

**MATERNAL AND FETAL OUTCOMES OF WOMEN**  
**REFERRED TO CHARLOTTE MAXEKE JOHANNESBURG**  
**ACADEMIC HOSPITAL WITH PROLONGED LABOUR**

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in Obstetrics and Gynaecology

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## **DECLARATION**

I Darin Ali Othman Ashnaf declare that this Research Report is my own, unaided work. It is being submitted for the Degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

(Signature of candidate)

21/January /2019

## **DEDICATION**

This research dedicated to:

My husband (Dr. Hashem Burcan) and my children (Anas and Salma) who they have been after God the source of my strength and support throughout this work. Soul of my father, my mother, my sisters and my brothers for their support despite of the distance.

D. Ashnaf

## **ABSTRACT**

### **Introduction**

Prolonged labour or labour dystocia is a common obstetric complication and constitutes the most frequent indication for instrumental and caesarean delivery. Approximately eight percent of all women giving birth are affected by prolonged labour.<sup>1</sup> The correct diagnosis of labour is an important part of preventing prolonged labour. It is important to have an objective diagnosis of labour in order to avoid over diagnosing labour which can result in inappropriate interventions and increase the risk of maternal and fetal adverse outcomes.

### **Methods**

This was retrospective descriptive study of women referred to Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) due to prolonged labour over a four month period from August 2016 to November 2016. The total study sample included 165 women. All 165 medical records were available for review. Forty seven babies were admitted to the paediatric observation unit, files were found for 45 babies, records were not available for two babies.

### **Results**

Women were referred for prolonged active and latent phase of labour in 77 (46.6%) and 75 (45.5%) women respectively. Only 13 women were referred due to prolonged second stage of labour (7.9%). Ninety one (55.2%) women with prolonged labour had normal vaginal delivery and eight (4.8%) had instrumental delivery. The remainder of the women (n=66, 40%) delivered by caesarean section (CS). The only maternal adverse outcome found was postpartum haemorrhage in 4.3 % (n=7) of the total study population. Out of 165 births, there was one fresh still birth. A total of 47 babies (28.6%) required observation in the neonatal transitional care unit (TICU) mainly due to respiratory distress. Nine babies (5.5%) out of 164, required admission to neonatal ICU (NICU). The institutional protocol for management of labour was followed in only 33.3% of the women. In the rest of the population, appropriate management was either delayed or not done.

### **Conclusion**

In this study, there were few maternal and fetal adverse outcomes with prolonged labour. The institution protocol at CMJAH for management of labour dystocia was followed in only 33.3% of the study population.

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## **ABBREVIATIONS**

|              |                                                 |
|--------------|-------------------------------------------------|
| <b>ACOG</b>  | American College of Obstetrics and Gynaecology  |
| <b>AOL</b>   | Augmentation of labour                          |
| <b>AROM</b>  | Artificial rupture of membranes                 |
| <b>BMI</b>   | Body mass index                                 |
| <b>cART</b>  | Combined antiretroviral therapy                 |
| <b>CHBAH</b> | Chris Hani Baragwanath Academic Hospital        |
| <b>CMJAH</b> | Charlotte Maxeke Johannesburg Academic Hospital |
| <b>CPD</b>   | Cephalopelvic disproportion                     |
| <b>CS</b>    | Caesarean section                               |
| <b>ICU</b>   | Intensive care unit                             |
| <b>MTCT</b>  | Mother to child transmission                    |
| <b>TICU</b>  | Transitional intensive care unit                |
| <b>PPH</b>   | Postpartum haemorrhage                          |
| <b>PROM</b>  | Prelabour rupture of membranes                  |
| <b>RCOG</b>  | Royal College of Obstetrics and Gynaecology     |
| <b>ROM</b>   | Rupture of membranes                            |
| <b>VVF</b>   | Vesicovaginal fistula                           |
| <b>WHO</b>   | World Health Organization                       |

# 1. LITERATURE REVIEW

## 1.1 Introduction

Prolonged labour or labour dystocia is a common obstetric complication and constitutes the most frequent indication for instrumental and caesarean delivery. Approximately eight percent of all women giving birth are affected by prolonged labour.<sup>1</sup>

Diagnosing prolonged labour is inherently difficult. It is a controversial issue that has been discussed ever since Friedman introduced the graphic analysis of labour in 1954.<sup>1</sup> He defined the following three stages of labour. The first stage starts with uterine contractions leading to complete cervical dilatation and is divided into latent and active phases. In the latent phase, irregular uterine contractions occur with slow and gradual cervical effacement and dilatation. The latent phase is prolonged if it continues for more than 20 hours in nulliparous and more than 14 hours in multiparous women.<sup>2</sup> The active phase of labour, demonstrated by an increased rate of cervical dilatation and fetal descent, starts at three to four centimeter cervical dilatation. It is subdivided into phases of accelerations, maximum slope and deceleration.<sup>2</sup>

The second stage of labour is defined as complete dilatation of cervix to delivery of the infant with an average of 60 minutes in nulliparous and 30 minutes in multiparous women.<sup>2</sup> It is considered prolonged if it continues for more than an hour in nulliparous and 30 minutes in multiparous women. The third stage of labour involves delivery of the placenta.<sup>2</sup>

Delays in both first and second stage of labour can lead to adverse outcomes of mother and baby. Reported incidences for labour dystocia vary among previous studies due to differences in the definitions used as well as differences in the characteristics of the women and gestational age between study populations.<sup>3</sup> Two different studies, the first done by Zhu *et al.* and the second by Kjaergaard *et al.* found the incidence of labour dystocia among their populations to be 20% and 37% respectively.<sup>3,4</sup> A cohort study of pregnant women at Chris Hani Baragwanath Hospital in South Africa was undertaken to assess the fetal, maternal and obstetric risks associated with prolonged latent phase of labour.<sup>5</sup> The incidence of prolonged latent phase of labour in this study was comparatively low, at 5.9%.<sup>5</sup> This study, by Maghoma and Buchmann, demonstrated a number of adverse maternal as well as fetal outcomes due to prolonged latent phase of labour.<sup>5</sup> The maternal complications recorded included postpartum hemorrhage, infection and augmentation of labour.<sup>5</sup> Fetal adverse outcomes assessed included Apgar score of <7 at five minutes, intrapartum passage of meconium, admission to the neonatal ICU,

intrapartum still birth and neonatal death. In a study done by Bailit *et al.*, to evaluate the differences in outcomes between women presenting to health care facilities in latent phase versus active phase of labour, they found that latent phase admission was associated with an increased cesarean delivery rate, increased number of obstetric interventions and increased maternal infection rates.<sup>6</sup>

Similarly, in 2009, a study in Canada, the described risk of both maternal (chorioamionitis, obstetric trauma, need for blood transfusion, hysterectomy, PPH, admission to ICU) and fetal adverse outcomes (five minute Apgar<7, sepsis, admission to neonatal ICU) increased with the duration of second stage of labour. This is particularly true for duration longer than three hours in nulliparous and longer than two hours in multiparous women.<sup>7</sup>

## **1.2 Maternal Factors in prolonged labour**

### **1.2.1 Maternal age**

Childbirth at a young (less than 20 years) or advanced maternal age (more than 35 years) is associated with increased risk of adverse maternal and perinatal outcomes.<sup>8</sup> A large number of researchers have reported that increased maternal age over 35 years is associated with an increased risk of pregnancy induced medical conditions and maternal mortality.<sup>9</sup> These women are at greater risk of developing labour dystocia and requiring caesarean or instrumental deliveries resulting in pelvic floor injuries.<sup>9</sup> There is also an increased risk of adverse pregnancy outcomes including stillbirth, preterm labour (both spontaneous and iatrogenic) and low birth weight.<sup>8,10</sup>

A retrospective cohort study conducted by Greenberg *et al.* to examine lengths of first and second stages of labour across maternal age groups found that there were significant differences between the lengths of labour among women of different ages.<sup>11</sup> In the first stage of labour, the median duration in nulliparous women, increased from 9.2 hours in the age group less than 20 years to 11 hours ( $p \leq 0.001$ ) in age group of 35 to 40 years.<sup>11</sup> In comparison, in multiparous women the first stage was longer in women less than 20 years old than the women of 40 years and over by 6.1 hours and 5.7 hours ( $p=0.02$ ) respectively.<sup>11</sup> In the second stage of labour, there were differences in duration in both nulliparous and multiparous women. In nulliparous women, the median length was 51 minutes in the age group less than 20 years compared to 148 minutes ( $p \leq 0.001$ ) in the age group more than 40 years. In multiparous women, those less than 20 years

old had a median length of 16 minutes compared to 26 minutes ( $p \leq 0.001$ ) in the age group more than 39 years.<sup>11</sup>

A study by Treacy *et al.* in Ireland, was conducted in nulliparous women to determine whether maternal age affects uterine function.<sup>12</sup> Over 10 000 nulliparous women in spontaneous labour at term were analyzed over a five year period. The use of oxytocin, duration of labour and risk of caesarean delivery for failure to progress was measured and compared to maternal age. The overall rate of prolonged labour was 3.7%, with 6.5% of women requiring caesarean delivery. The results showed a significant increase in labour dystocia due to uterine dysfunction with advancing maternal age.<sup>12</sup> Caesarean delivery rates were also found to increase over three fold between the categories of less than 20 years and more than 35 years of age, particularly those done due to dystocia or no progress.<sup>12</sup> Possible reasons for this age-related increase in labour dystocia may be related to diminished uterine contractility, altered connective tissue compliance and reduced maternal voluntary effort.<sup>12</sup>

In a retrospective review from 2009 in the United States, Cavazos-Rehg *et al.* used hospital billing data to identify possible associations between maternal age and morbidity following labour and delivery.<sup>8</sup> They compared women less than 19 years of age with a control group of women 25 to 29 years and found an increased risk of chorioamnionitis and endometritis.<sup>8</sup> However, this does not seem to be as a result of prolonged labour as the rate of labour dystocia in mothers less than 20 years was comparable to, if not less than, the rate of dystocia in mothers 20 to 25 years.<sup>12</sup>

### 1.2.2 Maternal Obesity

Obesity, as defined by the World Health Organization and the Institute of Medicine, is a body mass index (BMI) more than or equal to  $30 \text{ kg/m}^2$ .<sup>13</sup> The overall incidence of obesity is increasing worldwide, particularly in women of reproductive age. The prevalence varies between 8 and 30% depending on the population in question.<sup>13</sup> The South African Demographic and Health Survey (SADHS) of 2003, found that the overall prevalence of obesity in South African adult women is 27%, 15% of which are within reproductive age.<sup>14</sup> Obese pregnant women have a higher risk of a number of maternal and fetal complications including miscarriage, pre-eclampsia, gestational diabetes, fetal macrosomia and stillbirth.<sup>15</sup>

There is also an increased risk of postdates pregnancy requiring induction of labour or prolonged labour leading to augmentation with oxytocin, possible primary postpartum haemorrhage and perineal trauma.<sup>16</sup>

Maternal obesity has a direct influence on mode of delivery. Delay or non progress in the first stage of labour is significantly more common in obese women with the risk ranging between 1.5 to 3 times more likely.<sup>15</sup> Prolonged first stage is the most common indication for caesarean section (CS), even after augmentation with oxytocin. There is a two to three fold increased risk of CS in women with a BMI greater than 30kg/m<sup>2</sup>.<sup>15</sup> Additionally, a cohort published in 2011 by Fyfe *et al.* found that in term nulliparous women in labour, being overweight or obese is an independent risk factor for CS in the first stage but not the second stage of labour.<sup>17</sup> For overweight or obese nulliparous women who reach the second stage of labour, increasing maternal BMI is not associated with a longer second stage or an increased risk of caesarean delivery.<sup>18</sup>

The cause of the increased caesarean delivery rate among obese women is most likely multifactorial. However, it is thought that obesity may be associated with impaired or poor myometrial contractility.<sup>19</sup> Zhang *et al.* tested myometrial strips of the uterus obtained from obese women who underwent an elective CS at term.<sup>19</sup> They found that myometrial strips from the obese women contracted with less force and frequency than similar myometrial strips obtained from normal weight women.<sup>19</sup> The exact mechanism is unknown, although, elevated cholesterol levels, which are generally found in overweight and obese women, are thought to inhibit the contractility of the myometrium. Alterations in cholesterol levels, which have an important role in cell signaling, may have an impact on effectiveness of uterine contractions during labour.<sup>19</sup>

