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Incidence, management and outcomes of prolonged second stage of labour in a rural setting in Malawi: a retrospective cohort study

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Abstract

Background Prolonged second stage of labour may lead to maternal and perinatal complications. Options for clinical management are augmentation with oxytocin, instrumental vaginal birth or second-stage caesarean section. We aimed to describe incidence, management and outcome of prolonged second stage of labour in a rural hospital in Malawi.

Methods Retrospective analysis of medical records and partographs of all women who gave birth in 2015–2016 in a rural mission hospital in Malawi, comparing labour tracings with management protocols. Primary outcomes were incidence of prolonged second stage, instrumental vaginal birth and caesarean section. Furthermore, management and outcomes were assessed. Women arriving in hospital in the second stage of labour were compared to women arriving in an earlier stage of labour.

Results Of all 3,426 women giving birth in the study period, 566 (16.5%) presented while already in the second stage. Based on their partographs, 307 (9.0% of 3426) were diagnosed with prolonged second stage. Of these women, 22 (7.2%) had labour augmented with oxytocin, 31 (10.1%) gave birth by vacuum extraction and 64 (20.9%) by caesarean section. Spontaneous vaginal birth occurred in 212 (69.0%). Women with prolonged second stage had an increased risk of having any complication, postpartum haemorrhage being the commonest. There was no difference in neonatal outcomes between women with or without a documented prolonged second stage. Of the 566 women presenting in the second stage, 538 (95.1%) had spontaneous vaginal births and 38 (6.7%) ended up having prolonged second stage registered in their partographs.

Conclusion Prolonged second stage of labour was relatively common, and perhaps under-diagnosed due to a very sizeable proportion of women arriving whilst already in the second stage, of whom most gave birth spontaneously. Caesarean section occurred twice as often as vacuum extraction, suggesting a role for additional training and decision-making during childbirth to support the use of vacuum extraction.

Keywords Prolonged labour, Prolonged second stage, Vacuum extraction, Caesarean section, Partograph

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Background

The second stage of labour is defined as the period between full dilatation and expulsion of the neonate. Various definitions in the literature exist regarding the appropriate duration of this time frame, but in many areas, the partograph is used as the basis to identify whether the first or second stage of labour is prolonged [1–3]. Prolonged labour and associated interventions may have several complications, including obstetric anal sphincter injury, postpartum haemorrhage, and perinatal complications [4–6]. Prolonged second stage of labour, which in its neglected form is also referred to as obstructed labour, can lead to severe maternal and neonatal complications and even obstetric fistula, a particular problem in low-resource settings [7].

Several factors can attribute to delay in receiving appropriate health care, as described in Thaddeus and Maine's Three Phases of Delay model [8]. Although specific numbers are lacking, in many low- and middle-income settings, a considerable proportion of women are perceived by midwives and clinicians to only attend health facilities once they are in advanced labour. These women go without any monitoring during earlier stages of labour. Moreover, even in hospital, delays in diagnosis of complications and appropriate management during advanced labour may occur, particularly during the second stage, and such delays may contribute to increased maternal and perinatal morbidity.

A prolonged second stage of labour can be managed by augmentation with oxytocin, instrumental vaginal birth, or caesarean section. Augmentation of labour with oxytocin in the presence of ruptured membranes can be warranted when contractions have become ineffective. When using oxytocin in the second stage of labour, the underlying cause of prolonged labour should be carefully considered [9]. A previous caesarean section is a relative contra-indication for oxytocin use, although oxytocin can safely be used in women with a uterine scar in care settings with intensive maternal and fetal monitoring, as long as midwives and clinicians are aware of the increased risk of uterine scar rupture in presence of oxytocin augmentation [10–12].

Instrumental vaginal birth requires competent providers to perform vacuum extraction, which is a relatively simple procedure to teach and learn. Counterintuitively, instrumental vaginal births are uncommon in several parts of the world [7, 13, 14]. Instead, potentially much more difficult second-stage caesarean sections are resorted to as the preferred intervention, although these carry much higher risks of maternal and neonatal complications [13, 15]. Especially in low-resource settings, incidence rates of instrumental vaginal births below 1% are reported, compared to 10–15% in several European countries [7, 13–16]. Initiatives to re-utilize vacuum extractions have shown to be effective, whereby women expressed a preference for vacuum extraction over caesarean section [17, 18].

