and neonates that got admitted to the special care unit. They found that out of the 22% of neonates that were admitted to the special care unit, 58% of those admissions were due to birth asphyxia.

Partograms for monitoring labour

The partogram is the graphical recording of the progress of labour and a record of the conditions of the mother and the foetus. It has been used as early as the 1970s to record and evaluate if labour is progressing normally. It is used to indicate when augmentation is needed and also to recognise when CPD occurs long before obstructed labour happens (11).

There are other features also recorded on the partogram that are equally as important such as the descent of the head and the quality of the uterine activity.

Methodology for studying labour progression

Measuring latent phase of labour can be a difficult task due to difficulty in diagnosing the actual start of labour. Patients also arrive at different stages of labour and we are sometimes unsure of onset. It is also unethical to do hourly per vaginal examinations. Newer statistical methods using repeat measure analysis with an interval censored regression make the study of length of labour possible. This methodology has been used by Zhang and also in the MA.

Caesarean sections rate

Caesarean section is a very important, lifesaving procedure when the baby or the mother's life is in danger during the birth process. Throughout the years we have watched caesarean section deliveries rise steadily even though benefit of the caesarean delivery has not been well established (17).

A longitudinal analysis was conducted looking at nationally representative data on caesarean section rates from 1990 – 2014 in 150 countries. It was found that the caesarean section rate increased by 6.7% from 1990-2014 globally. When broken down and looked at by region or by country the trends were different in Africa. There are vast differences between countries where as the rate decreased in Nigeria and Morocco it increased markedly in Egypt. It is worrisome that in Africa there was such a small increase in the caesarean section rate which could mean that there were still women who need caesarean deliveries but don't have access to it due to lack of resources (18). The WHO made a statement around this strive for a perfect

caesarean section rate saying that every effort should made to ensure every woman that needs a caesarean section gets one, rather than striving to have a perfect rate (19).

Caphelopelvic disproportion

Caphelopelvic disproportion is a condition that occurs in labour when the pelvis of the mother and the size of foetus' head is a mismatch. CPD is diagnosed clinically but is a difficult diagnosis. It is often made when labour doesn't progress by 1cm per hour.

It is more common in nulliparous women than it is in multiparous women. CPD can be confidently excluded as a retrospective diagnosis if vaginal delivery occurred regardless of whether the delivery was assisted or not.

This results in mechanical obstruction of the foetus and its inability to pass through the birth canal. There are a few factors that can cause CPD and they are classified into three categories which was proposed by Craig from Cape Town 1961. There is absolute CPD (permanent maternal conditions, contracted pelvis, pelvic exostoses, spondylolisthesis, anterior sacrococygeal tumours), there are temporal causes of CPD (foetal cause, hydrocephalus and big baby), and then there are relative causes of CPD (brow presentation, face presentation, occipitoposterior positions and deflexed head) (19).

There are a number of women who will undergo caesarean section due to poor progress and a percentage of those will be due to true CPD, but there are a number of those patients who will only have relative CPD or no CPD at all.

The setting of goals in the progression of labour in Dublin, by O'Driscoll lead to a reduction in the caesarean section rate. They proposed that labour should progress at 1cm/hr and if this did not occur over 4 hours, CPD should be clinically excluded. Once CPD was excluded, the membranes should be ruptured and an oxytocin infusion should be started (20).

They found that the caesarean section rate reduced to 4.8% and the most common indications for caesarean section were dystocia, antepartum haemorrhage and breech presentation (20). However, this may lead to unnecessary interventions (20).

Problem statement

Latent phase of labour is a poorly understood phase of labour because onset is always difficult to ascertain. Prolonged latent phase of labour is a criterion for referral from a midwife obstetric unit to a hospital according the Maternity Care Guidelines. When women have been in latent labour for 8 hours, they will be augmented with a syntocinon infusion or will have a caesarean section if they have obstetric contraindications to being augmented.

There are current changes in the definition of latent phase of labour internationally. The previous study conducted in Soweto South Africa showed poor outcomes in babies and mother who have had prolonged latent phase of labour. (13)

Since the 2002 study done in South Africa there has been a change in that women and babies have a higher BMI's, there is better access to antenatal care, women present to the labour ward earlier in labour. It was therefore decided that a re-evaluation of latent phase of labour and the problems associated with prolonged latent phase of labour is needed.

