

# Perinatal Outcome in 1515 Cases of Prolonged Second Stage of Labour in Nulliparous Women

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## Abstract

**Objective:** To examine perinatal outcomes among nulliparous women with a second stage of labour lasting more than three hours.

**Methods:** We conducted a retrospective review of all nulliparous women over a 14-year period who had a term, live, singleton, cephalic fetus  $\geq 2500$  g and who had a second stage of labour lasting at least three hours. Outcome measures included five-minute Apgar score  $< 7$ , cord arterial pH  $< 7.10$ , admission to the NICU, neonatal seizures, and neonatal death. Rates of serious long-term neurologic morbidity were also analyzed. Outcomes were compared with those of a similar cohort of women who delivered after less than three hours in the second stage.

**Results:** During the study period, 1515 women met the inclusion criteria. The majority of women (67%) delivered vaginally, after up to 10 hours in the second stage of labour. The overall rate of Caesarean section was low (15.7%). The rate of permanent neurologic impairment was 2.6 per 1000 deliveries.

**Conclusion:** Among nulliparous women, 84% were spared a possibly difficult Caesarean section in the second stage of labour or a potentially difficult operative vaginal delivery by allowing a longer second stage. However, surviving neonates had a higher risk of permanent neurologic handicap. Our study indicates that the optimal management of the second stage of labour remains controversial.

## Résumé

**Objectif :** Examiner les issues périnatales chez des nullipares ayant connu un deuxième stade du travail d'une durée supérieure à trois heures.

**Méthodes :** Nous avons mené une analyse rétrospective, sur une période de 14 ans, portant sur toutes les nullipares qui ont accouché à terme d'un fœtus unique en présentation céphalique  $\geq 2500$  g et qui ont connu un deuxième stade du travail d'une durée d'au moins trois heures. Parmi les critères d'évaluation, on trouvait un indice d'Apgar à cinq minutes  $< 7$ , un pH du sang artériel de cordon  $< 7,10$ , l'admission à l'UNSI,

les convulsions néonatales et le décès néonatal. Les taux de morbidité neurologique grave à long terme ont également été analysés. Les issues ont été comparées à celles d'une cohorte semblable de femmes ayant accouché après un deuxième stade du travail d'une durée de moins de trois heures.

**Résultats :** Au cours de la période d'étude, 1 515 femmes ont répondu aux critères d'inclusion. La majorité des femmes (67 %) ont connu un accouchement vaginal, et ce, même après un deuxième stade du travail dont la durée avait atteint jusqu'à 10 heures dans certains cas. Le taux global de césarienne était faible (15,7 %). Le taux de détérioration neurologique permanente était de 2,6 sur 1 000 accouchements.

**Conclusion :** Quatre-vingt-quatre pour cent des nullipares ont pu, en permettant la prolongation du deuxième stade, éviter une césarienne qui aurait pu être difficile au cours du deuxième stade du travail ou encore un accouchement vaginal opératoire potentiellement difficile. Toutefois, les nouveau-nés ayant survécu ont été exposés à un risque accru de handicap neurologique permanent. Notre étude indique que la prise en charge optimale du deuxième stade du travail demeure un sujet controversé.

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## INTRODUCTION

The second stage of labour is a time of increased risk of asphyxia for the fetus.<sup>1</sup> Uterine contractions are usually stronger and more frequent than in the first stage.<sup>1</sup> Maternal bearing down efforts may compromise placental perfusion.<sup>2</sup> Descent of the fetal head may result in umbilical cord compression or tightening of a nuchal cord.<sup>1,3,4</sup> Head compression may decrease cerebral perfusion.<sup>1,3</sup> Fetal lactic acid levels increase with maternal pushing.<sup>5,6</sup>

Before the introduction of continuous electronic fetal heart rate (FHR) monitoring, the usual practice in managing the second stage of labour was to avoid a prolonged second stage and to expedite delivery by operative means in order to reduce the risk of fetal asphyxia.<sup>7</sup> This approach sometimes led to difficult operative vaginal deliveries, which could be traumatic for the fetus, or to difficult Caesarean sections, which could contribute to maternal morbidity.