Objective of this study was to assess incidence of prolonged second stage of labour and use of interventions in a rural facility in Malawi, sub-Saharan Africa. Furthermore, we aimed to analyse characteristics, management and outcomes of women arriving in hospital during the second stage of labour and compare these with those admitted in earlier phases of labour. Studies into the management of prolonged second stage of labour in under-studied rural settings may contribute to identifying suitable interventions to improve maternity care that are tailored to local needs. Although there have been several reports on the management of prolonged second stage of labour, none have been from a similar rural setting, as far as we are aware. Furthermore, since the study setting has a large proportion of women arriving late in active labour or whilst already in the second stage of labour, analysing the outcomes in this specific group of women could give insight into their risk status and open up opportunities for possible targeted interventions.

Methods

Study design and setting

This retrospective study was performed from January 1st, 2015 to January 1st, 2017, in St Luke's Hospital, as part of a larger research project into prolonged labour and caesarean section. A dataset with all births occurring during the two-year study period, as used in a previous publication, was adapted for detailed analysis of women with prolonged second stage of labour [19]. All births that occurred in the facility within this period are used as sample population for this study. Due to the retrospective design and a limited study period no power analysis was performed.

St. Luke's Hospital is a 150-bed faith-based facility in rural Southern Malawi, providing free Basic and Comprehensive Emergency Obstetric Care for its catchment population.

The maternity department consists of antenatal, labour and postnatal wards, a maternity waiting home and an out-patient antenatal care clinic. Antenatal care at the time was provided according to the former four-visit-focused antenatal care model developed by the World Health Organization (WHO) [20]. St. Luke's Hospital served as the referral centre for two health centres and was equipped to provide basic and comprehensive obstetric and neonatal care for births above an estimated gestational age of 32 weeks. Whenever further referral was deemed necessary and safe, for example in case of established preterm labour before 32 weeks, or

