Prolonged passive second stage of labor in nulliparous women—Prevalence and risk factors: A historical cohort study

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Abstract

Introduction: This study examined the prevalence of and risk factors for a prolonged passive second stage of labor in nulliparous women.

Material and Methods: This was a historical cohort study of all nulliparous women (n = 1131) at two delivery units in Sweden. Maternal and obstetric data were obtained from electronic medical records during 2019. Duration of the passive second stage was measured as time from retracted cervix to start of pushing. Prolonged passive second stage was defined as ≥ 2 h. Prevalence was calculated and associations between prolonged passive second stage and maternal, obstetric and neonatal characteristics and potential risk factors were assessed using logistic regression models.

Results: The prevalence of prolonged passive second stage was 37.6%. Factors associated with an increased risk of prolonged passive second stage were epidural analgesia (adjusted odds ratio [aOR] 3.93; 95% confidence interval [CI] 2.90–5.34), malpresentation (aOR 2.26; 95% CI 1.27–4.05), maternal age ≥ 30 years (aOR 2.00; 95% CI 1.50–2.65) and birthweight ≥ 4 kg (aOR 1.50; 95% CI 1.05–2.15). Maternal body mass index ≥ 30 (aOR 0.52; 95% CI 0.34–0.79) and noncohabiting (aOR 0.51; 95% CI 0.30–0.89) reduced the odds of prolonged passive second stage.

Conclusions: A prolonged passive second stage of labor in nulliparous women is common (n = 425 [38%]). We found epidural analgesia, malpresentation, maternal age ≥ 30 years and birthweight ≥ 4 kg to be major risk factors associated with an increased risk of a prolonged passive second stage. Birth outcomes for prolonged passive second stage need to be investigated to strengthen evidence for the management of the second stage of labor.

KEYWORDS
labor stage, nullipara, passive, second stage, second stage labor duration

Abbreviations: aOR, adjusted odds ratio; BMI, body mass index (kg/m²); CI, confidence interval; CS, cesarean section; OR, odds ratio; SD, standard deviation.

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1 | INTRODUCTION

The second stage of labor is often presented as a single continuous phase, beginning at full dilation of the cervix and finishing at the birth. However, when the second stage is managed with delayed pushing it is divided into two phases: the passive second stage, where the presenting part rotates and descends passively down the maternal pelvis, followed by the active second stage with pushing.\(^1\) The physiology of the two phases differs. In the active second stage, utero-placental perfusion and fetal oxygenation deteriorate because of longer and more frequent contractions, unlike in the passive second stage.\(^5\) The passive second stage has rarely been studied, and the two phases are generally not separated in the current literature, although a prolongation of the duration of each phase could have different risk factors, causes and consequences for the mother and the baby. Our study is, to our knowledge, the first to only describe the passive second stage.

The fetal descent is slower in nulliparous women than in parous women.\(^3\) Characteristics of pregnant women and circumstances during birth have changed over time. Compared with earlier generations, pregnant women today are generally older, have a higher body mass index (BMI), and more often have induced labor and use an epidural.\(^5\) The length of the second stage for nulliparous women has increased,\(^2\) and the proportion of cesarean sections (CS) in the second stage has also risen over time.\(^6\) The optimal length of the passive second stage is not known, and a universal accepted definition for prolongation is lacking. Recent recommendations suggest individualized management and give support for the avoidance of unnecessary interventions in the second stage if the condition of the woman and fetus is satisfactory and progress of labor is acceptable.\(^1,7\) Little is known about factors that influence the passive second stage in nulliparous women. A few studies have identified factors associated with the arrest of fetal descent, but these have only described births necessitating operative delivery, included a combination of null- and multiparous women and lacked information on spontaneous vaginal deliveries and whether immediate or delayed pushing was standard management.\(^3,4,8\) The aim of this study was thus to study the prevalence of and risk factors for prolonged passive second stage in nulliparous women.