AIM

The aim of this study is to describe the maternal and neonatal outcomes in women with prolonged latent phase of labour. The study will be from June 2016 – June 2017.

Objectives

1. To describe all women who present to the admission ward in CHBAH who were referred as being in latent phase of labour or who presented in latent phase of labour.

2. To describe the median time from diagnosis of latent phase labour to a cervical dilatation of 6cm.

3. To describe the median time from the diagnosis of latent labour to 10cm dilation/ delivery.

4. To describe mode of delivery, immediate complications (PPH/Pyrexia) in women with prolonged latent phase of labour

5. To describe neonatal outcomes: apgars, birth weight, the presence of MSL, admission to the NICU in women with prolonged latent phase of labour

Methods

Setting

CHBAH is a tertiary hospital in Soweto.

This study will be conducted at Chris Hani Baragwanath Academic Hospital. We have about 20 000 deliveries a year. We have between 4 to 7 MOU's that refer to patients CHBAH.

All women referred to CHBAH all are seen, assessed and admitted through our admissions ward which is manned by interns and registrars under consultant supervision. Women who have been assessed and we are unsure whether labour has been established or not, or women who are in the latent phase of labour, are sent to first stage for monitoring and progress of labour. The women who are diagnosed as prolonged latent phase of labour who need artificial rupture of membranes and augmentation of labour, are sent to labour ward for augmentation under continuous foetal monitoring.

Study Population:

Women who present in latent labour or who are referred for prolonged latent phase of labour

Sample size

The study is a descriptive, retrospective cohort study and a sample size calculation is therefore not necessary. We will collect data for one year. Where we will include an estimate of 200 women.

Data Management:

The admissions register, the 1st stage registers will be searched for women who present to CHBAH at less than 6 cm. This is the dilatation used at this institution for transfer to labour ward. Data will be entered on a data-sheet and then into a RedCap Data Base. The data will be transferred to STATA for analysis.

Inclusion criteria

Admission dilatation of - < 6 cm cervical dilated

Vertex

Weight>2500g

Only women with at least 2 vaginal examinations will be included

Exclusion criteria

Previous uterine surgery

Multiple pregnancy

Active phase of labour - > 5 cm cervical dilated

Abnormal foetus

Data collection

The register in admissions and in the first stage will be searched for women referred for latent labour. The medical notes of these women will be retrieved and entered onto a data sheet. The data sheet will be piloted using 5 files. All files of women who have been in first stage for longer than 8 hours will be checked to see if they meet the inclusion criteria.

Explanatory variables:

Age, parity, gravity, gestational age, booking bloods, CD4/viral load if HIV positive, previous obstetric history, habits (smoking, alcohol), antenatal risk assessment, GA at booking, maternal height, weight, BMI, birth weight, ROM, dilatation at 1st exam in labour, HAB, head at station, moulding, caput position of the cervix, effacement, length of cervix

Outcome variables:

Mode of delivery, augmentation of labour, temperature, need for analgesia, APGAR scores, admission to NICU/TICU.

Data analysis.

Categorical variables will be described using frequencies and percentages and continuous variables using means (SD) and medians (IQR, ranges). A repeated-measures analysis will be used to construct average labour curves. An interval-censored regression will be used to estimate duration of labour stratified by cervical dilation at admission and centimetre by centimetre change. The starting point will be 10cm (time=0) and the time will be calculated backwards (30 minutes before full dilatation will be -30 and so forth). We will assume that labour data is log-normal. The median, 5th and 95th percentile will be calculated.

Limitations

CHBAH is a very busy hospital and sometimes there are lack in resources in terms of staff.

Patient may not always get their 4 hourly assessments due to the hospital being busy. The seniority of the health worker doing the assessment varies and the assessments are not objective. This is a retrospective study therefore information may be lost or poorly recorded. An intervention that is ordered, such as analgesia or syntocinon may not have been administered.

Funding

The cost of printing and stationary will be funded by the researcher.

Ethical issues

We will seek permission to perform this study from the CEO of CHBAH by registering the study online on the National Health Research DataBase and also the University of Witwatersrand Human Research Ethics Committee.