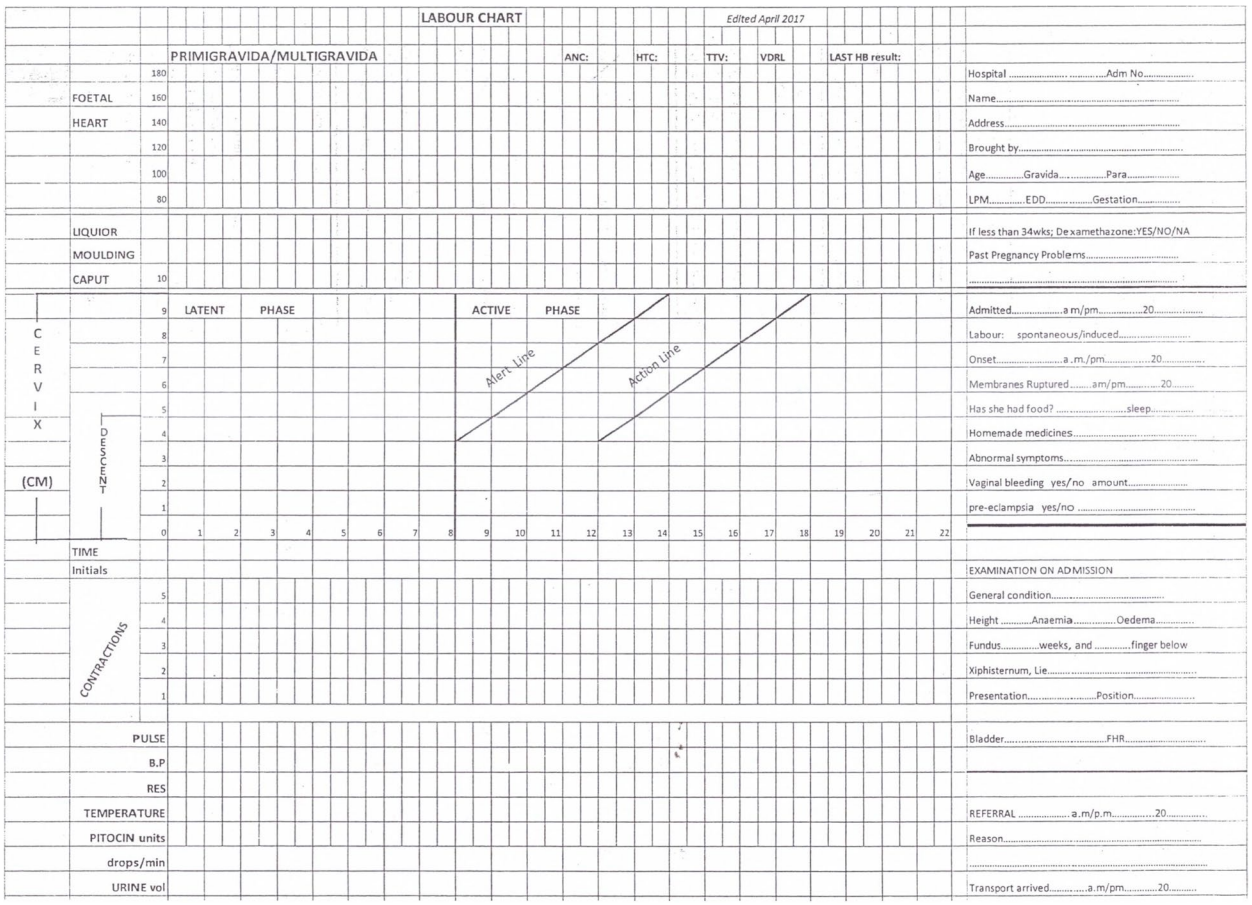

Fig. 1 The labour chart with partograph used in St Luke's Hospital, Malawi, adapted from the modified WHO partograph [20]. This labour chart is used for all women admitted to labour ward and contains all information on history, received antenatal care and progress of labour

for postpartum or neonatal referrals, the closest referral hospital was Zomba Central Hospital at 30 min by ambulance. Zomba Central Hospital is one of the few hospitals in the country with a large neonatal intensive care unit. Most often neonates were referred postpartum rather than antepartum or intrapartum, since referral during established preterm labour was often considered to be unsafe. Obstetric referrals were rare and mostly occurred during the postpartum period, for example when reoperation was needed or when the woman was in need of admission to an intensive care unit. Ante- or intrapartum referrals for maternal indications rarely occurred. Pain relief by epidural analgesia was not available in either St. Luke's or Zomba Central Hospital.

Training on vacuum extraction

In February 2015, local training for midwives and associate clinicians (clinical officers) in the use of vacuum extraction was organised by two medical doctors Global Health and Tropical Medicine (MD GHTM) from the Netherlands. After this training, vacuum extraction was regularly encouraged and mentored, and birth outcomes and indications for caesarean section were reviewed regularly during the morning report. Throughout the study period, the Dutch medical doctors continuously worked alongside associate clinicians and nurse-midwives in the labour ward.

Instrumental vaginal births are included in the routine training program of nurse/midwives and clinical officers in some teaching institutions in Malawi, but not everyone is exposed to this practice during pre- or postgraduate training. In the study setting, both a metal cup (Malmström) and Kiwi Omnicup were available, whereby the latter was reused several times after intensive cleaning [17]. There was selective use of episiotomy in case of instrumental birth or fetal compromise, based on the assessment of the attending midwife or clinician.

Data collection

We used a database that was created for an overarching project into clinical decision-making during childbirth, containing all medical records of women who gave birth

during the study period [19, 21–23]. Key document in the maternity records is the partograph, which contains all required information regarding obstetric history, risk factors, antenatal care, labour progress, outcome and puerperium. In Malawi, a labour chart incorporating the modified WHO partograph is used (Fig. 1) [24, 25]. Records without a labour chart and partograph, and those with unfilled partographs, were not included. Women who gave birth before reaching the facility (146 births before arrival in the study period) were also excluded. Partographs have an alert line that progresses at one centimetre per hour and an action line plotted four hours beyond (Fig. 1). It is recommended that passing the action line requires an intervention to expedite birth. Prolonged second stage of labour was defined as an active second stage lasting more than two hours in a primiparous or one hour in a parous woman, following guidelines from the National Institute for Health and Care Excellence (NICE) and the American College of Obstetricians and Gynecologists (ACOG) for the second stage of labour [26, 27].

Data analysis and outcomes

Data were analysed with IBM SPSS, version 24. Outcomes were grouped and compared between women stratified by moment of admission. Primary outcome was the incidence of prolonged second stage of labour. Secondary outcomes were management and outcomes of prolonged second stage of labour and characteristics, management and outcomes of women arriving in the second stage of labour. Separate assessment of indications and complications of vacuum extractions was performed. Pearson's Chi-squared test was used to compare categorical variables between groups.