2 | MATERIAL AND METHODS

This was a historical observational cohort study where information on maternal, obstetric and neonatal characteristics were obtained by review of electronic medical records of all nulliparous women at two delivery units in Sweden between January 1 and December 31, 2019. The included delivery units had 2262 and 1509 births, respectively, during 2019, of which a total of 1433 women were nulliparous. Both units manage low- and high-risk births. Rates of spontaneous vaginal deliveries at the units were 66.7% and 69.8%, instrumental deliveries 12.1% and 12.8% and CS (elective and emergency) 21.2% and 17.4% for nulliparous women. The general clinical practice at these units is “delayed pushing,” instructing women to avoid pushing until either an irresistible urge to push or the presenting part has descended to the perineum. Manual rotation of malpresentation is not included in general obstetrical practice in Sweden.

The inclusion criteria were nulliparous women with singleton pregnancies in cephalic presentation at ≥37 gestational weeks who reached the second stage of labor. We excluded women who underwent elective CS, those who had an emergency CS in the first stage, those with stillbirths and deliveries missing data on retracted cervix or start of the active second stage (Figure 1).

2.1 | Definition of prolonged passive second stage

The passive second stage was defined as from complete dilation of the cervix until the start of the active second stage or from complete dilation of the cervix until time of birth in case of an emergency CS before the start of the active second stage. Prolonged passive second stage was defined as ≥2 h.

2.2 | Data collection and variable definition

The data were retrieved from medical charts and registered on a specific report form developed by the research group. The following data were assessed for maternal, obstetric and neonatal risk factors and expressed as odds ratios (ORs) and adjusted ORs (aORs): maternal—height (<160, ≥160 cm), BMI (<30, ≥30 kg/m\(^2\)), smoking and cohabiting in the first trimester, maternal age at delivery (<30, ≥30 years), fetal weight (<3000 g), gestational diabetes mellitus (diet, medication or pre-existing), hypertension (pregestational, gestational or preeclampsia); obstetric—onset of labor (spontaneous, induction), method of induction (prostaglandins, balloon catheter, amniotomy/oxytocin), length of first stage (active), length of second stage (passive, and active), use of epidural analgesia, use of oxytocin augmentation (no oxytocin, start in first stage, start in passive second stage or start in active second stage), presentation at birth (occiput-anterior or malpresentation) and gestational age at delivery (calculated from the earliest obstetric ultrasound scan or the last menstrual period). The neonatal variable was birthweight (<4, ≥4 kg).
The onset of active labor was defined as regular painful contractions, three to four in a 10-min period, and a cervical dilation of ≥3 cm, in accordance with the Swedish criteria in 2019. Cervical examinations were performed according to the standards, at least once every second hour, but could be more frequent depending on labor progression or maternal and fetal conditions. Prolonged first stage (active) was defined as ≥10 h. Bishops scores from induced labors and length of the latent phase were not included because data were missing. Spinal analgesia \( (n = 5) \) was included in the epidural variable. The variable malpresentation contained occiput-posterior presentation \( (n = 50) \), brow presentation \( (n = 3) \), deep transverse \( (n = 4) \), face presentation \( (n = 1) \) and other presentations \( (n = 7) \). The duration of the second stage for nulliparous women is described in the Swedish National Guidelines as the passive second stage usually lasting 1–2 h and the active second stage lasting 0.5–1 h. An annual cohort was chosen for data sampling given the lack of previous studies reporting on the prevalence of and risk factors for prolonged passive second stage. The STROBE guidelines for cohort studies were followed for this manuscript.

### Table 1

| Time of passive second stage (h) | \( n \) | % |
|---------------------------------|-------|---|
| Passive second stage 0–<2 h     | 706   | 62.4 |
| Prolonged passive second stage ≥2 h | 425   | 37.6 |
| 1 to <2                         | 214   | 18.9 |
| 2 to <3                         | 153   | 13.5 |
| 3 to <4                         | 113   | 10.0 |
| 4 to <5                         | 75    | 6.6 |
| ≥5                              | 84    | 7.4 |

2.3 | Statistical analysis

The prevalence of prolonged passive second stage was calculated, and initial analyses were performed to assess differences between the two groups. Continuous data were dichotomized and compared using Student’s t-test and categorical data using the chi-squared test. Statistical significance was defined as a \( p \)-value of <0.05. Risk factors were analyzed by logistic regression, and data were presented as crude ORs and aORs with 95% confidence intervals (CIs). Variables at \( p < 0.05 \) in the univariate analyses were analyzed with stepwise multiple regression with backwards elimination to control for confounders. Three groups containing maternal, obstetric and neonatal variables were calculated in step 1, and variables from all three groups with \( p < 0.1 \) were analyzed in step 2. Statistical analyses were performed using IBM SPSS Statistics® version 25.