Timeline of study

Ethics	February 2018
Post Grad Meeting	March 2018n
Data collection	March – April 2018
Data analysis	May 2018
Write up	June – July 2018

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APPENDIX 2 : Data collection sheet

DATA SHEET:

Mother's age : Race:

[_] Black [_] Coloured [_] Caucasian [_] Asian [_] Other

HIV Status:

[_] Negative [_] Positive [_] Unknown

CD4+ count: _____ Viral load: _____

Pregnancy history:

Has the subject been pregnant in the past?

[__] Yes [__] No

If yes,

Year Weight Complications Outcomes

Nutritional status:

Mid-upper arm circumference (MUAC): [__][__]cm

Height [__]. [__][__]m [_] Not recorded

Weight [__][__][__]kg [_] Not recorded

Habits:

Smoking during pregnancy? [_] Yes [_] No [_] NR

Drink alcohol during pregnancy? [_] Yes [_] No [_] NR

Haemoglobin

Booking haemoglobin value? [__][__].[__] [_] NA

Syphilis

RPR result: [_] Negative [_] Positive [_] Unknown

If yes was the patient treated [_] Yes [_] No

Rhesus

Rh results [_] negative [_] positive [_] unknown

If yes antibodies detected [] Yes [] No [] not recorded

Pregnancy related comorbidities

Hypertensive disorders

[_] chronic hypertension [_] pre-eclampsia [_]Eclampsia

[_] HELLP syndrome [_] other

If other, please specify

Asthma [_] yes [_] no [_] unknown

Epilepsy [_] yes [_] no [_] unknown

Other [_] yes [_] no [_] unknown

If yes, please specify

Labour and delivery

Gestational age at delivery in weeks:

Gestational age determined by

[_] Fundal height

[_] Last menstrual period

[_] Ultrasound

Rupture of membranes (ROM):

Date of ROM: [___] [___] /[___][___] / 201[___] [__] Not recorded

Time of ROM: [___][___] h [___][___] [__] unknown

Type:

Artificial (AROM) [] Yes [] No

Spontaneous [] Yes [] No

Not recorded [] Yes [] No

Liquor:

Clear [] Yes [] No

Offensive [] Yes [] No

Meconium-stained [] Yes [] No

No recorded [] Yes [] No

Evidence of fetal distress [] Yes [] No

If yes, specify (tick all that apply):

Meconium-stained amniotic fluid (MSAF)? [] Yes [] No

Abnormal cardiotocograph? (CTG/NST) [] Yes [] No

Fetal distress unclassified [] Yes [] No

Other _____ [] Yes [] No

Analgesia

Pethidine [] Yes [] No

Morphine [] Yes [] No

Epidural [] Yes [] No

Other

Antibiotics [] Yes [] No

If yes state what was given:

Mode of delivery:

Vaginal delivery [] Yes []No

Episiotomy [] Yes [] No

Assisted delivery [] Yes [] No

If yes give indication type: [_]forceps [_]vacuum

Use of oxytocin [] Yes []No

If yes: start time [__][__]:[__][__] finish time [__][__]:[__][__]

Caesarean section [] Yes [] No

If yes give indication

Maternal outcome

Number of days in hospital:

Pyrexia at any time:

Tachycardia [] Yes [] No

If present give range:

Evidence of endometritis [] Yes [] No

Postpartum haemorrhage [] Yes [] No

If yes, please quantify

Blood transfusion []Yes [] No

If yes, how many:

Hysterectomy for puerperal sepsis [] Yes [] No

Died [] Yes [] No

Cause of death……...

Post-operative complications

Postpartum haemorrhage [] Yes [] No

Surgical intervention [] Yes [] No

If yes state type used:

Hysterectomy [] Yes [] No

Admission to High care area [] Yes [] No

If yes give indication

Admission to ICU [] Yes [] No

If yes give indication

Neonatal Outcome:

Gender: [__] Male [__] Female

Date of birth: [___][___] / [___][___] / 201[___]

Birth weight: [___][___][___][___] grams [__] Not available

Apgar score:

1 min [___][___] [__] Not done/unknown

5 min [___][___] [__] Not done/unknown

Did the neonate need resuscitation immediately post-delivery? [] Yes [] No

Supplemental oxygen [] Yes []No

Outcome:

Discharged home with mother [] Yes [] No

Admitted to neonatal ward [] Yes [] No

Reason for admission:……....