Results

During the study period, 3,426 records of women who gave birth in the facility were collected and analysed. Of these women, 307 (9.0%) were diagnosed with prolonged second stage based on the criteria presented in the methods section. In 22/307 (7.2%) women, labour was augmented with oxytocin. Thirty-one (10.1%) gave birth by vacuum extraction and 64 (20.8%) by caesarean section. Spontaneous vaginal birth occurred in 212 women (69.1%).

Tables 1 and 2 show characteristics and outcomes of women with or without prolonged second stage of labour, stratified for admission in second stage and admission earlier in labour (in latent or first stage). Data on maternal history were thought to be unreliable, with many missing values, and there were only three (0.1%) women with a history of diabetes and 63 (1.8%) with a history of any hypertensive disorder (of which 16 experienced eclampsia). No women were registered to have a history of heart disease.

Table 3 shows maternal complications for all four groups. The commonest complication was postpartum haemorrhage (3.1% of all women). Women with prolonged second stage seemed to have a slightly higher chance of having any complication (15.8% and 9.3% complications in the prolonged second stage groups versus 3.8% and 6.6% in the groups without a prolonged second stage of labour).

In total, 3,512 neonates were born. There were 36 fresh stillbirths, 23 macerated stillbirths and 30 early neonatal deaths. These rates were not higher in the groups with prolonged second stage of labour.

Second stage admissions

From all 3426 women who gave birth in the study period, 566 (16.5%) women were admitted while already in the second stage. Women who were admitted in the second stage were more frequently of higher parity, older age and had attended fewer antenatal care consultations as compared to women admitted in the latent or first stage. They also had given birth by caesarean section less frequently in a previous pregnancy (2.8%, Table 4).

Out of these 566 women, 538 (95.1%) had spontaneous vaginal births, seven (1.2%) gave birth by vacuum extraction and 21 (3.7%) by caesarean section. Thirty-eight women (6.7%) had a registered prolonged second stage of labour of whom 10 (26.3%) gave birth by caesarean section, four (10.5%) by vacuum extraction and 24 (63.2%) had spontaneous vaginal births. None of these women had labour augmented with oxytocin. There were no maternal deaths, compared to four in the women who were admitted in the latent or first stage of labour. There were no differences in neonatal outcomes between the two groups, except that neonates born to women presenting in the second stage of labour were generally of lower birth weight.

Vacuum extraction

In total, 69 vacuum extractions (2.0% of 3,426 births) were performed in the facility, of which 29 (42.0%) with the indication prolonged second stage. Of all women undergoing vacuum extraction, 32 (46.4%) were aged under 20. Twenty-nine (42%) of the vacuum extractions were performed for prolonged second stage of labour and for 22 (31.9%) no indication was recorded in the file. In total, 10 complications (14.5%) were registered: six (8.7%) women who underwent vacuum extraction experienced postpartum haemorrhage (according to the medical records), three (4.3%) had a cervical tear and one (1.4%) woman had retained products of conception. All survived and were discharged without major morbidity.

Table 1 Characteristics of women with and without prolonged second stage of labour