2.4 | Ethical approval

The study was granted ethical approval by the Swedish Ethical Review Authority (Dnr 2017/447–31, date of approval November 22, 2017).

3 | RESULTS

A total of 1131 nulliparous women met the inclusion criteria (Figure 1); among these, 37.6% experienced a prolonged passive second stage.
second stage. The duration of the passive second stage divided in hours is shown in Table 1. The range of time spent in the passive second stage was between 0 and 581 min, mean time 110 min (standard deviation [SD] 111), median 75 min, and the 95th percentile was 335 min. A total of 85 women (7.5%) had a recorded passive second stage of 0 min, and 44 women (3.9%) had a retracted cervix at their first vaginal examination. Oxytocin was used for augmentation in 59.8% of the deliveries; in one-third of these, the augmentation started in the passive second stage. The duration of the passive second stage when initiating augmentation varied from 0 to 360 min, with a mean time of 143 min (SD 74). About one-third of the women started it within 2 h in the passive second stage, and two-thirds of the women started after 2 h. The incidence of obstetric interventions in the study population was high. Only 21% of the nulliparous women in this study had a labor without any of the following interventions: induction of labor (20.6%), epidural analgesia (64.4%) or augmentation (59.8%), and 12.8% received all three interventions. The mean time of the labor (20.6%), epidural analgesia (64.4%) or augmentation (59.8%), and meconium-stained fluid was prevalent in 26% of the labors and prolonged rupture of membranes (>18 h) in 20%.

Significant characteristics of women with prolonged passive second stage are shown in Table 2. Maternal height (<p>0.001), diabetes (<p>0.001), hypertensive disorders (<p>0.001), fear of childbirth (<p>0.093) and induction of labor (regardless of method; <p>0.496) were also tested but were not statistically significant. Receiving oxytocin augmentation was significant in the initial analyses (<p>0.001), but the effect was not significant when stratified by the different stages of labor (<p>0.073).

Table 3 displays plausible risk factors for a prolonged passive second stage. The use of epidural analgesia was associated with an almost four-fold increased risk, and fetal malpresentation doubled the risk. Maternal age ≥ 30 years doubled the odds of prolonged passive second stage, and BMI ≥ 30 and noncohabiting reduced the odds by half. Smoking was significant for reducing the risk of prolonged passive second stage during the univariate analysis but not in the multivariate. A neonatal birthweight of ≥4 kg increased the risk by 60%. A prolonged first stage, retracted cervix at first vaginal examination and gestational age were significant risk factors in the unadjusted analyses. Their effects were attenuated after adjusting for confounding factors in the multivariate analyses.