**Key Words:** Labour, second stage, perinatal morbidity and mortality, cerebral palsy

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There is no consensus on what constitutes a “prolonged” second stage of labour and when it is appropriate to intervene. The American College of Obstetricians and Gynecologists (ACOG) defines a prolonged second stage in nulliparous women as lasting more than two hours without epidural anaesthesia and more than three hours with epidural anaesthesia.<sup>8</sup> The Society of Obstetricians and Gynecologists of Canada does not recommend time limits for the second stage of labour, but suggests that abnormal descent of the presenting part should be suspected after two hours in nulliparous women because of the reduced likelihood of spontaneous vaginal delivery.<sup>9</sup> Similarly, the World Health Organization suggests that termination of labour should be considered after two hours in the second stage in nulliparous women because of the reduced likelihood of spontaneous vaginal delivery.<sup>10</sup> French national guidelines recommend attempting instrumental delivery after 30 minutes of bearing down, even in the presence of normal electronic FHR monitoring, to reduce the risk of fetal asphyxia.<sup>11</sup>

In a previous report from our hospital in 1995,<sup>12</sup> we found no increased risk of adverse perinatal outcomes with increasing duration of the second stage of labour among 6041 nulliparous women. We describe here the perinatal outcomes after a prolonged second stage of labour lasting more than three hours among nulliparous women at our hospital between 1993 and 2006. We also describe the long-term outcome of the babies admitted to the NICU after a prolonged second stage.

## METHODS

We performed a retrospective chart review of nulliparous women who delivered after a prolonged second stage of labour at the Women’s Hospital in Winnipeg, Manitoba. The Women’s Hospital is one of two obstetric teaching hospitals affiliated with the University of Manitoba. Obstetricians supervise almost all deliveries and there is 24-hour in-house presence of anaesthesiology and neonatology staff. We included in our review nulliparous women who delivered non-anomalous, term ( $\geq 36$  weeks), cephalic, live singleton neonates weighing  $\geq 2500$  g between January 1993 and April 2006 and who had a prolonged second stage of labour (based on ICD-9-CM coding from the hospital record for 1993 to 2003 and ICD-10-CA coding for 2004 to 2006).

Each maternal chart was reviewed for details relating to the mode of delivery, length of the second stage of labour, birth weight, five-minute Apgar score, and umbilical cord pH. The Perinatal Morbidity Committee database was

reviewed to identify all babies  $\geq 2500$  g born to nulliparous mothers and requiring admission to the NICU for any indication. Similarly, the Perinatal Mortality Committee files were used to identify all perinatal deaths of babies weighing  $\geq 2500$  g.

The duration of the second stage of labour was defined as the time between full cervical dilatation on vaginal examination and delivery of the baby. This interval was underestimated because vaginal examinations were not strictly scheduled but were performed on the basis of clinical indication (e.g., with urge to push, before topping-up of epidural anesthesia, or with changes in FHR tracings). The duration of maternal pushing was not recorded.

There were no protocols with respect to management of the second stage; decisions were based on the clinical judgement of the attending physician. This included decisions related to the use of oxytocin augmentation (low-dose protocol), the use of regional anesthesia, fetal scalp sampling for pH, initiation of pushing, episiotomy, operative vaginal delivery, and Caesarean section. Continuous electronic FHR monitoring was universal in the second stage.

For the purposes of this analysis, a prolonged second stage of labour was defined as lasting more than three hours. Outcomes were compared with those of a similar cohort of nulliparous women who delivered non-anomalous, term, cephalic, live singleton neonates weighing  $\geq 2500$  g during the same time period but who delivered after less than three hours in the second stage. Life-table analysis was used to determine the probability of:

1. ultimately achieving a spontaneous vaginal delivery,
2. ultimately achieving any vaginal delivery, and
3. achieving such a delivery within the subsequent hour.