Due to the effects of maternal weight, it is suggested that the use of a single “normal” labour curve may lead to over diagnosis of labour dystocia in overweight women. More appropriate definitions need to be developed for labour arrest in obese women. By doing so the number of CS in obese women may be reduced.<sup>20</sup>

### 1.2.3 Maternal height and ethnicity

Previous studies from the 1940s showed a relationship between maternal height, pelvic dimensions and the likelihood of achieving a vaginal delivery.<sup>21</sup> A comparative prospective

study among primigravidas of African and Caucasian origin was performed by Okewole *et al.* in northern London, United Kingdom.<sup>21</sup> The study aimed to determine whether there is a relationship between ethnicity, maternal shoe size and height, and the potential for delivering vaginally.<sup>21</sup> Results showed that with a maternal height of greater than 165 centimeters, there was roughly a twofold increased chance of delivering vaginally. However, both height and shoe size were shown to have poor predictive ability for vaginal delivery.<sup>21</sup> As a screening test for cephalopelvic disproportion (CPD), maternal height was more predictive than shoe size.<sup>21</sup> A meta-analysis of nine studies by Dujardin *et al.* also confirmed a significant association between short maternal height and an increased risk of CS.<sup>22</sup>

The association between ethnicity and mode of delivery was examined in a retrospective analysis by JM Ibison.<sup>23</sup> A total of 30 825 “low risk” primigravidas were identified and their mode of delivery analysed in relation to their ethnicity.<sup>23</sup> The main findings showed that African, West Indian, Bangladeshi, Indian and Pakistani women were at elevated risk of delivery by CS compared with Caucasian women, and Bangladeshi and Indian women had higher risks of delivery by forceps and ventouse compared with Caucasian women.<sup>23</sup> Ethnicity may have an influence on maternal height as well as pelvic size and shape. It has been suggested that there is an increased risk of emergency CS for CPD among African women due to their relatively short stature and greater proportion of anthropoid pelvises.<sup>21</sup>

#### 1.2.4 Parity

Labour dystocia in nulliparous women is common. Primiparity is associated with increased intrapartum risks. A case controlled study, by Hashim *et al.* in India, showed a caesarean section rate of 15% in primigravida and 1% in multigravida woman.<sup>24</sup> Primiparous women were more prone to prolonged first and second stage of labour and had the longest and most gradual labour curve when compared with multiparous women. Primiparous women were also at higher risk of emergency delivery for fetal distress and operative delivery.<sup>24</sup> Similarly, a study in a Nigerian tertiary hospital showed primigravid women to be at a higher risk of dystocia compared with the multipara women.<sup>24</sup>

#### 1.2.5 Hypertensive disease

In terms of the actual effect of the hypertensive disease on progress of labour, evidence is conflicting. A retrospective cohort study done by Bregand-White *et al.*, using data from the Consortium on Safe Labour, looked at labour progression in induced nulliparous women at

term with hypertensive diseases in pregnancy.<sup>25</sup> They found that labour progression in the first stage was particularly longer in women with chronic hypertension and super imposed pre-eclampsia compared to controls.<sup>25</sup>

Magnesium sulphate is an important part of management in the pre eclamptic and eclamptic woman in terms of neuroprotection.<sup>26</sup> In 1997, Within *et al.* conducted a randomized, double blinded, placebo controlled trial to assess the effect of magnesium sulphate on the duration of labour.<sup>27</sup> The study found that the use of magnesium sulphate did not affect any component of labour but did necessitate a higher dose of oxytocin for augmentation and prevention of postpartum haemorrhage.<sup>27</sup> A second, more recent prospective study published in February 2017, aimed to determine the contractile patterns induced by oxytocin in a myometrium exposed to magnesium sulphate.<sup>26</sup> The results confirmed that magnesium sulphate pretreatment, before oxytocin is given, does not impair oxytocin-induced myometrial contractility, however, it can affect contractions and response to oxytocin if used simultaneously.<sup>26</sup>

Magnesium sulphate is also an agent previously advocated by some for tocolysis due to its antagonistic effect on calcium binding.<sup>26</sup> However, studies on preterm labour do not confirm this. Therefore, magnesium sulphate may reduce the force of contractions and slow the progress of labour but it does not stop it completely.<sup>26</sup>

### **1.3 Fetal factors in prolonged labour**

Fetal macrosomia is a known risk factor for labour dystocia. The most common causes of fetal macrosomia are diabetes mellitus in pregnancy and postdate pregnancy.<sup>28</sup> In 1990, Turner *et al.* examined the association between the duration of labour and infant birthweight.<sup>29</sup> The results showed that the duration of labour (both first and second stage) increased as birth weight increased regardless of whether oxytocin was used for augmentation of labour.<sup>29</sup>

A prospective multicenter cohort showed that vaginal examination on admission can provide information on risk for dystocia.<sup>30</sup> The number of fifths of the fetal head above the pelvic brim had the strongest association with dystocia.<sup>30</sup> The lack of descent of the fetal head often leads to dystocia resulting in CS.<sup>30</sup>

## **1.4 Labour-related factors**

### **1.4.1 Epidural anaesthesia and pain control**

Pain of labour, caused by the contraction of the uterus and the dilation of the cervix, is transmitted through the visceral afferent (sympathetic) nerves entering the spinal cord from T10 to L1. In the later stages, perineal stretching transmits painful stimuli through the pudendal and sacral nerves (S2 to S4). The sensation of pain produces a maternal stress response leading to the release of hormones including adrenaline. Adrenaline can have a relaxant effect on the uterus that may result in prolonged labour.<sup>31</sup>

Epidural analgesia effectively relieves pain during labour and delivery.<sup>32</sup> Theoretically, adequate pain relief should aid in the progress of labour by limiting the maternal stress response.<sup>31</sup> There is, however, still controversy surrounding the effect of the epidural analgesia on the duration and progress of labour. A study done by Agrawal *et al*, in India, involved 120 nulliparous women comparing epidural to no analgesia, showed that epidural analgesia resulted in a shorter duration of the first stage but a statistically significant prolonged duration of the second stage of labour.<sup>33</sup> Similarly, in 2011, a Cochrane review done by Anim-Somuah *et al*. showed no difference in the duration of first stage but a significantly longer duration of for the second stage.<sup>34</sup> In contrast, in 2017, Shen *et al*. conducted a randomised controlled trial found no effect of epidural on the duration of the second stage of labour compared with a placebo infusion.<sup>35</sup> There was no statistical difference in the rates of spontaneous vaginal delivery in both groups.<sup>35</sup>

## **1.5 Maternal complications of prolonged labour**

### **1.5.1 Infection**

Intrapartum chorioamnionitis and postpartum pelvic infection are more common with prolonged labour.<sup>36</sup> In the study done at Chris Hani Baragwanath Academic Hospital by Maghoma and Buchmann looking at maternal outcomes after prolonged latent phase of labour, postpartum pyrexia ( $>38^{\circ}\text{C}$ ) and puerperal sepsis were found to be more frequent in women with a prolonged latent phase of labour.<sup>5</sup> In this study the incidence of postpartum pyrexia and puerperal sepsis was 21% ( $p<0.0001$ ) and 4% ( $p=0.045$ ) respectively.<sup>5</sup>

Early postpartum maternal infection has been found to be increased with the duration of second stage of labour. Duration of less than one hour is associated with the lowest risk of infection whereas more than three hours duration has a significantly higher risk.<sup>37</sup> A retrospective review

of over 220 000 women by Laughon *et al.* showed a threefold higher risk of chorioamnionitis for both nulliparous and multiparous women with prolonged second stage of labour.<sup>38</sup>

There have been suggestions that intrauterine infection itself contributes to abnormal uterine activity. Satin *et al.* studied the effects of chorioamnionitis on the need for augmentation with oxytocin.<sup>39</sup> They found that women diagnosed with chorioamnionitis early in labour, prior to the use of oxytocin, had a shorter interval from oxytocin initiation to delivery compared to controls. In contrast, women diagnosed with intrauterine infection later in labour, after initiation of oxytocin, had considerably longer labour times than the controls. These women required higher doses of oxytocin and also had a four times higher risk of CS for dystocia compared to controls. Due to this difference in clinical presentation it is evident that intrauterine infection has a variable effect on labour progress. It is difficult to determine whether intrauterine infection is the cause or the result of dysfunctional labour.<sup>39</sup>

#### 1.5.2 Postpartum haemorrhage

In developing countries, postpartum haemorrhage (PPH) is a major cause of maternal mortality. According to the World Health Organisation (WHO), it accounts for 25% of direct obstetric deaths.<sup>40</sup> PPH may result from prolonged labour and augmentation with oxytocin due to the development of uterine atony following delivery.<sup>36</sup> Regular contractions over several hours of labour will exhaust the uterine muscles and thereby reduce their ability to contract over time, causing uterine dysfunction and uterine atony post delivery. For this reason, patients with prolonged labour are more likely to suffer PPH. Similarly, induction of labor with misoprostol has also been shown to be associated with PPH in previous studies.<sup>41</sup> In South Africa, according to the Saving Mothers Report (2011-2013), prolonged labour was an underlying factor in 25.3% of maternal death due to obstetric haemorrhage.<sup>42</sup> A retained placenta may also precipitate PPH. Retained placenta accounted for 6.6% of maternal deaths due to obstetric haemorrhage in South Africa between 2011 and 2013.<sup>42</sup> A study by Coviello *et al.* showed an increased chance of retained placenta in nulliparous women who had an increased duration of first or second stage of labour.<sup>40</sup>

#### 1.5.3. Uterine rupture

Labor dystocia is a significant risk factor for uterine rupture.<sup>43</sup> Abnormal thinning of the lower uterine segment during prolonged labour increases the risk particularly in women of parity more than three and in women with a prior caesarean delivery.<sup>36,43</sup> In the developed world, the overall

incidence of uterine rupture is less than one per 1 000 deliveries. Over 90% of these cases occur in women with a scarred uterus due to previous CS.<sup>44</sup> Other risk factors for uterine rupture include uterine anomalies, advanced maternal age, macrosomia and multiple gestation, all of which are more likely to be associated with prolonged labour.<sup>44</sup>

The rupture of an unscarred uterus is very uncommon but can be associated with higher maternal and neonatal morbidity and mortality. The estimated incidence is 1/5700 to 1/20 000 pregnancies depending on the country.<sup>45</sup> The inappropriate use of uterotonic agents during labour dystocia is often an iatrogenic cause of uterine rupture particularly high dose oxytocin for induction of labour at term.<sup>46</sup>

#### 1.5.4 Increase risk of caesarean section

Although caesarean delivery can be lifesaving for the fetus and the mother, there is significant concern that caesarean delivery is being overused.<sup>47</sup> There has been a rapid increase in the rate of caesarean births with a current global caesarean rate of 18.6% and an average increase of 4.4% every year.<sup>48</sup> According to the Saving Mothers Report for 2011 to 2013, South Africa had a national caesarean rate of 23.1%.<sup>42</sup> Labour dystocia is the most commonly reported indication for primary CS.<sup>31</sup> It accounts for roughly 50% of all CS in nulliparous women. It is also the surgical indication for the majority of women with repeat CS in labour.<sup>31</sup>

The relative risks of maternal mortality, ureter and bladder injury, hysterectomy, neonatal respiratory distress and fetal death have all been shown to be increased with CS compared with vaginal delivery.<sup>48</sup> The risks of placenta praevia and uterine rupture in future pregnancies are also increased.<sup>48</sup> Population-based cohorts have demonstrated significantly increased risks of maternal intraoperative trauma and perinatal asphyxia with caesarean delivery at full cervical dilatation compared with caesarean delivery at less than full cervical dilatation.<sup>49</sup> In South Africa, maternal complications were significantly higher following second stage CS.<sup>50</sup> Similar findings have been reported in other studies.<sup>51</sup>