| Characteristics                  | Prolonged passive second stage ≥ 2 h | Prolonged passive second stage < 2 h |
|----------------------------------|-------------------------------------|-------------------------------------|
| Maternal Age (years)             |                                     |                                     |
| <30                              | 257 22.7                             | 530 46.9                            |
| ≥30                              | 168 14.9                             | 176 15.6                            |
| Body mass index (kg/ m²)         |                                     |                                     |
| <30                              | 374 33.8                             | 584 52.8                            |
| ≥30                              | 42 3.8                               | 106 9.6                             |
| Missing                          | 9 16                                |                                     |
| Smoking first trimester           |                                     |                                     |
| Non-smoker                       | 410 36.4                             | 655 58.1                            |
| Smoker                           | 11 1.0                               | 41 3.6                              |
| Missing                          | 4 10                                |                                     |
| Epidural analgesia               |                                     |                                     |
| No                               | 77 6.8                               | 326 28.8                            |
| Yes                              | 348 30.8                             | 380 33.6                            |
| Oxytocin augmentation            |                                     |                                     |
| No augmentation                  | 54 4.8                               | 400 35.4                            |
| Start in first stage             | 141 12.5                             | 199 17.6                            |
| Start in passive second stage    | 198 17.5                             | 26 2.3                              |
| Start in active second stage     | 32 2.8                               | 81 7.2                              |
| Prolonged first active stage     |                                     |                                     |
| No                               | 352 31.2                             | 621 54.9                            |
| Yes                              | 72 6.4                               | 86 7.6                              |
| Retracted cervix at first vaginal exam |                     |                                     |
| No                               | 415 36.7                             | 672 59.4                            |
| Yes                              | 10 0.9                               | 34 3.0                              |
| Gestational (week)               |                                     |                                     |
| ≥37–42                           | 390 34.5                             | 671 59.3                            |
| ≥42                              | 35 3.1                               | 35 3.1                              |
| Presentation                     |                                     |                                     |
| Occiput-anterior                 | 389 34.4                             | 678 59.9                            |
| Malpresentation                  | 36 3.2                               | 28 2.5                              |
| Neonatal Birthweight (kg)        |                                     |                                     |
| <4                               | 355 31.4                             | 633 56.0                            |
| ≥4                               | 70 6.2                               | 72 6.4                              |
| Missing                          | – 1                                 |                                     |

4 | DISCUSSION

We found a prolonged passive second stage to be common and was reported in 38% of the included nulliparous women (n = 1131). Major risk factors associated with a prolonged passive second stage were maternal age ≥ 30 years, epidural analgesia, malpresentation and birthweight ≥ 4 kg. High BMI and noncohabiting during pregnancy were associated with a reduced risk.

The prevalence of a prolonged passive second stage in low- and high-risk women in this study (38%) was greater than...
A prevalence of a passive second stage previously described. Other smaller studies from Sweden reported high-risk women in low-risk nulliparous women and 25.6% (n = 597) in low- and high-risk women. A French study reported a prevalence of 8.6% (n = 3330) in low-risk nulliparous women (>2 h). The variations in prevalence could reflect differences in obstetrical settings and clinical management factors. Some settings may advocate operative delivery at a fixed time, which is not the case in the context of this study. A noticeably large number of women in this study had a passive second stage lasting several hours: 6.6% lasting 4–<5 h and 7.4% lasting ≥5 h. It is possible that expectant management in the passive second stage causes a higher frequency of adverse outcomes, but this needs to be investigated further. A prolonged second stage is well described as being associated with increased maternal and neonatal complications, but evidence concerning birth outcomes in relation to the duration of the passive second stage is lacking. As far as we know, this has only been investigated in one previous study, which did not find any associations between postpartum hemorrhage and a passive second stage of ≥2 h in nulliparous women. The motivation for this study’s 2-h cut-off to define a prolonged passive second stage was made in accordance with previous published studies assessing the passive second stage. The high prevalence of 38% raises questions about how to define the prolonged passive second stage in nulliparous women. Since the second stage has mostly been studied as one continuous phase, with the passive second stage unrecognized, and given the lack of evidence concerning birth outcomes in relation to the duration of the passive second stage, the optimal cut-off for prolonged passive second stage remains unclear. Future studies on this subject can contribute to modifications of the definition, which may be useful for identifying relevant obstetric interventions during this phase. The balance between expectant management and obstetric interventions involves the avoidance of both adverse birth outcomes and unnecessary interventions since obstetric interventions during this phase comprises both the risk of hyperstimulation with oxytocin augmentation and the increasing risk of adverse maternal and neonatal outcomes associated with both instrumental deliveries and a CS at full dilatation.

We identified epidural analgesia as the risk factor with the highest aOR in the studied population (4.03; 95% CI 2.98–5.45). The prevalence of epidurals in this study was 64.4%, which is in line with national reports of 63% of nulliparous women in Sweden. We found no previous studies of associations between the duration of the passive second stage and epidural analgesia, but several studies have compared the duration of the second stage and epidurals, finding it significantly longer for nulliparous women with an epidural. This potentially increases the risk of interventions such as augmentation and instrumental delivery. It has been theorized that epidurals affect fetal rotation negatively. Another interpretation is that epidurals can be a marker for a dysfunctional labor with more pain, thus necessitating pain relief.