The following measures of perinatal outcomes were assessed:

1. death during the second stage or in the neonatal period,
2. five-minute Apgar score  $< 7$ ,
3. neonatal seizures or encephalopathy,
4. admission to the NICU for any indication, and
5. admission to the NICU with five-minute Apgar score  $< 7$  or arterial cord pH  $< 7.10$  or encephalopathy.

The data were analyzed by a life-table (or survival analysis) method. For the neonate, this method was used to determine the probability of morbidity if undelivered after various durations of second stage. The long-term neurodevelopmental outcome for the babies admitted to the NICU was obtained as described previously.<sup>13</sup>

**Table 1. Mode of delivery among 1515 nulliparous women with a second stage of labour lasting longer than three hours**

Length second stage in minutes	Total deliveries, n	Total SVD, n	Total OVD, n	Total VD, n	Total CS, n
181 to 240	629	322	270	592	37
241 to 300	354	128	163	291	63
301 to 360	190	64	82	146	44
361 to 420	127	41	55	96	31
421 to 480	73	24	26	50	23
481 to 540	65	19	31	50	15
541 to 600	35	6	18	24	11
≥ 601	42	11	17	28	14
Total	1515	615 (40.6%)	662 (43.7%)	1277 (84.3%)	238 (15.7%)

SVD: spontaneous vaginal delivery; OVD: operative vaginal delivery (forceps and/or vacuum); VD: vaginal delivery

**Table 2. Probabilities of vaginal delivery and Caesarean section in relation to the time elapsed in second stage of labour**

Length second stage in minutes	Number undelivered at start of time period	Probability of SVD in next hour, %	Probability of any VD in next hour, %	Probability of any subsequent SVD, %	Probability of any subsequent VD, %	Probability of any subsequent CS, %
180	1515	21	39	41	84	16
240	886	14	33	33	77	23
300	532	12	27	31	74	26
360	342	12	29	29	72	28
420	215	11	23	28	71	29
480	142	13	35	25	72	28
540	77	8	31	22	68	32
600	42	7	29	26	67	33

SVD: spontaneous vaginal delivery; VD: vaginal delivery (includes spontaneous and forceps/vacuum assisted)

Approval to carry out this review was obtained from the Health Research Ethics Board at the University of Manitoba.

## RESULTS

Between January 1993 and April 2006, 17 940 nulliparous women delivered a singleton term cephalic baby weighing  $\geq 2500$  g. Of these, 1515 women delivered after a second stage of labour lasting more than three hours, 886 women delivered after more than four hours, 532 women delivered after more than five hours, and 342 women delivered after more than six hours.

The number of cases and methods of delivery in each one hour block after three hours in the second stage are shown in Table 1. The overall Caesarean section rate remained low (15.7%). The probability of achieving a vaginal

delivery with increasing duration of the second stage of labour is presented in Table 2. In our cohort, the majority of women (67%) delivered vaginally, even after 10 hours in the second stage of labour.

Measures of perinatal outcome were determined in relation to the duration of the second stage of labour (Table 3). Of the 1515 neonates, 77 (5.1%) had a five-minute Apgar score  $< 7$ , 36 (2.4%) were admitted to the NICU, and 10 (0.7%) had confirmed or suspected seizures. The duration of the second stage, obstetrical details, and diagnosis in the neonates who were admitted to the NICU with an eventual poor outcome are shown in Table 4.