#### 1.5.5 Fistula Formation

Approximately two million women in the developing world are affected by obstetric fistula and according to the WHO there are roughly 130,000 new cases of obstetric fistula each year.<sup>52</sup> A recent study by Vangeenderhuysen *et al.* on incidence of obstetric fistulas in African countries showed that there were roughly 33 000 new cases in sub-Saharan Africa each year.<sup>53</sup> Previous

descriptive studies from sub-Saharan Africa have found that obstetric fistula often result from factors that include an immature and contracted pelvis, cephalopelvic disproportion, and obstructed labour. With labour dystocia, sustained pressure to tissues of the birth canal may impair circulation and result in tissue necrosis.<sup>36</sup> Several days after delivery vesicovaginal, vesicocervical, or rectovaginal fistula may develop.<sup>36</sup> The second most common cause of obstetric fistula is the direct tearing of the vagina and perineum which is more likely to occur during precipitous delivery or obstetric manoeuvres.<sup>54</sup>

#### 1.5.6 Pelvic Floor Injury

Injury to the pelvic floor muscles, nerve supply, or interconnecting fascia is a common consequence of vaginal delivery.<sup>36</sup> Both prolonged second stage of labour and assisted delivery are associated with severe perineal lacerations leading to an increased risk of urinary and anal incontinence following delivery and pelvic organ prolapse in later life.<sup>36</sup> Third and fourth degree tears have been reported to occur in approximately 7% of vaginal deliveries among primiparous mothers in Sweden.<sup>55</sup> Globally, the incidence is estimated at 1 to 4%.<sup>7</sup> In 2015, a prospective cohort study at Chris Hani Baragwanath Academic Hospital, South Africa, was done to evaluate risk factors and describe repair methods for obstetric anal sphincter injuries.<sup>56</sup> The study reported a surprisingly low incidence of 0.5% over a 15 months period. Only 37% of the study population were primigravidas.<sup>56</sup>

A large population-based cohort study by Simic *et al.* showed that the risk of severe perineal lacerations increased with the duration of the second stage.<sup>55</sup> The risk of laceration was almost 1.5 times higher if the second stage continued into the second hour compared with those women delivering after one hour (95% CI 1.28–1.58). Women who required an instrumental delivery were 2.24 times more likely to sustain a severe perineal laceration compared those who did not (95% CI 2.07–2.42).<sup>55</sup>

### 1.6 Neonatal complications of prolonged labour

#### 1.6.1 Neonatal trauma

Trauma to the fetus is more common following delayed second stage of labour.<sup>5</sup> Complications such as shoulder dystocia as well as the greater need for operative deliveries can result in neonatal injuries.<sup>49</sup> Instrumental deliveries are often the cause of neonatal cerebral haemorrhage, fracture or brachial plexus injuries.<sup>49</sup>

### 1.6.2 Birth Asphyxia

Prolonged labour is one of the commonest causes of birth asphyxia.<sup>57</sup> According to the WHO, four million neonatal deaths occur yearly due to birth asphyxia, representing 38% of all under five years childhood mortality. In South Africa, the perinatal mortality rate, for babies weighing more than 500 grams, due to intrapartum asphyxia is 5.6 per 1000 births at district level hospitals and 4.7 per 1000 in national central hospitals.<sup>58</sup> Birth asphyxia is defined as “an insult to the fetus due to failure to breathe or breathing poorly at birth”.<sup>59</sup> It is a metabolic acidemia measured at birth as pH less than 7.0 or a five minute Apgar score of 3 or less.<sup>7</sup> In January 2015, a prospective, observational study by McClure *et al.* found asphyxia to be the most common cause of stillbirth in low to middle income countries.<sup>57</sup>

A study done in July 1988 by Marrin and Paes aimed to evaluate the Apgar score as a diagnostic test for the presence of asphyxia.<sup>60</sup> Using an umbilical cord arterial pH less than 7.2 as evidence of asphyxia, the one minute Apgar score showed poor sensitivity as a marker of asphyxia.<sup>60</sup> For this reason the Apgar score at five minutes is more predictive of fetal well-being. However, only a small minority of neonates with low Apgar scores after five minutes will have evidence of metabolic acidosis on umbilical cord blood gas.<sup>60</sup>

A retrospective analysis by Saunders *et al.* was done to evaluate the relationship between the duration of the second stage of labour and the frequency of low Apgar scores or admissions for neonatal observation. Their findings showed no association with second stage duration of up to three hours.<sup>61</sup> In contrast, a large population-based cohort study done by Sandström *et al.* found that pushing time, in the second stage, of more than 60 minutes was associated with a 2.5 fold increased risk of acidosis compared to 15 minutes or less of pushing (95% CI 1.51–4.30).<sup>62</sup>

The severity of symptoms and the prognosis of the baby depends on the risk factors present as well as the management instituted after delivery. Those neonates who survive the initial period have an increased risk of developing neurological complications including epilepsy, cerebral palsy and developmental delay.<sup>63</sup> Sandström *et al.* found that compared with a duration of the second stage of labour of one hour, a duration of more than four hours was associated with an 80% increased risk of admission to NICU (95% CI 1.58–2.04).<sup>62</sup>

### 1.6.4 Meconium Aspiration

Peripartum aspiration of meconium stained amniotic fluid leads to chemical pneumonitis with

inflammation of pulmonary tissues, mechanical airway obstruction and hypoxia of the neonate. Seriously affected infants frequently die or suffer long-term neurological sequelae.<sup>5</sup>

#### 1.6.5 Neonatal death

In 1987, a study by Friedman and Neff analysed of more than 58 000 deliveries showed that a latent phase of more than 12 hours was associated with a 2.5 fold increases risk of neonatal death.<sup>64</sup> In South Africa, according to the Saving Babies Report 2011-2013, intrapartum asphyxia was the third highest cause of early neonatal death. Common factors included problems with fetal monitoring, the inappropriate use of the partogram and abnormalities of the second stage of labour.<sup>58</sup>

### 1.7 The Partogram in management of labour

In 1954, Friedman developed his cervicograph after observing the cervical dilatation of 100 primigravid African women at term.<sup>65</sup> In 1972 Philpott enhanced this tool by adding categories to aid in the assessment of fetal and maternal condition and progress of labour. This ‘partogram’ provides a practical way to aid midwives in the assessment of laboring women and increase the quality and regularity of observations of mother and fetus in labour.<sup>66</sup> It is a simple, inexpensive tool that gives a continuous pictorial overview of labour and serves as an ‘early warning system’ where progress is not ideal.<sup>66</sup> The alert line was added following the result of a prospective study of 624 women by Philpott. The alert line represents a progress rate of one centimeter per hour.<sup>65</sup> It aims to represent the slowest 10% of primigravidas within the active phase of labour. The alert line was mainly added to help identify women progressing slowly who require transfer to a higher level of care. The second stage of the partogram development was the introduction of an action line four hours to the right of the alert line. This line aims to help identification and prompt effective management of slow progress of labour.<sup>65</sup>

In 2006, a study by Lavender *et al.* showed that by using the partogram the frequency of prolonged and augmented labour, PPH, uterine rupture, puerperal sepsis and perinatal morbidity and mortality was reduced.<sup>67</sup> However, in 2014 a Cochrane review by Lavender T *et al.*, the author concluded that the routine use of the partogram as a standard of labour management could not be recommended based on their findings.<sup>65</sup> They felt that further evidence on its efficacy was required and the use of the partogram should be determined by individual centers until stronger evidence is available.<sup>65</sup>

There are concerns that the use of the partogram increases the number of unnecessary interventions as it assumes that all women will progress at the same rate.<sup>67</sup> In 2006 randomised controlled trials by Lavender T *et al.* assessed different placement of the partogram action lines (two hours vs four hours from the alert line).<sup>67</sup> It was found that the two hour action line increased the need for intervention without improving maternal and neonatal outcomes. For this reason the four hour action line is advocated by the WHO.<sup>67</sup>

### **1.8 Active management of labour**

The correct diagnosis of labour is a very important part of preventing prolonged labour. Incorrect, overdiagnosis of labour can result in inappropriate interventions. The active management of labour includes a number of key components: early amniotomy, early diagnosis of uterine dysfunction, augmentation with oxytocin and good nursing and psychological support throughout the labour.<sup>68</sup> In a 2013 meta-analysis of randomized trials, the "active management of labour" approach, a combination of early amniotomy and early oxytocin administration versus routine care for women in spontaneous labour, shortened the duration of labour and showed a small decrease in the caesarean delivery rate.<sup>68</sup> Another trial done by Akoury *et al.* showed a significant drop in the number of operative deliveries when womens' labour was actively managed. However, despite this, there was no effect on the rate of fetal morbidity and mortality.<sup>69</sup>

#### **1.8.1 Amniotomy**

Artificial rupture of membranes or amniotomy has long been thought to improve the progress of labour by the release of prostaglandins and the strengthening of contractions. In recent years, the use of amniotomy has been introduced as a routine procedure into maternity unit throughout the United Kingdom and Ireland and parts of the developing world.<sup>70</sup> There is, however, little evidence to support the efficacy of amniotomy alone without highlighting the possible adverse effects for both mother and baby. A Cochrane review by Smyth *et al.* showed no difference in the rate of CS for those with amniotomy and those without.<sup>70</sup> Therefore, the routine use of amniotomy is not recommended for women in spontaneous labour or where labour has become prolonged.<sup>70</sup>

#### **1.8.2 Risk of mother to child transmission with rupture of membranes**

At the end of 2015, an estimated 1.8 million children under the age of 15 years were living with HIV infection or AIDS worldwide. The large majority of HIV infected children acquire their

infection through vertical transmission. An estimated 40% of mother-to-child-transmission (MTCT) occurs postnatally during the breastfeeding period, therefore, more than 50% of transmission still occurs in-utero or peripartum.<sup>71</sup> The introduction of combined antiretroviral therapy (cART) has been successful in treating mothers with HIV, suppressing the viral load (VL) and dramatically reducing the risk of MTCT compared with mono therapy or no cART during pregnancy and delivery.<sup>72</sup> Combined ART is now universally used in prevention but evidence from the cART era is sparse. A small study in Spain found an increase in transmission rates of untreated women, with a duration of rupture of membranes (ROM) more than six hours compared with the women taking cART.<sup>72</sup> Whereas a single center study in Miami, Florida, found an association between MTCT and duration of ROM only when the maternal VL was more than a 1000 copies/ml.<sup>72</sup>

Current WHO 2015 guidelines recommend that all pregnant and breastfeeding women living with HIV should be initiated on cART and remain on lifelong treatment regardless of CD4 count and clinical stage of the disease.<sup>73</sup> In South Africa, HIV infection is estimated at about 30.8% of the antenatal population.<sup>74</sup> The risk of becoming infected with HIV during pregnancy and seroconverting is much higher than non pregnant women. This raises the possibility of women with recent HIV infection going into labour without the protection of cART. For this reason, the use of amniotomy in the South African setting is avoided as far as possible. Rupture of membranes for more than four hours before delivery is associated with an increased risk of transmission of HIV/AIDS from mother to child.<sup>75</sup>

### 1.8.3 Oxytocin for augmentation of labour

Oxytocin is one of the most commonly used drugs in labour and is a drug with a long history of use. There are, however, many different dosage regimens suggested which may increase the possibility of misuse. Oxytocin, if used incorrectly, can lead to major complications including uterine hyperstimulation and rupture resulting in fetal hypoxia and even fetal demise.<sup>76</sup> Due to the properties of oxytocin there is also a risk of the patient developing dilution hyponatraemia or water intoxication.<sup>76</sup>

With regards to the dosage of oxytocin, the Royal College of Obstetrics and Gynaecology (RCOG) recommends that oxytocin infusion should be given via a reliable infusion pump at the lowest dose possible. They recommend starting with a rate of one milliunit (mU) per milliliter of oxytocin and increasing by one mU after 30 minutes until the desired effect of three

contractions in 10 minutes is reached. The total dose of oxytocin used should not exceed five units.<sup>76</sup>