	Admission 2nd stage without prolonged 2nd stage *N* = 528	Admission 2nd stage with prolonged 2nd stage *N* = 38	Admission latent/ first stage without prolonged 2nd stage *N* = 2562	Admission latent/first stage with prolonged 2nd stage *N* = 269	*(Missing: (unknown which stage admitted) (N = 29)*	Total *N* = 3426
Age						
< 20	104 (21.1)	7 (19.4)	665 (26.6)	77 (29.1)	*7*	**860 (25.9)**
20–24	129 (26.2)	5 (13.9)	761 (30.4)	85 (32.1)	*6*	**986 (29.7)**
25–29	105 (21.3)	12 (33.3)	463 (18.5)	51 (19.2)	*5*	**636 (19.2)**
30–34	87 (17.7)	6 (16.7)	348 (13.9)	32 (12.1)	*3*	**476 (14.4)**
≥ 35	67 (13.6)	6 (16.7)	265 (10.6)	20 (7.5)	*1*	**359 (10.8)**
Total	492	36	2502	265	*22*	**3317**
Missing	36	2	60	4	*7*	**109**
Parity						
Nullipara	137 (26.6)	10 (27.8)	954 (37.3)	108 (40.3)	*6*	**1215 (35.8)**
Multipara	379 (73.4)	26 (72.2)	1602 (62.7)	160 (59.7)	*12*	**2179 (64.2)**
Total	516	36	2556	268	*18*	**3394**
Missing	12	2	6	1	*11*	**32**
Previous CS						
Yes	12 (2.4)	4 (11.1)	228 (8.9)	21 (7.8)	*7*	**272 (8.0)**
No	496 (97.6)	32 (88.9)	2327 (90.8)	247 (92.2)	*12*	**3114 (92.0)**
Total	508	36	2555	268	*19*	**3386**
Missing	20	2	7	1	*10*	**40**
Type of gestation						
Singleton	510 (96.6)	34 (89.5)	2510 (98.0)	259 (96.3)	*27*	**3340 (97.5)**
Twins	18 (3.4)	4 (10.5)	52 (2.0)	10 (3.7)	*2*	**86 (2.5)**
Total	528	38	2562	269	*29*	**3426**
Missing	0	0	0	0	*0*	**0**
Gestational age						
< 32	11 (4.4)	0	38 (2.6)	2 (1.2)	*1*	**52 (2.7)**
32–34	10 (4.0)	0	78 (5.3)	5 (2.9)	*0*	**93 (4.8)**
35–36	48 (19.1)	2 (10.0)	342 (23.1)	38 (22.4)	*2*	**432 (22.4)**
37–39	168 (66.9)	15 (75.0)	922 (62.4)	107 (62.9)	*4*	**1216 (63.1)**
> 39	14 (5.6)	3 (15.0)	98 (6.6)	18 (10.6)	*0*	**133 (6.9)**
Total	251	20	1478	170	*7*	**1926**
Missing	277	18	1084	99	*22*	**1500**
ANC visits						
< 4	231 (57.3)	14 (46.7)	1084 (47.2)	92 (34.2)	*7*	**1428 (41.7)**
≥ 4	172 (42.7)	16 (53.3)	1215 (52.8)	155 (57.6)	*5*	**1563 (52.3)**
Total	403	30	2299	247	*12*	**2991**
Missing	125	8	263	22	*17*	**435**
Oxytocin augmentation						
Yes	1 (0.2)	0	75 (3.0)	22 (8.2)	*1*	**99 (2.9)**
No	526 (99.8)	38 (100.0)	2448 (97.0)	247 (91.8)	*4*	**3263 (97.1)**
Total	527	38	2523	269	*5*	**3362**
Missing	1	0	39	0	*24*	**64**
Mode of birth						
SVB	514 (97.3)	24 (63.2)	1985 (77.5)	188 (69.9)	*1*	**2712 (79.2)**
VE	3 (0.6)	4 (10.5)	35 (1.4)	27 (10.0)	*0*	**69 (2.0)**
CS	11 (2.1)	10 (26.3)	542 (21.2)	54 (20.1)	*28*	**645 (18.8)**
Total	528	38	2562	269	*29*	**3426**
Missing	0	0	0	0	*0*	**0**

SVB Spontaneous vaginal birth, *VE* Vacuum extraction, *CS* Caesarean section, *ANC* Antenatal care

Table 2 Neonatal outcomes

	Admission 2nd stage without prolonged 2nd stage *N* = 546 neonates	Admission 2nd stage with prolonged 2nd stage *N* = 42 neonates	Admission latent/ first stage without prolonged 2nd stage *N* = 2614 neonates	Admission latent/ first stage with prolonged 2nd stage *N* = 279 neonates	*(Missing: unknown which stage admitted)* (N = *31 neonates)*	Total *N* = 3512 neonates
Neonate						
Live birth	530 (97.1)	40 (95.2)	2547 (97.7)	271 (97.1)	*27*	**3415 (97.5)**
FSB	7 (1.3)	2 (4.8)	22 (0.8)	2 (0.7)	*3*	**36 (1.0)**
MSB	5 (0.9)	0	16 (0.6)	1 (0.4)	*1*	**23 (0.7)**
Neonatal death	4 (0.7)	0	21 (0.8)	5 (1.8)	*0*	**30 (0.9)**
Total	546	42	2606	279	*31*	**3504**
Missing	0	0	8	0	*0*	**8**
Birthweight						
< 1500	9 (1.7)	0	24 (0.9)	4 (1.5)	*0*	**37 (1.1)**
1500–1999	22 (4.1)	1 (2.6)	54 (2.1)	3 (1.1)	*0*	**80 (2.3)**
2000–2499	74 (13.7)	8 (21.1)	268 (10.5)	27 (10.0)	*4*	**381 (11.1)**
2500–2999	212 (39.3)	9 (23.7)	899 (35.2)	85 (31.4)	*9*	**1214 (35.5)**
3000–3499	184 (34.1)	15 (39.5)	1005 (39.4)	114 (42.1)	*10*	**1328 (38.8)**
≥ 3500	39 (7.2)	5 (13.2)	301 (11.8)	38 (14.0)	*1*	**384 (11.2)**
Total	540	38	2551	271	*24*	**3424**
Missing	6	4	63	8	*7*	**88**
AS1						
≥ 7	511 (94.5)	32 (80.0)	2399 (92.6)	224 (81.8)	*21*	**3187 (91.8)**
< 7	30 (5.5)	8 (20.0)	192 (7.4)	50 (18.2)	*5*	**285 (8.2)**
Total	541	40	2591	274	*26*	**3472**
Missing	5	2	23	5	*5*	**40**
AS5						
≥ 7	528 (97.4)	37 (92.5)	2535 (97.9)	262 (95.3)	*22*	**3384 (97.5)**
< 7	14 (2.6)	3 (7.5)	54 (2.1)	13 (4.7)	*4*	**88 (2.5)**
Total	542	40	2589	275	*26*	**3472**
Missing	4	2	25	4	*5*	**40**