MAS [] Yes [] No

TTTN [] Yes [] No

Respiratory distress [] Yes [] No

Died after delivery [] Yes [] No

Cause of death:……

Labour related:

Date of admission: [__][__]/[__][__]/[__][__][__][__]

Time of admission: [__][__]:[__][__]

Dilation on admission:

Effacement of cervix on admission:

Position of cervix:

HAB on admission:

Station on admission

Caput on admission:

Moulding on admission:

Number of vaginal deliveries:

Time of dilation- going backward in minutes. Only dilation is a time, the rest are as described in column 1

	1	2	3	4	5	6	7	8	9	10	Delivered
Dilatation											
HAB											
5/4/3/2/1/0											
Station-3/-2/-1/0/+1/+2/+3											
Caput											
Moulding											

Time of delivery:

Date of delivery:

APPENDIX 3: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr Bongi Rubushe

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M180248

NAME: (Principal Investigator)	Dr Bongi Rubushe
DEPARTMENT:	Obstetrics and Gynaecology Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	Maternal and fetal outcomes in women with prolonged latent phase of labour at Chris Hani Baragwanath Academic Hospital
DATE CONSIDERED:	23/02/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Yasmin Adam
APPROVED BY:	Professor CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	11/07/2018

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **February** and will therefore be due in the month of **February** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 4: Author Guidelines from the South African Medical Journal

Research

Guideline word limit: 4 000 words

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section, which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

Select figures and tables for your paper carefully and sparingly. Use only those figures that provided added value to the paper, over and above what is written in the text.

Do not replicate data in tables and in text .

Structured abstract

This should be 250-400 words, with the following recommended headings:

Background: why the study is being done and how it relates to other published work.

Objectives: what the study intends to find out

Methods: must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.

Results: first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.

Conclusion: must be supported by the data, include recommendations for further study/actions.

Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.

Do not include any references in the abstracts.

Here is an example of a good abstract.

Main article

All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

The following are additional heading or section options that may appear within these:

Objectives (within Introduction/Background): a clear statement of the main aim of the study and the major hypothesis tested or research question posed

Design (within Methods): including factors such as prospective, randomisation, blinding, placebo control, case control, crossover, criterion standards for diagnostic tests, etc.

Setting (within Methods): level of care, e.g. primary, secondary, number of participating centres.

Participants (instead of patients or subjects; within Methods): numbers entering and completing the study, sex, age and any other biological, behavioural, social or cultural factors (e.g. smoking status, socioeconomic group, educational attainment, co-existing disease indicators, etc)that may have an impact on the study results. Clearly define how participants were enrolled, and describe selection and exclusion criteria.

Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.

Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

Results

Start with description of the population and sample. Include key characteristics of comparison groups.

Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.

Do not replicate data in tables and in text.

If presenting mean and standard deviations, specify this clearly. Our house style is to present this as follows:

E.g.: The mean (SD) birth weight was 2 500 (1 210) g. Do not use the ± symbol for mean (SD).

Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

Discussion

Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

Statement of principal findings

Strengths and weaknesses of the study

Contribution to the body of knowledge

Strengths and weaknesses in relation to other studies

The meaning of the study – e.g. what this study means to clinicians and policymakers

Unanswered questions and recommendations for future research

Conclusions

This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.

General:

- Manuscripts must be written in UK English.
- The manuscript must be in Microsoft Word format. Text must be single-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes).
- Please make your article concise, even if it is below the word limit.
- Qualifications, full affiliation (department, school/faculty, institution, city, country) and contact details of ALL authors must be provided in the manuscript and in the online submission process.

- Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.
- Include sections on Acknowledgements, Conflict of Interest, Author Contributions and Funding sources. If none is applicable, please state ‘none’.
- Scientific measurements must be expressed in SI units except: blood pressure (mmHg) and haemoglobin (g/dL).
- Litres is denoted with an uppercase L e.g. 'mL' for millilitres).
- Units should be preceded by a space (except for % and ºC), e.g. '40 kg' and '20 cm' but '50%' and '19ºC'.
- Please be sure to insert proper symbols e.g. µ not u for micro, a not a for alpha, b not B for beta, etc.
- Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160.
- Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
- Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.
- If you wish material to be in a box, simply indicate this in the text. You may use the table format –this is the only exception. Please DO NOT use fill, format lines and so on.

APPENDIX 5: Turnitin Originality Report

Turnitin Originality Report

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