The recommendations of the RCOG may be a bit conservative. A retrospective observational study by Zhang *et al.* compared starting infusion rates of oxytocin and the incremental increase every 30 mins. They found that a higher starting dose and incremental increase of four mU/ml reduced the duration of the first stage of labour by 0.8 hours and 1.3 hours in nulliparous and multiparous women respectively. By reducing the duration of labour, the risk of meconium staining, chorioamnionitis and newborn fever was reduced.<sup>77</sup>

### **1.9 New concept of abnormal labour**

Due to the sharp increase in frequency of obstetric interventions such as oxytocin augmentation and caesarean delivery there has been a re-evaluation of guidelines regarding labour dystocia. The sigmoid-shaped labour curve described by Friedman has long been accepted as the normal course of labour.<sup>78</sup> However, more recent studies and observations have suggested a much slower rate of cervical dilation may be more appropriate.<sup>78</sup> Guidelines from the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine for the safe prevention of the primary CS are largely based on work by Zhang *et al.* and the Consortium on Safe Labour (2010), describing patterns of cervical dilation and fetal descent. The following differences have been highlighted: 1) the active phase of labour may not start until the cervix is five to six centimeters dilated, 2) dilation in labour can be slower than one centimeter per hour and 3) the cervix does not always dilate in a linear fashion, but is more likely to be hyperbolic.<sup>79</sup> Therefore, arrest of dilation cannot be diagnosed in a nulliparous woman until six centimeters has been reached and should also not be diagnosed until more than four hours has passed with no progress in the presence of ruptured membranes and adequate contractions.<sup>47</sup>

Concerns have been raised regarding the guidelines set forward by Zhang *et al.* for example, the presence of selection bias of the women included as well as statistical methods used in analyzing data. It is thought that by waiting for four hours to diagnose prolonged labour, treatment of women in the late active stage is delayed, which may not be beneficial. Lastly, it is not ideal to use progress of cervical dilation alone to assess the progress of labour. The labour process is made up of several different maternal and fetal factors, all of which are important in assessing the likelihood of safe vaginal birth.<sup>80</sup>

## **2. AIMS OF THE STUDY**

### **2.1 Study Aims**

Prolonged labour is a major cause of increased maternal and fetal morbidity and mortality. There has been much work done on the subject internationally. The more commonly used definitions of prolonged labour date back to the work by Friedman in the 1950s but more recent studies have been put forward which challenge the existing thoughts on prolonged labour.<sup>2,77</sup> The aim of this study was to describe maternal and fetal adverse outcomes following referral for prolonged labour. It also aimed to assess the indications and appropriateness of referrals from primary level facilities to a tertiary level hospital. In addition, the study aimed to assess the appropriateness of management of women at Charlotte Maxeke Johannesburg Academic Hospital including whether the institutional protocols were followed and resultant patient outcomes.

### **2.2 Objectives**

2.2.1 To determine number of women referred from clinics to CMJAH with prolonged labour and the indications for referral from 1st of August 2016 to 30th of November 2016.

2.2.2 To describe the findings at referral facilities and on arrival at CMJAH

2.2.3 To describe the adverse maternal outcomes

2.2.4 To describe the adverse fetal outcomes.

2.2.5 To describe the management of the women at CMJAH and comment on appropriateness of interventions.

### **3. METHODOLOGY**

#### **3.1 Study Design**

This was a retrospective descriptive study of women who were referred to Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) due to prolonged labour. Women transferred from local clinics and Midwife Obstetric Units were identified using the admission record in Area 162 (Maternity admissions) at CMJAH.

#### **3.2 Study Setting**

Charlotte Maxeke Johannesburg Academic Hospital is a tertiary level hospital that provides Obstetric and Gynecological services and caters to the surrounding areas. It is the referral hospital for clinics, community health care centers and district hospitals in the central Johannesburg region, Gauteng, South Africa.

Low risk pregnant women receive intrapartum care at certain community health care centers in central Johannesburg. These facilities are run by midwives and advanced midwives. If there are any risk factors or problems during labour, the woman is referred to CMJAH for further management. The patient is transported via ambulance accompanied by a midwife to CMJAH. The woman is then received at CMJAH maternity admissions, where she is assessed and managed according to the Wits Obstetric protocol (Appendix C). This includes CTG on arrival and examination to assess progress of labour. Once prolonged labour is confirmed, the woman is transferred to labour ward for augmentation of labour (Appendix D). If the membranes have been ruptured for more than 12 hours, antibiotics are given (Appendix E). Similarly, if the patient arrives in second stage of labour, management is according to the protocol (Appendix F).

#### **3.3 Study Population**

The study population consisted of all women who were referred due to prolonged labour between 1 August 2016 and 30 November 2016. Inclusion criteria included viable pregnancies of more than 34 weeks gestation and cephalic presentation. The population included women transferred from other facilities for alternative indications who were then found to have prolonged labour on arrival at CMJAH. Women who were transferred post delivery or less than 34 weeks gestation were excluded. Women who were diagnosed with prolonged labour whilst at CMJAH but had not been referred from another facility to the hospital were excluded.

### 3.4 Data Collection

Data was collected from medical records with the use of a data sheet (Appendix A). Prolonged labour was defined as per the University of Witwatersrand Department of Obstetrics and Gynaecology protocol (Appendix C). Prolonged latent phase was defined as more than eight hours at less than three centimeters dilated, prolonged active phase, as progress of less than one centimeter per hour and prolonged second stage, if the women had not started to bear down after one hour of full cervical dilatation, or if delivery had not occurred after 45 minutes of pushing in a nullipara and 30 minutes in a multiparous women. The duration of labour (first and second stage) was measured from the time of the first clinical assessment in labour at the referral facility.

Evaluation of the management at CMJAH was based on assessment of the woman by the doctors on duty, the use of cardiotocography (CTG), appropriate usage of the partogram, duration of rupture of membranes and coverage with antibiotics, use of oxytocin and rate of CS. Maternal and neonatal outcomes were also assessed. The CTG was interpreted by the registrar on duty and fetal distress was diagnosed according to the University of Witwatersrand protocol (Appendix G). In the cases of neonatal admission to TICU or NICU, information on neonatal outcomes was obtained from neonatal files.

### 3.5 Data Analysis

Data was captured on Excel spreadsheets. Descriptive statistics were employed using means with standard deviations and medians with ranges. Categorical variables were tabulated and their frequencies were recorded. Comparison of frequencies were made using Chi-squared tests. One way ANOVA tests were used to determine sample variances. Statistical significance was indicated by a p-value of less than 0.05.

### 3.6 Ethical Approval

The research protocol was submitted and approved by the University of Witwatersrand's Human Research Ethics committee (M170268) (Appendix B) and institutional approval was obtained from the CEO of CMJAH.

### 3.7 Funding

Costs for the study were minimal as the study was a retrospective study. Costs included stationary and printing costs which were covered by the principal investigator.

## **4. RESULTS**

### **4.1 Study population**

The total number of women referred to CMJAH over the four month study period was 659 women. Of these, 165 (25.0%) were referred due to prolonged labour. The other 494 women were referred due to other reasons and were excluded from the study. All 165 patient records found.

### **4.2. Maternal characteristics**

#### **4.2.1 Age**

As summarised in table 4.1, mean age identified in this study population was 25.2 years old; the oldest woman was 36 years and the youngest was 14. The majority (n=127 women, 76.9%) were between 20 and 35 years of age.

#### **4.2.2 Parity and gravidity**

The majority of the study population were nulliparous (n=108, 65.5%). The median parity was 0 and range 0-3. Sixty percent of the women (n=99) were primigravidas with a median gravidity of 1 and range of 1-4.

#### **4.2.3 Previous medical and obstetric history**

Eight women (4.8%) out of 165 had a previous first trimester miscarriage, another four (2.4%) had a previous termination of pregnancy (TOP) for social reasons and three participants (1.8%) had an early neonatal death (END) in a previous pregnancy.

Five participants had a history of medical conditions (3.0%); four of them (2.4%) had chronic hypertension and one participant was a known asthmatic. None of the participants had a previous CS delivery.

#### **4.2.4 Gestational age**

Mean gestational age was 38 weeks and 6 days ( $\pm 1$  week 5 days). The majority of the study population (n=149, 90.3%) was at or near term.

#### **4.2.5 Body mass index**

Patients' weight was recorded for 148 patients. The mean patient weight was 67 ( $\pm 13.2$ ) kilograms. A mean height of 1.6 ( $\pm 0.1$ ) meters was recorded for 112 participants thus allowing

for calculation of BMI for 111 participants (67.3%) (in one woman height recorded but not weight). Mean BMI was found to be 26.4 kg/m<sup>2</sup>, with a range of 16kg/m<sup>2</sup> to 60kg/m<sup>2</sup>. Twenty six women (23.4%) had a BMI of more than 30kg/m<sup>2</sup>.

Table 4.1 Patient demographics and other characteristics

| <b>Characteristics</b>                                                                                                                                                | <b>Number (%)</b><br><b>Mean (Standard deviation)</b><br><b>Median (Range)</b><br><b>N=165</b>             | <b>p-value</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------|
| <b>Age (years)</b><br>< 20<br>20-35<br>> 35                                                                                                                           | 25.2 (±5.1)<br>35 (21.3)<br>127 (76.9)<br>3 (1.8)                                                          | 0.1            |
| <b>Parity</b><br>0<br>1<br>2<br>3                                                                                                                                     | 0 (0 – 3)<br>108 (65.5)<br>28 (16.9)<br>25 (15.2)<br>4 (2.4)                                               | 0.1            |
| <b>Gravidity</b>                                                                                                                                                      | 1 (1 – 4)                                                                                                  | 0.1            |
| <b>Gestational age (GA)</b><br><br>36-40 weeks<br>41-42 weeks<br><br>Method of determining GA<br>- Dates (LMP)<br>- Early US<br>- Late US<br>- Symphysiofundal height | 38weeks 6days (±1 week 5 days)<br>149 (90.3)<br>16 (9.7)<br><br>141 (85.5)<br>6 (3.6)<br>13 (7.9)<br>5 (3) | 0.1            |
| <b>BMI(kg/m<sup>2</sup>)</b>                                                                                                                                          | N=111<br>26.4 (±6.15)                                                                                      | 0.1            |

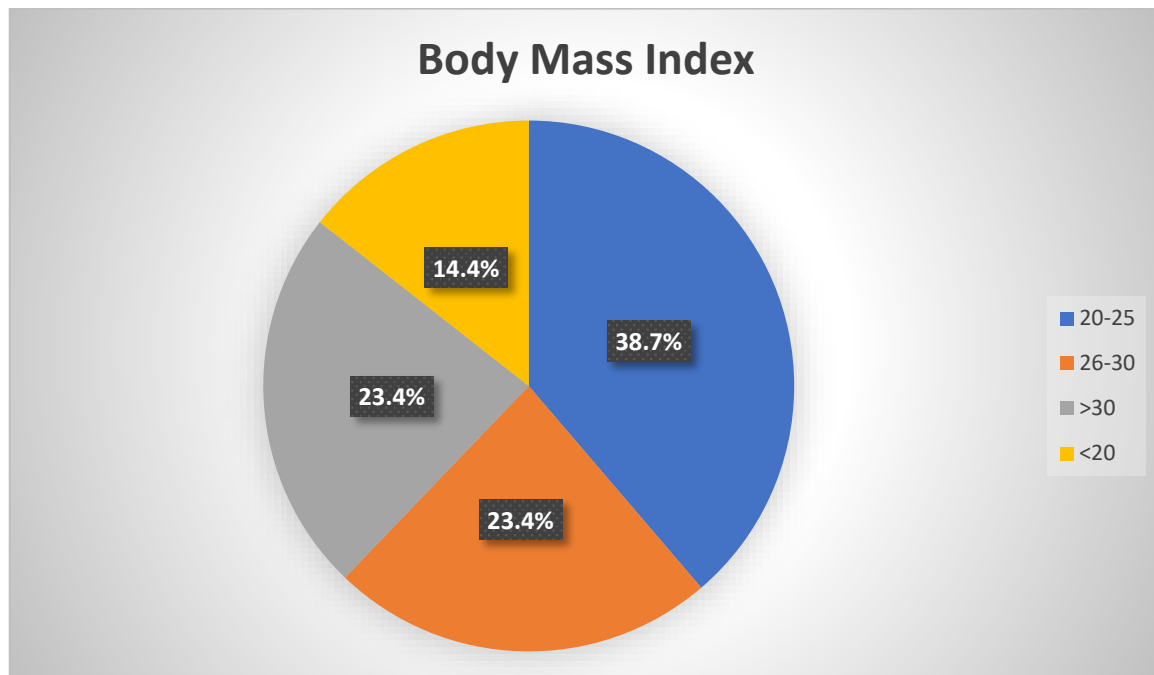


Figure 4.1 Distribution of BMI

#### 4.2.6 Booking bloods

All women who were referred due to prolonged labour were booked either at the clinic or hospital that referred them. Average booking haemoglobin (Hb) was 11.9g/dL ( $\pm$ SD, 1.2g/dL) and 163 women (98.8%) were Rhesus positive. The RPR was known in 159 women and was non-reactive in the majority (96.4%), reactive in five (3%) and unknown in one woman.