SVB Spontaneous vaginal birth, *VE* Vacuum extraction, *CS* Caesarean section, *AS1* 1-min Apgar score, *AS5* 5-min Apgar score, *FSB* Fresh stillbirth, *MSB* Macerated stillbirth

Discussion

Our findings highlight two important challenges in the management of prolonged labour in this setting.

Firstly, it was noted that a sizeable proportion of women reached the hospital already in the second stage of labour. Outcomes of these labours were generally good, without clear disparities in maternal and neonatal complications or the proportion of neonates with low Apgar scores when compared to women who were already at the hospital during the first stage of labour.

This contradicts earlier studies highlighting higher rates of maternal and neonatal complications. For instance, in teaching hospitals in Ethiopia, admission during the second stage was associated with poorer neonatal outcomes, showing a significantly higher proportion of low Apgar scores and a trend towards increased neonatal intensive care admission [28]. However, other studies from Nigeria and Ghana did not find any differences in neonatal outcomes between women admitted in the first or second stage of labour [29, 30]. A separate study from Nigeria found that women admitted in the second stage had a higher incidence of genital tract lacerations, postpartum haemorrhage and uterine rupture [31]. In our study, a relatively large subgroup of the women who were admitted in the second stage of labour ($N = 38$) ultimately ended up having a registered prolonged second stage on the partograph. In this latter group, there seemed to be a higher rate of instrumental vaginal births, caesarean sections and complications. Considering the challenges women described to reach the hospital in time, a larger number of women may have actually sustained a prolonged second stage of labour before reaching the hospital. Women might have started labour at home or were referred from smaller health facilities and therefore had to arrange transport in order to reach the hospital,

Table 3 Maternal complications

Maternal complications	Admission 2nd stage without prolonged 2nd stage *N* = 528	Admission 2nd stage with prolonged 2nd stage *N* = 38	Admission latent/ first stage without prolonged 2nd stage *N* = 2562	Admission latent/ first stage with prolonged 2nd stage *N* = 269	*(Missing: unknown which stage admitted) (N = 29)*	Total *N* = 3426
None	507 (96.2)	32 (84.2)	2387 (93.4)	243 (90.7)	*25*	**3194 (93.6)**
Any complication	20 (3.8)	6 (15.8)	168 (6.6)	25 (9.3)	*1*	**220 (6.4)**
PPH	*12 (2.3)*	*1 (2.6)*	*78 (3.1)*	*14 (5.2)*	*0*	***105 (3.1)***
Infection	*0*	*2 (5.3)*	*14 (0.5)*	*2 (0.7)*	*1*	***19 (0.6)***
RPOC	*6 (1.1)*	*3 (7.9)*	*32 (1.3)*	*5 (1.9)*	*0*	***46 (1.3)***
Uterine rupture	*0*	*0*	*11 (0.4)*	*1 (0.4)*	*0*	***12 (0.4)***
Death	*0*	*0*	*4 (0.2)*	*0*	*0*	***4 (0.1)***
Other	*2 (0.4)*	*0*	*29 (1.1)*	*3 (1.1)*	*0*	***34 (1.0)***
Total	527	38	2555	268	*26*	**3414**
Missing	1	0	7	1	*3*	**12**

PPH Postpartum haemorrhage, *RPOC* Retained products of conception

indicating first and second phases of delay, which cannot always be translated in time. However, outcomes of the 528 women who arrived in the second stage but without a registered prolonged second stage had similar outcomes compared to women who arrived earlier in labour without a prolonged second stage, suggesting that most of these women who arrived late indeed might not have had a prolonged second stage.