There were no intrapartum fetal deaths, regardless of the length of the second stage of labour. Among our cohort of 1515 deliveries, one infant died in the NICU, giving a perinatal mortality rate of 0.7 per 1000 births. The baby

**Table 3. Probability of perinatal morbidity among 1515 infants born after a second stage of labour lasting more than three hours**

Length second stage in minutes	Probability of ultimately being born with five-minute Apgar score < 7 if undelivered at beginning of time interval, %	Probability of ultimately being admitted to NICU if undelivered at beginning of time interval, %	Probability of ultimately being admitted to NICU with five-minute Apgar score < 7 or cord pH < 7.20, or encephalopathy, if undelivered at beginning of time interval, %
180	5.08	2.38	1.32
240	4.97	2.71	1.47
300	3.95	2.82	1.50
360	4.68	3.51	1.76
420	3.72	4.19	1.86
480	4.23	4.23	2.82
540	5.19	4.94	1.30
600	9.52	4.76	2.38

delivered after a second stage lasting three hours and 41 minutes (Table 4, case 1). The baby's mother was morbidly obese, with a personal history of asthma and a family history of malignant hyperthermia for which she had not been tested. After two hours in the second stage, variable FHR decelerations to 80 beats per minute appeared in association with every contraction, with a delayed return of the FHR to baseline. At three hours, it was decided to attempt delivery with vacuum extraction. While epidural anesthesia was being induced, profound fetal bradycardia developed. This prompted an unsuccessful attempt at vacuum extraction, followed by emergency Caesarean section after epidural anaesthesia had taken effect. The baby's five-minute Apgar score was 0, and the umbilical cord pH (probably venous blood) was 7.11. The baby had severe hypoxic ischemic encephalopathy and died at nine weeks of age from *Pseudomonas* bacteremia and pneumonia.

There were two perinatal deaths among infants born to nulliparous women with a second stage of labour lasting less than three hours (Table 5, cases 8 and 10), giving a perinatal mortality rate of 0.14 per 1000 births.

Among the babies of nulliparous women who delivered after a second stage of labour lasting more than three hours, five had a permanent neurologic handicap. One case (Table 4, case 4) was excluded from calculations as it involved a genetic syndrome in a child born to consanguineous parents. Four cases of confirmed or suspected cerebral palsy were identified at follow-up that were probably (cases 2, 3, and 5) or possibly (case 6) related to a prolonged second stage (Table 4). The incidence of permanent neurologic dysfunction in our cohort was 2.64 per 1000 deliveries. There were two cases of permanent

neurologic handicap among nulliparous women with a second stage lasting less than three hours (Table 5, cases 7 and 9), giving an incidence of 0.14 per 1000 births. A second stage of labour lasting more than three hours was associated with a significantly increased risk of permanent neurologic impairment.

## DISCUSSION

Historically, many of the concerns regarding potential fetal harm arising from a prolonged second stage of labour derived from studies published prior to the introduction of continuous FHR monitoring.<sup>7,14,15</sup> After use of intrapartum monitoring became routine, several studies supported the conclusion that a prolonged second stage confers no additional risk to the fetus with respect to rates of low five-minute Apgar scores,<sup>12,16–21</sup> low arterial cord pH,<sup>12,17,18,20</sup> NICU admissions,<sup>12,16–19</sup> and death.<sup>12,17</sup> These observations held even in studies in which the duration of the second stage was extended to beyond four hours.<sup>16–18</sup> One exception was a population-based study of over 31 000 deliveries that identified increased neonatal risk with increasing duration of the second stage.<sup>22</sup> Long-term neurologic outcome has not been addressed in any previous study of prolonged second stage.

In our previous cohort (1988 to 1992), we found no worsening of perinatal outcome with increasing duration of the second stage of labour.<sup>12</sup> No baby died or suffered permanent neurological damage after a prolonged second stage. As a result, we concluded—albeit with important qualifications—that operative intervention is not warranted on the basis of arbitrary time limits in the second stage of labour.