Twenty four women out of 165 (14.5%) were HIV positive, of which all except one was on HAART (95.8%). Their average CD4 counts were 366 cells/mm. Three women had a viral load (VL) lower than detectable levels (LDL), in five the level was less than 1000 copies and in the remaining 15 (62.5%) women, VL was unknown.

### 4.3 Referral

#### 4.3.1 Referral place

The majority of the study population was referred from local clinics (n=148, 89.7%). Only 17 women (10.3%) were referred from district level hospitals (South Rand Hospital). Distribution of referral facilities shown in figure 4.2.

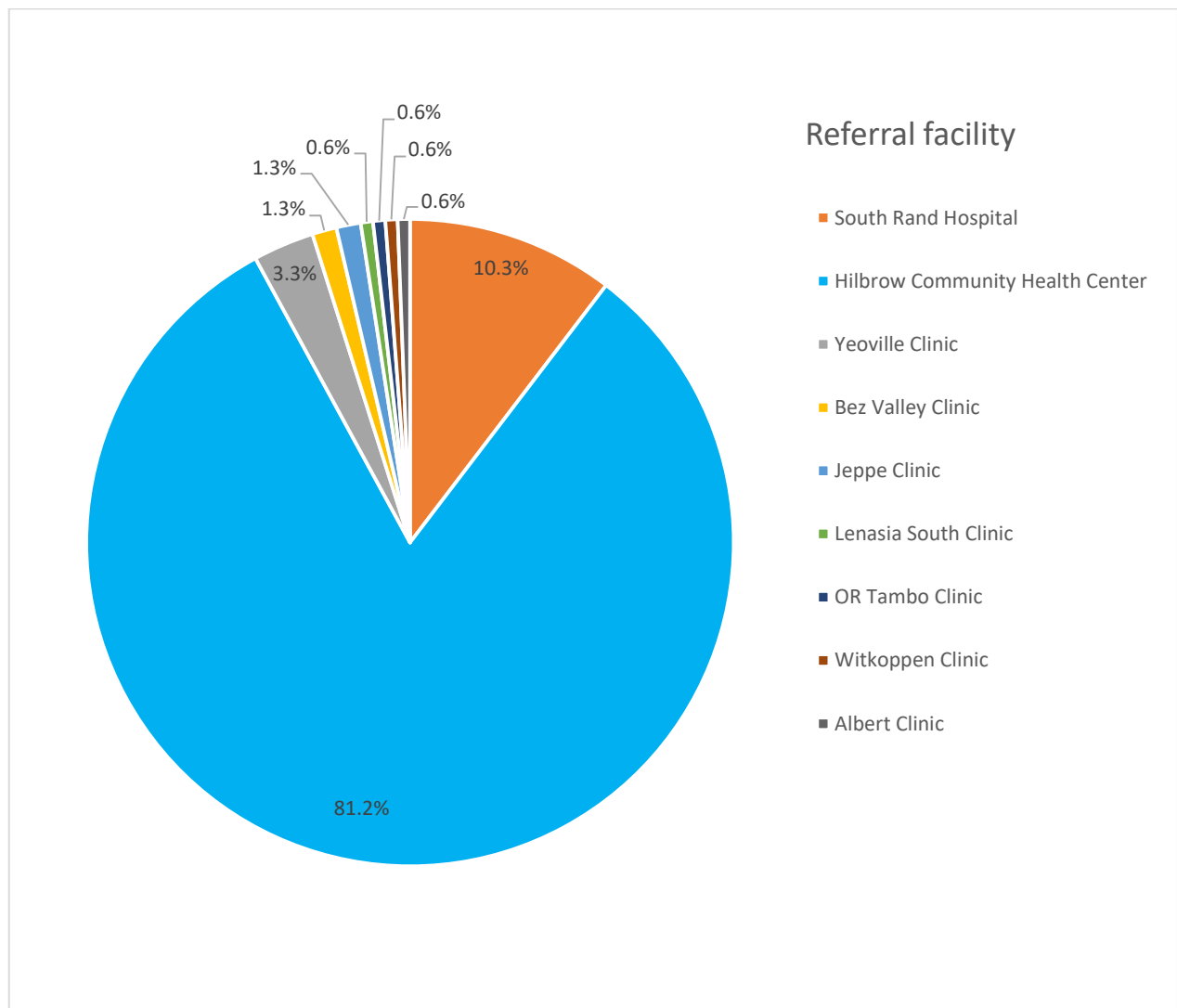


Figure 4.2 Distribution of referral facilities

#### 4.3.2 Reason for referral

Most of the women were referred due to prolonged active phase of labour, 77 (46.6%) and prolonged latent phase of labour 75 (45.5%). Only 13 (7.9%) women were referred due to prolonged second stage of labour. Some patients who were referred for prolonged active phase also had a prolonged latent phase when analyzing their clinic records. Seven women were referred for fetal distress and two for hypertension in pregnancy. On arrival at CMJAH they were also found to have prolonged labour. Additional indications for referral included CPD, MSL, low haemoglobin and maternal tachycardia.

Table 4.2 Indications for referral to CMJAH

| <b>Reason for referral</b>    | <b>Number (%)</b><br><b>N=165</b> |
|-------------------------------|-----------------------------------|
| <b>Prolonged active phase</b> | 77 (46.6)                         |
| <b>Prolonged latent phase</b> | 75 (45.5)                         |
| <b>Prolonged second stage</b> | 13 (7.9)                          |

#### 4.3.3 Time taken to transfer

Average time taken to decision at the referral facility was three hours with a median of 10 hours and a range of 0.25 to 37 hours. The average actual time taken to transfer the patient to CMJAH was 2.5 hours with a median of 2 hours and range of 0.25 to 10.5 hours.

### 4.4 Progress of labour

#### 4.4.1 Assessment on arrival at CMJAH

From 165 patients, 113 (68.5%) were in active phase of labour ( $\geq 4\text{cm}$ ) on arrival to CMJAH, 33 (20%) were in latent phase of labour ( $\leq 3\text{cm}$ ) and only 19 (11.5%) women arrived in second stage of labour. The mean cervical dilatation was 5.7 ( $\pm 2.4$ ) cm.

Forty of the 75 women (53.3%) referred as prolonged latent phase, arrived in active phase of labour, and nine of the 77 women (11.6%) referred as prolonged active phase of labour, arrived fully dilated.

#### 4.4.2 Duration of labour

One hundred and eleven women had prolonged latent phase. The mean duration was 16.2 ( $\pm 5.9$ ) hours. There were no details available on the latent phase for 16 women because they arrived in active phase of labour. A total of 92 women had prolonged active phase with a mean duration of 11.1 ( $\pm 4.3$ ) hours. The maximum duration was 25 hours. For the total sample (n=165), the average duration of second stage of labour was 46 minutes. However, for the 31 women with prolonged second stage the average duration was 115.9 ( $\pm 78.7$ ) minutes with the range of 45 – 360 minutes.

When comparing the duration of labour between nulliparous and multiparous women, the difference between mean duration of latent and active phase was not statistically significant. For

the second stage of labour, mean duration for nulliparous and multiparous women was again not statistically significant ( $p=0.73$ ) (table 4.3).

Table 4.3 Duration of stages of labour according to parity

|                            | <b>Stage of Labour (hours)</b> |               |                                       |
|----------------------------|--------------------------------|---------------|---------------------------------------|
|                            | <b>Mean (SD)</b>               |               |                                       |
|                            | <b>Latent</b>                  | <b>Active</b> | <b>2<sup>nd</sup> stage (minutes)</b> |
| <b>Nulliparous (n=108)</b> | 15.9 (6.24)                    | 10.4 (4.2)    | 147.6 (84.9)                          |
| <b>Multiparous (n=57)</b>  | 14.8 (5.9)                     | 11.1 (4.9)    | 94.5 (55.9)                           |
| <b>p value</b>             | 0.37                           | 0.52          | 0.73                                  |

#### 4.4.3 Mode of delivery

Ninety one (55.2%) women with prolonged labour had normal vaginal delivery and eight (4.8%) had instrumental delivery. The remainder of the women ( $n=66$ , 40%) delivered by CS. The most common indication for CS was fetal distress ( $n=44$ , 66.6%) followed by poor progress ( $n=21$ , 31.8%) CPD ( $n=11$ ; 16.6%), failed augmentation of labour ( $n=6$ ; 9.1%) and failed vacuum delivery ( $n=2$ ; 3.0%). Details of patient deliveries are indicated in table 4.4.

Table 4.4 Mode of delivery

|                                                      | <b>Mode of Delivery</b> |                     |               |                          |
|------------------------------------------------------|-------------------------|---------------------|---------------|--------------------------|
|                                                      | <b>Number (%)</b>       |                     |               |                          |
| <b>Phase of prolonged labour indicating referral</b> | <b>Vaginal Delivery</b> | <b>Instrumental</b> |               | <b>Caesarean section</b> |
|                                                      |                         | <b>Forceps</b>      | <b>Vacuum</b> |                          |
| <u>Latent phase</u>                                  | 40 (43.9)               | 2                   | 1             | 31 (47)                  |
| <u>Active phase</u>                                  | 45 (49.5)               | 0                   | 3             | 30 (45.5)                |
| <u>Second stage</u>                                  | 6 (6.6)                 | 1                   | 1             | 5 (7.5)                  |
| <u>Total</u>                                         | 91 (55)                 | 3                   | 5             | 66 (40)                  |

## 4.5 Maternal and neonatal outcomes

### 4.5.1 Maternal outcomes

Maternal outcomes are shown in table 4.5. The mean blood loss for all deliveries was 423ml ( $\pm 251$ ml), seven women with prolonged labour complicated with postpartum haemorrhage. One of them delivered by CS and the other six had normal vaginal deliveries. Of these seven women five required blood transfusion, however, one patient with a haemoglobin of 5.7g/dL refused transfusion due to religious reasons. Puerperal sepsis was identified in three women (1.8%); two of them were pyrexial and tachycardic on day two post CS and responded to intravenous (IV) antibiotics and one presented on day ten post CS with superficial wound sepsis. She also responded well to IV antibiotics. Two women had deep second degree vaginal tears and 36 women had elective episiotomy. No severe perineal lacerations were sustained.

Three women (1.8%) required evacuation of the uterus for retained products of conception. One woman presented with antepartum haemorrhage (APH) and abruptio placenta was confirmed during CS. One woman developed an ileus on the third day post CS. One woman required a relook laparotomy which found intra-abdominal bleeding due to poor haemostasis at the initial surgery.

Table 4.5 Maternal complication

| Maternal outcomes              | Number (%) |
|--------------------------------|------------|
| Infection                      | 3 (1.8)    |
| Primary postpartum haemorrhage | 7 (4.3)    |
| Uterine rupture                | 0          |
| Pelvic floor injury:           |            |
| - 3rd/4th degree               | 0          |
| - 2nd degree                   | 2 (1.2)    |
| Others Complications:          |            |
| - Evacuation                   | 3 (1.8)    |
| - Abruptio placenta            | 1 (0.6)    |
| - Relook laparotomy            | 1 (0.6)    |
| - Ileus                        | 1 (0.6)    |

#### 4.5.2 Neonatal outcomes

The mean weight was 3227g ( $\pm 437$ g). Five babies were less than or equal to 2500g; 154 babies between 2500 and 4000 g; and five (3%) were more than 4000g. The woman with the heaviest baby (5080g) delivered vaginally after a prolonged second stage.