Secondly, we found that in this setting, second-stage caesarean section was performed much more frequently for prolonged second stage than vacuum extraction, even though the vacuum extraction rate was higher than reported in other similar settings [32, 33]. Use of vacuum extraction had been described previously in a similar setting in Malawi, although in a cohort of HIV-positive women only [34]. Labour augmentation with oxytocin was used as an intervention in prolonged second stage of labour, but only when women were already present in hospital before the second stage of labour. In comparison to international studies, we did not observe many complications from second-stage caesarean section [15, 35].

Vacuum extraction has been reported as a good alternative to second-stage caesarean section and may save a considerable amount of time compared to waiting for space in the operating theatre [36]. Vacuum extraction can be performed in the labour ward and thus carries many benefits for both woman and child, as well as for the clinical team. Recovery after vacuum extraction is quicker and reduces the burden on maternity care [18]. Pre-service training on instrumental vaginal birth is crucial and all clinicians involved in maternity care should be able to perform it.

Our study results provide insight into standard clinical practice in a low-resource setting and can serve as a baseline for developing interventions aimed at improving the quality of care. Settings such as the one in our study often face significant staffing challenges. These might hamper optimal maternity care, which should include one-to-one care, which clearly is an impossibility in Malawi with current staffing levels. Low staffing levels may lead to suboptimal fetal monitoring or labour attendance, ultimately affecting labour outcomes [37].

Studies from different settings report varying outcomes of prolonged second stage of labour and a recent meta-analysis reports an increase in maternal and neonatal complications [4, 38, 39]. However, no reports on outcomes from a similar low-resource setting were found. In our setting, prolonged second stage of labour seemed relatively common and was associated with a slightly higher rate of maternal complications. A large proportion of women with prolonged second stage, however, had uncomplicated spontaneous vaginal births. Regarding women arriving in the second stage of labour, outcomes were reassuring, possibly due to higher parity in this group. With multiparous women generally labouring quicker, distance and logistics may cause them to reach the facility in advanced labour, but still have an uncomplicated vaginal birth. It remains important for women, especially nulliparous women or those with a history of caesarean section, to have a facility-based birth and therefore to be admitted earlier in labour or stay in a maternity waiting home if not yet in labour, when living far from a health facility [40].

Strengths and limitations

A strength of this study is that it comprises a real picture of common labour ward management in a rural setting, identifying areas to optimize care. However, retrospective assessment of clinical situations comes with

Table 4 Comparison between women admitted in 2nd stage and women admitted earlier in labour

	Admission 2nd stage *N* = 566	Admission latent/first stage *N* = 2831	Pearson Chi-square test
Age			
< 20	111 (21.0)	742 (26.8)	*P* = 0.000
20–24	134 (25.4)	846 (30.6)	
25–29	117 (22.2)	514 (18.6)	
30–34	93 (17.6)	380 (13.7)	
≥ 35	73 (13.8)	285 (10.3)	
Total	528	2767	
Missing	38	64	
Parity			
Nullipara	147 (26.6)	1062 (37.6)	*P* = 0.000
Multipara	405 (73.4)	1762 (62.4)	
Total	552	2824	
Missing	14	7	
Previous CS			
Yes	16 (2.9)	249 (8.8)	*P* = 0.000
No	528 (97.1)	2574 (91.2)	
Total	544	2823	
Missing	22	7	
Type of gestation			
Singleton	544 (96.1)	2769 (97.8)	*P* = 0.018
Twins	22 (3.9)	62 (2.2)	
Total	566	2831	
Missing	0	0	
Gestational age			
< 32	11 (4.1)	40 (2.4)	*P* = 0.161
32–34	10 (3.7)	83 (5.0)	
35–36	50 (18.5)	380 (23.1)	
37–39	183 (67.5)	1029 (62.4)	
> 39	17 (6.3)	116 (7.0)	
Total	271	1648	
Missing	295	1183	
ANC visits			
< 4	245 (56.6)	1176 (46.2)	*P* = 0.000
≥ 4	188 (43.4)	1370 (53.8)	
Total	433	2546	
Missing	133	285	
Oxytocin augmentation			
Yes	1 (0.2)	97 (3.4)	*P* = 0.000
No	564 (99.8)	2695 (96.5)	
Total	565	2792	
Missing	1	39	
Mode of birth			
SVB	538 (95.1)	2173 (76.8)	*P* = 0.000
VE	7 (1.2)	62 (2.2)	
CS	21 (3.7)	596 (21.1)	
Total	538	2562	
Missing	0	0	
Maternal complication			
Any	26 (4.6)	193 (6.8)	*P* = 0.049
None	539 (95.4)	2630 (93.2)	
Total	565	2823	
Missing	1	8	
Neonate			
Live birth	551 (97.3)	2762 (97.7)	*P* = 0.750
FSB	6 (1.1)	22 (0.8)	
MSB	5 (0.9)	17 (0.6)	
Neonatal death	4 (0.7)	25 (0.9)	
Total	566	2826	
Missing	0	5	
Birthweight			
< 1500	6 (1.1)	25 (0.9)	*P* = 0.000
1500–1999	19 (3.4)	47 (1.7)	
2000–2499	74 (13.3)	273 (9.9)	
2500–2999	215 (38.6)	967 (35.0)	
3000–3499	199 (35.7)	1114 (40.3)	
≥ 3500	44 (7.9)	339 (12.3)	
Total	557	2765	
Missing	9	66	
AS1			
≥ 7	526 (94.1)	2577 (91.8)	*P* = 0.065
< 7	33 (5.9)	230 (8.2)	
Total	559	2807	
Missing	7	24	
AS5			
≥ 7	546 (97.5)	2742 (97.7)	*P* = 0.753
< 7	14 (2.5)	64 (2.3)	
Total	560	2806	
Missing	6	25	