Our findings support previous studies reporting on BMI and duration of the second stage, where obesity has been associated with a shorter second stage. This study is the first to separate the two phases in the second stage and focus only on the passive second stage. We found that a BMI ≥30 halved the odds for a prolonged passive second stage compared with women with a lower BMI. The
reason for this can only be speculated upon, although obesity is associated with pelvic floor dysfunction. A higher BMI increases intra-abdominal pressure, which can weaken the pelvic floor muscles and fascia. We also found a protective effect of noncohabiting during pregnancy. This is an interesting finding but is also difficult to interpret. Previous evidence has associated unmarried women with adverse birth outcomes, such as preterm birth and low gestational weight. However, the terms unmarried and noncohabiting are not strictly equivalent, and there may be other confounding factors that were not investigated in this observational study.

Induction of labor has been associated with an increased risk for arrest of descent in the second stage. This was not supported in our study, where results showed no increased risk for prolonged passive second stage (p = 0.5), irrespective of the induction method. The incidence of induction of labor in the study population was 20.6%, matching the national rate for nulliparous women of 20.3%.

A major strength of this study is the low level of missing data and the annual cohort of all nulliparous women's births at two hospitals. The study examined multiple potential variables for a prolonged passive second stage, including maternal, obstetric and neonatal characteristics. Clinical data were collected via manual chart review. This provided detailed information from the charts and strengthened the validation in the collected data compared with registry data based on diagnostic codes, decreasing the risk of missing information because of lack of documentation of diagnostic codes or misclassifications. The historical design raises the possibility of biases inherent to this type of study.

Malpresentation is known to decrease fetal descent, and this was confirmed in the present study. Persistent occiput-posterior was the most common malpresentation, at 4.4% of the total population. We only report on fetal presentation at birth and have no information on presentation at an earlier point during labor. In total, 10%-20% of all babies are occiput-posterior in the early second stage, which presents no problem as long as the baby continues to rotate to occiput-anterior, but this may prolong the duration of the labor. Augmentation of labor occurred in 60% of all deliveries in our study population. This is compatible with the national rate of 61% of augmented labors in Sweden in 2019 (nulliparous women, spontaneous and induced labors). In this study, augmentation was initiated during the passive second stage in one-third of cases. In these cases, where augmentation started in the passive second stage, there were considerable differences regarding the duration of the passive second stage when the intervention started, ranging up to 3 h. Women with a passive second stage lasting less than 2 h received augmentation, and women with a passive second stage lasting well over 2 h did not. Over- and underuse of augmentation is a known problem. The lack of a clear definition of prolonged passive second stage may contribute to the unstructured use of augmentation and indicates an individual management for each labor that can depend on multiple factors such as progress in the first stage. An accurate diagnosis of prolonged labor is important for evidence-based clinical decision making and for women who experience a prolonged labor. The knowledge of risk factors for prolonged passive second stage may help when considering the use of oxytocin augmentation.

5 | CONCLUSION

The prevalence of a prolonged passive second stage in nulliparous women seems to be more common than previously described. We found epidural analgesia, malpresentation, maternal age ≥ 30 years and birthweight ≥4 kg to be major risk factors associated with an increased risk of a prolonged passive second stage. Further research should involve birth outcomes in relation to the duration of the passive second stage to identify the applicable use of any interventions during this phase. Ideal management should allow the greatest chance for spontaneous delivery without increased risks of adverse maternal and fetal outcomes.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

AUTHOR CONTRIBUTIONS

MB, LT and MO contributed to the conceptualization of this study. MB analyzed the data, wrote the original draft and is responsible for the reviewing and editing of the manuscript. LT and MO reviewed the analyses and contributed with skills in methodology and critical comments in the reviewing and writing of this manuscript. MB is the corresponding author and the guarantor of this study.

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