Out of 165, one baby was fresh still born and the mother had been referred for prolonged latent phase of labour and prolonged ruptured of membranes. She was booked and delivered by CS, the cord was found wrapped twice around the baby's neck.

A total of 47 babies (28.6%) required observation in TICU, mainly due to respiratory distress. Nine babies (5.5%) out of 164, required admission to neonatal ICU. Apgar scores of less than 7 at five minutes were found in eight babies (5.5%). No birth trauma was recorded. Eleven out of 164 babies (6.7%) had meconium stained liquor and were admitted to TICU for observation due to respiratory distress and possible meconium aspiration pneumonia. This comprised 23.4% of the admissions to TICU.

#### 4.6 Management at CMJAH

Of the 165 women, cardiotocography (CTG) was performed in 139 women (84.2%) on admission. Twenty seven (16.4%) women had a pathological trace requiring urgent delivery.

The partogram was plotted correctly in 129 (78.2%) women, incorrectly in seven (4.2%) women. It was plotted at all in 29 women. Active intervention (ROM, AOL, antibiotic, episiotomy), where the patient crossed the action line of the partogram, was instituted only in 59 (35.8%) women. In the rest of the women there was either a delay in active intervention or no intervention at all. All steps of the protocol were correctly followed, as appropriate for the individual woman, in 55 (33.3%) of women. In 110 (66.7%) women at least one element of the protocol was performed incorrectly or not at all.

Table 4.6 Management at CMJAH

|                                     | <b>Wits Obstetric protocol followed:</b> |                    |                 |
|-------------------------------------|------------------------------------------|--------------------|-----------------|
|                                     | <b>Correctly</b>                         | <b>Incorrectly</b> | <b>Not done</b> |
| <b>Cardiotocogram (CTG) (n=165)</b> | 139 (82.4%)                              | 0                  | 26 (15.7%)      |
| <b>Partogram (n=165)</b>            | 129                                      | 7                  | 29              |
| <b>Active Management:</b>           |                                          |                    |                 |
| <b>Artificial ROM</b>               | 29                                       |                    | 43              |
| <b>Augmentation of labour</b>       | 34                                       |                    | 53              |
| <b>Antibiotics</b>                  | 34                                       |                    | 29              |

## 5. DISCUSSION

### 5.1 Characteristics of women with prolonged labour

Compared with previous studies, age was not shown to be a significant risk factor for labour dystocia in this study ( $p=0.1$ ). The majority of the population (81.2%) were between 20 and 34 years old and only nine out of 165 participants (5.4%) were of advanced maternal age. In the study by Treacy A *et al.* approximately 10% of women were 35 years or older.<sup>12</sup> This would indicate that either, the index study population has fewer women with pregnancies at an advanced maternal age or that there may be a lower prevalence of older women with labour dystocia in the index study population. According to Statistics South Africa, only 3.6% of women giving birth in 2016 were between the ages of 40 and 54 years.<sup>81</sup> Considering the study population comprised low risk women referred from the clinic, the low number of older women is not surprising. Older pregnant women are more likely to have medical or obstetric conditions which necessitate management at a higher level of care both antenatally and intrapartum.

Mothers less than 20 years have been shown to have an increased risk of chorioamnionitis and endometritis following prolonged labour, however, in this study the three women who developed infection were all between 20 and 30 years old.<sup>19</sup>

All the women in the study had received antenatal care. There were five women (3%) with a diagnosis of syphilis during the pregnancy. This figure is similar to the estimated national syphilis prevalence of 2% in antenatal clinics in South Africa (2015).<sup>74</sup> All of the women diagnosed with syphilis had been treated appropriately during the pregnancy at their local clinic. Over 14% of women in this study were known to be HIV infected. This is less than half the South African national prevalence of 30.8% HIV infected pregnant women.<sup>74</sup>

The percentage of women with obesity in this study (23.4%) is noticeably higher than the national average according to the SADHS where roughly 15% of women between 15 and 45 years were found to be obese.<sup>14</sup> Previous studies have showed that a BMI of greater than 30 kg/m<sup>2</sup> increases the risk of prolonged labour, however, in this study there was no association between BMI and labour dystocia ( $p=0.1$ ).<sup>19</sup>

Further to this, obese women are more likely to present with prolonged labour in the first stage rather than the second stage of labour as described by Fyfe *et al.*<sup>17</sup> In the index study there was no association found between stage of prolonged labour (latent phase, active phase or second stage) and overweight or obesity. However, the numbers in this study are too small to adequately explore this.

There were two women referred to CMJAH with hypertension that had developed or around the time of labour. None of these women required magnesium sulphate infusion. The effect of hypertension or magnesium cannot be commented upon.

A study by Okewole *et al.* on maternal height and likelihood of vaginal delivery, showed that maternal height greater than 165 cm was positively associated with vaginal delivery.<sup>21</sup> In the index study, the average maternal height was only 160 cm which may have had an impact on the progress of labour. Dujardin *et al.* have previously shown an association between short maternal height and increased risk of CS<sup>22</sup>, in our study there were only ten women with a height less than 150 cm, five of whom were delivered via CS. It has been shown previously the increased prevalence of anthropoid pelvices in the African population contributes to an increase in emergency CS for CPD.<sup>21</sup> The study population was comprised of only African women, however, this is merely a representation of the population served by CMJAH and the community health care centers in central Johannesburg.

There was no significant association found between gestational age and prolonged labour ( $p=0.1$ ) as majority of the study population were near or at term. Only 16 women (9.7%) were between 41 and 42 weeks. The average birth weight was 3227g which is less than the expected average birth weight of 3500g. Fetal macrosomia is a recognized risk factor for labour dystocia, however, in our study only three percent of babies in our study were macrosomic.<sup>28</sup>

## **5.2 Referral factors**

The majority of women (89.7%) were referred from local clinics with 17 (10.3%) women coming from a level 1 district hospital. This indicates a problem in the referral system as women with labour dystocia should be managed at a district level. However, there have been several staffing and resource issues at South Rand Hospital resulting in a lack of theatre

facilities at this hospital. Of the 17 women referred from SRH, eight delivered vaginal, eight needed CS and one was delivered via forceps.

A total of 659 women were referred to CMJAH during the study period, with 25% of the referrals due to prolonged labour. This percentage is similar to a study by Perdok *et al.* in The Netherlands looking at referrals from primary to secondary level facilities where 23.5% of women referred were due to prolonged labour.<sup>82</sup> Transport between facilities can often result in delays in appropriate management. In this study, the average duration for transfer of a patient was 2.5 hours. This is in comparison to the study from The Netherlands, a developed country, where the median referral to delivery time was four hours and 40 minutes.<sup>82</sup>

### **5.3 Mode of delivery**

Of the women referred due to prolonged first stage of labour, 55.9% delivered vaginally, 40.1% had a CS and only 3.9% had an assisted delivery. Similarly, the women with prolonged second stage, 46.1% delivered vaginally, 38.5% via CS and 15.4% following assisted delivery. This percentage of women delivering vaginally is similar to the finding of Perdok *et al* where 58.3% delivered vaginally after prolonged first stage and 42.1% following prolonged second stage. The biggest difference is the rate of CS section and assisted delivery. In the Netherlands, only 14.3% of women required CS for prolonged first stage compared with the 40.1% in this study. In women with prolonged second stage, 56.1% delivered via assisted delivery compared to the 15.4% in this study.<sup>82</sup> These differences may highlight the effect of active management, correct implementation of hospital protocols or experience of health care personnel in assisted delivery. It may also result from a difference in the antenatal populations with regards to ethnicity and pelvic shape.<sup>23</sup>

Similar to previous studies, there was a higher proportion (65.5%) of nulliparous women in our study.<sup>24</sup> There were 53 out of 108 (49%) primigravid women who required CS. This is a much higher percentage than the 15% found by Hashim *et al* in India.<sup>24</sup> The duration of active and latent phase of labour in this study was not significantly different between primigravid ( $p=0.37$ ) and multigravida women ( $p=0.52$ ) as found in previous studies.<sup>24</sup> There was also no significant difference between the length of the second stage between primi and multiparous women ( $p=0.73$ ) which is a finding common to several previous studies.<sup>47</sup>

There were a number of women who arrived at CMJAH having progressed from the time at which the decision was made to refer. Many of these women went on to deliver vaginally with no adverse outcomes for mother or baby. This may indicate that the women were prematurely and inappropriately referred to CMJAH. This may be as a result of being incorrectly diagnosed in labour or from clinic staff not adhering to referral guidelines. However, these findings lend support to the newer guidelines advocated by the ACOG that the rate of cervical dilation is much slower than previously thought. Women may progress more slowly but still deliver vaginally if given enough time. The data to support this was collected in the USA by Zhang *et al.* and the Consortium on Safe Labour where the majority (78.4%) of women were given epidural analgesia.<sup>83</sup> In comparison, at CMJAH, there is no epidural service and most women are given intramuscular Pethidine for pain control. Allowing more time to achieve vaginal delivery decreases the number of repeat CS and the associated complications, however, it is not justifiable to continue labouring a patient for prolonged periods of time without adequate analgesia.<sup>79</sup>

#### **5.4 Maternal outcomes of prolonged labour**

Puerperal sepsis has previously been found to be more common in women who delivered by CS.<sup>5</sup> In our study, puerperal sepsis developed in only three women (1.8%), all of them underwent CS. Two out of the three women underwent CS due to prolonged second stage of labour of over two hours. This is in keeping with the findings of Stephansson *et al.* who found increased risk of infection with increasing duration of the second stage of labour.<sup>37</sup> The overall rate of maternal infection was surprisingly low at 1.8% with no cases of chorioamnionitis. This is lower than the four percent puerperal sepsis found by Maghoma and Buchmann at Chris Hani Baragwanath Hospital.<sup>5</sup>

The most common cause of PPH in women is uterine atony with labour dystocia being a significant risk factor.<sup>36</sup> In this study, the majority of cases (85.7%) of PPH occurred in women following a vaginal birth with the most noticeable cause being uterine atony. Only one patient with primary PPH delivered by CS.

It is estimated that between one and four percent of vaginal deliveries are complicated by obstetric anal sphincter injuries internationally.<sup>7</sup> In this study, there were no third or fourth degree perineal tears, only two women out of 99 (2%) who delivered vaginally, had deep

second degree vaginal tears. This may be due to the fact that less than five percent of women had an assisted delivery. Only 13% of women in this study were referred due to prolonged second stage of labour, this may also account for the low number of perineal injuries as risk of severe perineal laceration has been found to be related to prolonged length of second stage of labour rather than prolonged first stage of labour.<sup>55</sup> Findings in this study were more in keeping with those of the work done at Chris Hani Baragwanath Hospital by SM Tshabalala which found an incidence of third or fourth degrees tears of 0.5%.<sup>56</sup>

None of the women in this study had a rupture of the uterus. Uterine rupture is a very uncommon complication of prolonged labour in a woman with an unscarred uterus.<sup>45</sup> Augmentation of labour with high-dose oxytocin has an increased risk of uterine rupture<sup>46</sup>, in this study, all of the women who were augmented received low-dose oxytocin according to the Wits protocol (Appendix D).

### **5.5 Fetal outcomes of prolonged labour**

Fetal trauma is more common during prolonged second stage of labour due to an increase in instrumental delivery or shoulder dystocia.<sup>5,49</sup> However, if the 13 women referred due to prolonged second stage, no fetal injuries were recorded.

The primary indicator of birth asphyxia was an Apgar score less than 7 at five minutes. There were similar numbers of women with prolonged latent (2 women) and active phase (3 women) and second stage (3 women) of labour and the incidence of Apgar score less than 7 at five minutes. Five of these women underwent CS delivery and one assisted delivery due to fetal distress diagnosed on CTG. A prospective study by Sykes *et al.* to assess the relationship between the Apgar scores and the acid-base status of the babies at birth found that only 19% of the babies with a five minute Apgar score less than 7 had severe acidosis on cord blood gas.<sup>60</sup> Cord blood is not routinely taken at birth for deliveries at CMJAH. Therefore, it is not possible to determine whether the neonates with low 5 minute Apgar score truly had birth asphyxia.