difficulties. Partographs are sometimes filled out postpartum, particularly in emergency situations. Moreover, it is difficult to judge clinical decisions from paper, without input from the attending teams. Therefore, facility-based audit is important to understand clinical decisions and implement plans for improvement of decision-making during childbirth. Our study design did not allow for a clear comparison of outcomes since complications were not always properly registered on the partograph. A prospective cohort study with focus on complete documentation may provide better insight. We cannot arrive at conclusions about late-term complications, for example pelvic floor dysfunction, obstetric fistulas, or late neonatal complications. Long-term follow-up, after discharge from hospital, is a difficult exercise in this setting and

medical records from readmissions or future consultations can rarely be linked to previous records. A large study of outcomes after vacuum extraction versus caesarean section in a large urban hospital in Uganda showed, however, favourable long-term results after vacuum extraction [41].

Conclusion

Two challenges in management of prolonged second stage of labour were identified: (1) many women arrived in the hospital in the second stage of labour without any monitoring during earlier stages, and (2) use of vacuum extraction was low and should be enhanced to reduce second stage caesarean sections that come with much higher complication rates. Timely attention, combined with proper registration of labour progress and availability of instrumental birth, can assist in preventing prolonged (second stage of) labour and its adverse outcomes, and thereby lead to considerable improvements in health outcomes of women and children.

Abbreviations

ANC	Antenatal Care
AS 1	One-minute Apgar score
AS 5	Five-minute Apgar score
CS	Caesarean section
FSB	Fresh stillbirth
HMIS	Health Management Information System
MSB	Macerated stillbirth
RPOC	Retained products of conception
SVB	Spontaneous vaginal birth
VE	Vacuum extraction

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

WB and EvD drafted the research proposal under supervision of TvdA. Data collection was done by EvD under supervision of WB and aided by MK and AN. TP provided information on local practice and training. WB, JvR and TvdA drafted the manuscript, which was reviewed, adjusted and finally approved by all authors.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All methods were performed in accordance with the relevant guidelines and regulations. The study was approved by the National Health Science Research Committee of Malawi (NHSRC), as part of a broader study project into unnecessary caesareans and respectful maternity care (Approval Number 1995). As St. Luke's Hospital has no Institutional Review Board, hospital management gave permission to collect data in the facility according to Malawian regulations after NHSRC approval. Collected data were all transferred anonymously into the database. Data are presented in aggregate form only and no information can be traced back to individual women or involved staff. Therefore consent to participate was deemed unnecessary as per common protocol and national regulations. Case files were collected every month from the Health Management Information System (HMIS) departments' archives and were kept in locked storage in a secured research office during data for the entire time frame of data collection and thereafter.

Consent for publication

Not applicable.

Competing interests

JvR is a Senior Editorial Board Member and TvdA is an Editorial Board Member for BMC Pregnancy and Childbirth. All other authors declare no competing interests.

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