In this study, a total of 47 babies required admission to TICU mainly due to respiratory distress. The majority (85.1%) of them were delivered following prolonged first stage of labour, latent phase 19/47 and active phase 21/47 respectively, and a minority were delivered

following prolonged second stage of labour. Considering that only 13 women were referred due to prolonged second stage of labour, the percentage of babies requiring admission is almost double that of the babies delivered following prolonged first stage (53.8% vs 25.3% and 27.3% respectively). This is in keeping with studies showing that prolonged second stage of labour is associated with an increased risk of admission.<sup>62</sup>

Of the nine babies admitted to NICU, six of them were delivered following prolonged latent phase. This accounts for the majority of NICU admissions and is contrary to the findings by Bailit *et al.* who reported no differences in terms of NICU admission between women having prolonged latent and active phases of labour.<sup>6</sup> The poor reserve of the babies in this study may indicate the presence of underlying issues or intrauterine growth restriction not pick up during antenatal care. Alternatively, it may indicate the poor condition of women during prolonged labour, for example dehydration.

## **5.6 Management at CMJAH**

The correct diagnosis of labour is a very important part in preventing prolonged labour and avoiding inappropriate interventions. Diagnosis of prolonged labour (latent, active or second stage) from the referral center was confirmed in all participants on arrival at CMJAH. There were 89 cases where there was a delay in diagnosis of prolonged labour at the clinic which caused a further delay in referral and management. Almost a quarter of these women had neonatal complications.

Of the 139 women who had a CTG done on arrival at CMJAH, 27 (16.4%) of the women had a pathological trace according to the Wits protocol (Appendix G). Emergency delivered was arranged for these women. Fourteen (51.8%) of the babies delivered following pathological CTG intrapartum were admitted to neonatal care units (TICU or NICU) post delivery for observation. Staff shortage, patient overload and equipment shortages may account for the 15.7% of women who did not have CTG on arrival at CMJAH. Some patients in second stage labour may also been transferred to labour ward directly for delivery and therefore did not have CTG done in maternity admissions.

In this study, in a tertiary referral center, the partogram was plotted correctly in 129 (78.2%) women, incorrectly in seven (4.2%) women and not used at all in 29 women. This is

concerning considering the level of training of the health workers working in a tertiary level center. A study amongst healthcare providers in Nigeria, showed that knowledge on the use of the partograph for labour management is very low amongst nurses, midwives, and doctors working in the primary and secondary health care levels when compared to tertiary level care.<sup>84</sup>

The partogram was acted on appropriately (ROM, AOL, antibiotic, episiotomy) in only 59 women (35.7%). In the remainder of women there was either a delay in appropriate management or no active intervention. Active management has been shown in several centers to improve progress in labour and reduce the CS rate, however, the routine use of amniotomy in all women is not recommended. Due to the high rate of HIV in the South African population and the increased risk of mother to child transmission with increasing duration of ROM, amniotomy is not advisable. In this study, almost 15% of women were HIV infected and more than 60% of these women had an unknown VL. For this reason, routine amniotomy was not used in 80% of HIV positive women with intact membranes. This lack of intervention may have impacted on progress of labour. Amniotomy in these patients may also have alerted health care workers to the presence of MSL. There was often a delay in initiation of augmentation of labour. This may have been due to the shortages of nursing staff working in labour ward resulting in a higher ratio of women to nursing staff than is recommended.

### **5.7 Limitations**

This study was a retrospective study over only four months. This short period of time limited the study sample to 165 women. Maternity records were available for all women but poor documentation limited the amount of information obtained. Data collection also relied on record keeping from clinics. Paediatric records were not available for all babies and information such as cord blood gas was not available which limited our interpretation of the fetal outcomes.

### **5.8 Recommendation**

With the controversy in the definition of labour and the small population of this study, more research is needed to determine the definitions of prolonged labour in the South African context. Comparative studies to evaluate the maternal and fetal outcomes in different groups

of women with different definitions of labour (the old and new definitions) would help to establish a clear protocol for diagnosis and management of prolonged labour in this population. Improving the correct usage of institutional guidelines and the partogram in management of women referred for prolonged labour may decrease the number of resultant adverse fetal outcomes.

## **6. CONCLUSION**

There were minimal maternal adverse outcomes in women referred to CMJAH for prolonged labour. Fetal adverse outcomes were more apparent with over a quarter of babies requiring admission for respiratory distress and one intrauterine fetal demise. The institution protocol for management of labour dystocia was correctly followed only in 33.3% of the study population. This is a figure that should be address in future to help decrease the ever increasing rate of litigation in Obstetrics in the public sector.

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## APPENDIX A: DATA SHEET

|                                              |      |                                          |                                  |                     |                   |                            |
|----------------------------------------------|------|------------------------------------------|----------------------------------|---------------------|-------------------|----------------------------|
| <b>Data Collection Sheet</b>                 |      |                                          |                                  |                     |                   |                            |
| Research No.                                 |      |                                          |                                  |                     |                   |                            |
| <u>Demographics and pregnancy data:</u>      |      |                                          |                                  |                     |                   |                            |
| Age                                          |      |                                          |                                  |                     | height            |                            |
| parity /gravidity                            |      |                                          |                                  |                     | weight at booking |                            |
| gestational age                              |      |                                          | By EUS/LUS/DATES/SFH             |                     | bmi               |                            |
| Any maternal medical conditions/ previous CS |      | Yes/No                                   | Specify                          |                     |                   |                            |
| <u>Referral:</u>                             |      |                                          |                                  |                     |                   |                            |
| referral place                               |      | Clinic/Hospital(specify)                 |                                  |                     |                   |                            |
| Reason for referral                          |      |                                          |                                  |                     |                   |                            |
| Stage of labour                              |      | Latent/active/second stage               |                                  |                     |                   |                            |
| Times                                        |      | pt arrived to clinic                     | decision of transfer             | pt arrived to CMJAH | time of delivery  |                            |
| Date:                                        |      |                                          |                                  |                     |                   |                            |
| Management at CMJAH:                         |      |                                          |                                  |                     |                   |                            |
| CTG                                          |      | Yes/No                                   | Reactive/suspecious/pathological |                     |                   |                            |
| <u>Partogram used</u>                        |      | Yes/No                                   | cervical dilatation on admission |                     |                   |                            |
| Partogram acted                              |      | Yes/No                                   | HAB on admission                 |                     |                   |                            |
| AROM/SROM                                    | When | Yes/No                                   |                                  |                     |                   |                            |
| Augmentation with oxytocin                   |      | Yes/No                                   |                                  |                     |                   |                            |
| Antibiotics given                            |      | Yes/No                                   |                                  |                     |                   |                            |
| PROTOCOL followed                            |      | YES/NO                                   |                                  |                     |                   |                            |
| Mode of delivery:                            |      |                                          |                                  |                     |                   |                            |
| NVD                                          |      | Yes/No                                   |                                  | Episiotomy cut      | Yes/No            |                            |
| Assisted delivery                            |      | Vacum/Forceps                            |                                  |                     |                   |                            |
| cesarean section                             |      | Yes/No                                   |                                  |                     |                   |                            |
| <u>Adverse outcomes:</u>                     |      |                                          |                                  |                     |                   |                            |
| <u>Maternal:</u>                             |      | / Unknown                                |                                  |                     |                   |                            |
| infection                                    |      | chorioaminionitis/Peurperal sepsis/other |                                  |                     |                   | (Within current admission) |
| Primary PPH                                  |      | Yes/No                                   |                                  |                     |                   |                            |
| uterine rupture                              |      |                                          |                                  |                     |                   |                            |
| pelvic floor injuries                        |      |                                          |                                  |                     |                   |                            |
| complications at CS                          |      |                                          |                                  |                     |                   |                            |
| Others                                       |      |                                          |                                  |                     |                   |                            |
| <u>Fetal:</u>                                |      |                                          |                                  |                     |                   |                            |
| Trauma                                       |      |                                          |                                  |                     |                   |                            |
| Asphyxia                                     |      | Apgar scores                             |                                  | Cord pH             | ABG               |                            |
| Meconium aspiration                          |      | Yes/No                                   |                                  |                     |                   |                            |
| Admission to TU/NICU                         |      | Yes/No                                   |                                  |                     |                   |                            |
| END                                          |      | Yes/No                                   |                                  |                     |                   |                            |
| MSB                                          |      | Yes/No                                   |                                  |                     |                   |                            |
| FSB                                          |      | Yes/No                                   |                                  |                     |                   |                            |
| Birth Weight                                 |      | grams                                    |                                  |                     |                   |                            |
| HIV Status                                   |      |                                          |                                  |                     |                   |                            |
|                                              |      | 1.Non Reactive/ 2.Reactive/ 3.Unknown    |                                  |                     |                   |                            |
| If Reactive, On HAART                        |      | 1.Yes/ 2.No/ 3.Unknown                   |                                  |                     |                   |                            |
| When was HAART started                       |      | / Unknown                                |                                  |                     |                   |                            |
| CD4 count/Viral load                         |      | / Unknown                                |                                  |                     |                   |                            |
| Booking Blood:                               |      |                                          |                                  |                     |                   |                            |
| HB                                           |      |                                          |                                  |                     |                   |                            |
| RH                                           |      |                                          |                                  |                     |                   |                            |
| RPR                                          |      |                                          |                                  |                     |                   |                            |

## APPENDIX B: ETHICS CLEARANCE CERTIFICATE



R14/49 Dr Darin Ali Ashnaf

### HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL) CLEARANCE CERTIFICATE NO. M170268

**NAME:** Dr Darin Ali Ashnaf  
**(Principal Investigator)**  
**DEPARTMENT:** Obstetrics and Gynaecology  
Charlotte Maxeke Johannesburg Academic Hospital

**PROJECT TITLE:** Maternal and Fetal Outcomes of Patients Referred to  
Charlotte Maxeke Johannesburg Academic with  
Prolonged Labour

**DATE CONSIDERED:** 24/02/2017

**DECISION:** Approved unconditionally

**CONDITIONS:**

**SUPERVISOR:** Dr Susan Branch

**APPROVED BY:**   
Professor P. Cleaton-Jones, Chairperson, HREC (Medical)

**DATE OF APPROVAL:** 24/04/2017

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 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised 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 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 \_\_\_\_\_

## APPENDIX C: INSTITUTIONAL PROTOCOL

### GENERAL CARE OF WOMEN IN LABOUR

#### 1. Low risk women who present to hospitals in labour

Many women present in labour at hospitals even though they have no risk factors to qualify for hospital delivery. Such women, if not in advanced labour (cervix  $\leq 6$  cm dilated) may be transferred to a local midwife obstetric unit if a 'triage' system exists, with ambulance or planned patient transport available.

#### 2. Respect, privacy and companionship

Treat all women in labour with respect and courtesy. Ensure privacy and always perform intimate examinations behind screens or curtains. Each woman should be allowed one visitor to provide companionship during labour, subject to the discretion of the midwife in charge of the labour ward.

#### 3. Diet and fluids

Low risk women can be allowed to eat and drink during labour. An intravenous infusion is not needed. In general, high risk women should not eat in the active phase of labour, but may drink clear fluids. High risk women usually require an intravenous infusion of Ringer-Lactate solution to run at 120 mL/hour, or 70 mL/hour with cardiac disease or hypertension.

#### 4. Keeping the bladder empty

A full bladder interferes with the efficiency of uterine contractions. Be ready to assist women to go to the toilet or use a bedpan. If necessary, pass a urinary catheter to empty the bladder.

#### 5. Posture

Encourage women to walk around in the latent phase of labour, and in the early stages of the active phase of labour if possible. Any posture (sitting, standing, kneeling, lying) is acceptable in both phases of the first stage of labour except the flat supine position which causes aortocaval compression by the pregnant uterus.

#### 6. Artificial rupture of the membranes (amniotomy)

This procedure is not necessary in the *routine* management of normal labour, and is contraindicated in HIV-infected women with elevated plasma viral load (VL), unless the expected clinical benefit (better labour progress) is greater than the perceived increased risk of mother-to-child transmission of HIV.

#### 7. Partogram

In the active phase of labour, all clinical observations must be entered on the partogram. If an adequate entry has been made on the partogram, there is no need to make duplicate written notes. Examples are shown on pages 27, 33 and 34. A clinical assessment and plan should however be written separately in the notes after each labour progress examination.

## CARDIOTOCOGRAPHY (CTG) ON ADMISSION

Ideally, women who present to a referral hospital in labour should have specific risk factors, and need continuous CTG in labour. Run an admission tracing for 20 minutes, to screen for abnormalities before transferring the woman to labour ward. Self-referred low-risk women do not require CTG monitoring. Intermittent auscultation using a hand-held Doppler instrument or a fetal stethoscope should be used for women not on CTG.

## WOMEN TRANSFERRED FROM CLINICS AND OTHER HOSPITALS

These women need careful attention on admission, as they are being transferred for a problem or risk factor. The most common reasons for transfer are poor labour progress, hypertension, and suspected fetal distress (fetal heart rate abnormalities or thick meconium staining of the liquor). Carefully read the notes from the clinic and assess the progress of labour from the time the woman first presented.

**Enter progress on the partogram from the clinic, not on a new partogram.**

### THE PARTOGRAM: ALERT AND ACTION LINES

Record all findings of maternal and fetal condition, and of progress in labour, on the partogram. Also record all intravenous fluids administered, and the use of oxytocin, where indicated.

As soon as the active phase of labour is diagnosed, draw an alert line at a slope of 1 cm/hour from the first cervical dilatation that is  $\geq 4$  cm dilated. Alternatively, if

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the partogram has a pre-drawn alert line, the first cervical dilatation noted in the active phase of labour is placed on the alert line.

The action line is drawn 2 hours to the right of and parallel to the alert line, and represents poor progress where 'action' is indicated (amniotomy or oxytocin infusion or caesarean section). The action line may be used by midwife obstetric units (MOUs) to guide transfer of women with poor labour progress to hospital.

## **ABNORMALITIES OF THE FIRST STAGE OF LABOUR**

### **PROLONGED IN THE LATENT PHASE**

The latent phase is prolonged when it exceeds 8 hours.

#### **Management of suspected prolonged latent phase**

- Exclude other causes of abdominal pain, e.g. abruptio placentae, urinary tract infection, chorio-amnionitis
- Exclude false labour – characterised by no cervical changes and no increase in strength, regularity or frequency of labour pains. Women in false labour may be discharged home if there are no other obstetric problems
- If the woman is in the latent phase of labour, and after excluding fetal distress and obvious cephalopelvic disproportion, perform 'stretch and sweep', rupture the membranes and/or start an oxytocin infusion as for the active phase of labour.

### **POOR PROGRESS IN THE ACTIVE PHASE**

Labour is prolonged if the cervix dilates at  $<1$  cm/hour (crosses the alert line). Partograms illustrating poor labour progress are shown on pages 33 and 34.

- Use the rule of 4 Ps in the assessment – Patient (bladder, hydration, psychological state, pain), Powers, Passage, Passenger
- Exclude conditions requiring immediate caesarean section:
  - **Cephalopelvic disproportion** (big baby, short woman, increasing grade of lambdoid & sagittal suture moulding with no descent)
  - **Malpresentation**: breech presentation, face presentation, transverse lie
  - **Fetal distress**, run a CTG tracing
- Ensure adequate hydration: start an intravenous infusion of Ringer-Lactate to run at 125 mL/hour (non-cardiac, non-hypertensive women)
- Ensure that the bladder is empty; catheterize if necessary
- Give analgesia, epidural or pethidine/morphine
- Rupture the membranes if still intact
- In nulliparas, consider oxytocin infusion; use oxytocin in multiparas *only* if certain that there is no cephalopelvic disproportion.

## APPENDIX D: AUGMENTATION OF LABOUR PROTOCOL

### OXYTOCIN FOR AUGMENTATION OF LABOUR

1. Add 2 units oxytocin to 200 mL of Normal saline (OR 10 units oxytocin to 1000 mL of N/Saline)
2. Start infusion at a rate of 12 mL/hour – equivalent to 2 mU/minute
3. Increase by 12 mL/hour every 30 minutes until a minimum of 3 strong contractions (>40 seconds) in 10 minutes is achieved
4. Most women will experience 3-4 strong contractions in 10 minutes at a rate of 12 mU/minute (72 mL/hour)
5. When the desired contraction frequency is reached, do not increase the infusion rate further
6. The maximum infusion rate should not exceed 120 mL/hour (20 mU/minute)
7. Consider caesarean section if labour does not progress adequately after 4 hours of oxytocin in the active phase of labour

#### Precautions

- There must be no evidence of cephalopelvic disproportion
- There must be no evidence of fetal distress
- Use continuous CTG monitoring
- Use with caution in multiparas. Do not use oxytocin with parity  $\geq 5$  or previous caesarean section

#### Recommended Oxytocin Infusion

| Time    | Volume      | Oxytocin Dose | 2 IU in 200 mL | 10 IU in 1000 mL |
|---------|-------------|---------------|----------------|------------------|
| 0 min   | 12 mL/hour  | 2 mU/min      | 12 mL/hour     | 12 mL/hour       |
| 30      | 24          | 4             | 24             | 24               |
| 60      | 36          | 6             | 36             | 36               |
| 90      | 48          | 8             | 48             | 48               |
| 120     | 60          | 10            | 60             | 60               |
| 150     | 72          | 12            | 72             | 72               |
| 180     | 84          | 14            | 84             | 84               |
| 210     | 96          | 16            | 96             | 96               |
| 240     | 108         | 18            | 108            | 108              |
| 270 min | 120 mL/hour | 20 mU/min     | 120 mL/hour    | 120 mL/hour      |

## **APPENDIX E: ANTIBIOTIC USE WITH PROLONGED RUPTURE OF MEMBRANES**

### **PRELABOUR RUPTURE OF THE MEMBRANES**

This is rupture of the membranes before the onset of labour. The diagnosis must be confirmed by visual inspection, speculum examination, pH testing of vaginal fluid or, if necessary, by liquor volume assessment on ultrasound. Management depends on gestational age and/or estimated fetal weight (by palpation or ultrasound).

#### **Gestational age $\geq 34$ weeks or estimated fetal weight $\geq 2$ kg:**

1. Give ampicillin 2 g IV stat then 1 g IV 4 hourly and metronidazole 400 mg orally 8 hourly
2. If in labour, allow labour to proceed
3. If the woman is not in labour within 12-24 hours, induce labour with oxytocin or oral misoprostol, pending her Bishop score (page 95)

#### **Gestational age 26-33+ weeks or estimated fetal weight 800 g – 1999 g:**

1. Admit to hospital
2. Do not do digital vaginal examination if not in labour, as this may introduce pathogenic bacteria and cause chorioamnionitis
3. Give azithromycin 500 mg orally daily (or amoxicillin 500 mg 8 hourly)  
AND  
metronidazole 400 mg orally 8 hourly for 5 days
4. Give betamethasone 12 mg IM 12 hourly for 2 doses
5. Do not tocolyse if labour starts, irrespective of doses of betamethasone given
6. Observe temperature, heart rate, fetal heart rate, and pad checks 4 hourly
7. Palpate daily for evidence of chorio-amnionitis (irritable or tender uterus)
8. Do not measure white cell count or CRP (not sensitive or specific)
9. Do CTG daily
10. Induce labour at 34 weeks or at  $\geq 2$  kg, or if there are signs of chorioamnionitis
11. During labour, give ampicillin 2 g IV stat, then 1 g IV 4 hourly

#### **Gestational age $\leq 24$ weeks or estimated fetal weight $\leq 600$ g:**

1. Ensure that the membranes have definitely ruptured (reduced liquor volume on ultrasound). If in doubt, admit to hospital to observe for liquor drainage
2. If rupture of membranes has been confirmed (inevitable miscarriage), induce labour with oxytocin 10-20 units in 1 L Ringer-lactate at 120 mL/hr, after full discussion of the problem with the woman
3. In exceptional cases, e.g. poor obstetric history, pregnancy prolongation may be attempted in hospital under consultant supervision

## **APPENDIX F: MANAGEMENT OF PROLONGED SECOND STAGE**

### **POOR PROGRESS IN THE SECOND STAGE**

**The labour ward midwives should call a doctor:**

- If the woman has not started pushing after 1 hour of full dilatation, or
- If delivery has not occurred after 45 minutes of pushing in a nullipara, or 30 minutes of pushing in a multipara

**If the woman is not bearing down after 1 hour of full dilatation:**

1. Re-examine to make sure the cervix is fully dilated
2. Rupture the membranes if they are still intact
3. Exclude cephalopelvic disproportion, fetal distress or breech presentation: these will necessitate caesarean section
4. Estimate descent of the head in fifths palpable above the brim, i.e. the portion of head that still needs to descend into the pelvis
5. If the head is on the perineum, ask the woman to push, then assess descent and deliver if appropriate
6. If not for immediate delivery, start oxytocin infusion
7. Continue routine monitoring of the second stage
8. Re-assess after one more hour: if not delivered, caesarean section or assisted vaginal delivery will be required
9. With epidural analgesia, the second stage may be allowed to extend to three hours, provided there is no evidence of disproportion or fetal distress

### **Failure of the head to descend despite pushing**

If delivery has not occurred after 45 minutes of pushing in a nullipara, or 30 minutes in a multipara:

- Perform assisted vaginal delivery if the head is 0/5 or 1/5 palpable above the pelvic brim, with oxytocin infusion if necessary
- Perform caesarean section if the head is 2/5 or more palpable above the pelvic brim

## EPISIOTOMY

### Indications for episiotomy include:

- Thick or rigid perineum prolonging the second stage of labour
- Appearance of a very short perineal body (high risk of third-degree tear)
- Fetal distress in the second stage of labour where episiotomy may significantly speed up delivery
- Forceps delivery (usually)
- Breech delivery (usually)

Routine episiotomy is not necessary for vacuum delivery, nor for delivery of a preterm baby

Inject local anaesthetic (lidocaine 1% solution, maximum 20 mL) into the perineum before cutting the episiotomy. Perform a mediolateral episiotomy – avoid midline, lateral or bilateral episiotomy. The cut should start at the fourchette in the midline, at an angle of 40 to 60 degrees from the midline, and be made as the head is crowning, when the fourchette is stretched and thin.

## **APPENDIX G: DIAGNOSIS OF FETAL DISTRESS ON CTG**

### **EMERGENCIES IN LABOUR AND PROLONGED SECOND STAGE**

#### **FETAL DISTRESS**

Fetal distress is suspected when any of the following signs are observed:

- Baseline fetal heart rate >160 beats per minute
- Baseline fetal heart rate <110 beats per minute
- Baseline variability persistently  $\leq 5$  beats per minute on CTG (in the absence of sedating drugs)
- Late decelerations of the fetal heart rate
- Persistent severe or atypical variable decelerations
- Thick meconium staining of the liquor

#### **Management of fetal distress**

1. Explain the problem to the woman
2. Place the woman in a left lateral position
3. Ensure that the fetus is viable (estimated fetal weight >800-900 g) and has no obvious lethal congenital abnormalities
4. Perform vaginal examination for cervical dilatation, and to exclude cord prolapse or cord presentation
5. Unless hypertensive or cardiac, give a 500 mL intravenous bolus of Ringer-Lactate
6. Stop oxytocin infusion if labour is induced or augmented
7. Give oxygen by face mask for a brief period, using equipment to achieve an  $\text{FiO}_2$  of 80%
8. If the fetal heart rate shows no improvement:
  - If vaginal delivery is imminent (cervix fully dilated), deliver immediately, by vacuum extraction or forceps if feasible and necessary
  - If vaginal delivery is not imminent, give salbutamol 250 mcg IV over 2 minutes and prepare for immediate caesarean section
9. Call the neonatology doctor to be present at birth