**Table 4. Outcomes for 25 non-anomalous neonates requiring admission to the NICU for a five-minute Apgar score < 7, cord pH < 7.20, seizures, or requiring ventilatory support**

Case	Length of second stage, minutes	Mode of delivery	Gestational age, week	Birth weight, g	Five-minute Apgar score	Cord artery pH	Reason for NICU admission	NICU treatment/course	Follow-up
1	194	SVD	38	3243	6	—	Respiratory distress, possible sepsis	CPAP, antibiotics No encephalopathy	Normal at 4.5 years
2	195	SVD	40	3100	7	6.94	Group B streptococcal sepsis	Antibiotics, oxygen Seizure at 24 hours	Normal at 10 months
3	206	Midforceps	39	4824	4	7.01	Severe shoulder dystocia, chest compression, epinephrine for resuscitation	No encephalopathy	Normal at 6 years
4	209	Vacuum	41	4143	7	7.28	Abnormal movements, increased tone	Isolated seizure	Normal at 23 months
5	211	Low vacuum	40	3302	8	7.08	Respiratory distress	Intubation <24 hrs, antibiotics Hypertonia, possible seizures	Normal at 6 months
6	212	Midcavity vacuum	41	4232	7	7.01	Septic workup Erb's palsy	CPAP 8 hours	Erb's palsy resolved
7	218	SVD	40	3580	8	7.21	MAS PPHN	Intubated 3 days, no encephalopathy	Normal at 18 months
8	221	Forceps failed, CS	41	4039	0	7.11 (venous)	Asphyxia	Severe encephalopathy	Died at 2 months—pneumonia/bacteremia
9	240	Failed vacuum, CS	40	3950	3	6.73	Asphyxia	Moderate encephalopathy	Spastic quadriparetic cerebral palsy at age 6
10	242	SVD	39	4228	8	7.10	Acidosis	Brief intubation, MRI—subdural/intraventricular hemorrhage	Normal at 23 months
11	249	Failed vacuum/forceps, CS	39	3786	6	6.83	Acidosis	Intubation < 24hrs CT head—subdural hematoma	Normal at 9 years
12	253	Vacuum	39-40	3567	9	7.21	Respiratory distress	PPHN, intubated 48 hours	Normal at 13 months
13	279	Vacuum	40	5022	5	7.22	Respiratory distress	RDS, pneumothorax, intubated 15 hours	Normal at 7 years
14	280	CS	40	3490	8	7.09	Seizures	Severe encephalopathy MRI—diffuse brain infarction	Severe neurologic deficit age 5 years
15	296	Low forceps	41	4195	6	7.17	Respiratory distress	CPAP, antibiotics	Normal at 18 months
16	300	CS	38	2878	8	7.29	Respiratory distress	Intubated 24 hours	Normal age 2 years

*Continued*

Table 4. Continued

Case	Length of second stage, minutes	Mode of delivery	Gestational age, week	Birth weight, g	Five-minute Apgar score	Cord artery pH	Reason for NICU admission	NICU treatment/Course	Follow-up
17	312	Failed forceps, CS	41	3725	6	7.07	Possible seizures	Normal CT head, mildly abnormal EEG	Developmentally delayed at 2.5 years (consanguineous parents)
18	324	Failed forceps, CS	41	4482	4	7.16 (venous)	Neonatal depression, asphyxia	Intubated 48 hours, moderate encephalopathy	Normal at 20 months
19	372	Forceps/shoulder dystocia	41	3460	8	7.23	Respiratory	Pneumothoraces, intubated, chest tubes, no encephalopathy	No follow-up available
20	385	CS (7 to 10 minutes to extract head)	41	3261	4	6.99	Asphyxia	Multisystem organ failure; CT head-subdural/left cerebral parenchymal hemorrhage	Hemiparesis, developmental delay at 2 years 9 months
21	404	Failed vacuum/forceps CS	40	3968	6	7.04	Acidosis	Intubated 48 hours, no encephalopathy	Normal follow-up
22	489	SVD	41	3463	5	7.13	Neonatal depression	Ventilated 3 days, seizures MRI-cerebellar hemorrhage	Cerebral palsy age 10
23	503	Low mid vacuum	41	3289	6	7.11	Respiratory distress	Intubated 24 hours, no encephalopathy	No follow-up
24	521	Vacuum	39	3640	2	7.10	Observation for asphyxia	No encephalopathy MRI brain normal	Normal at 6 months
25	717	Forceps, shoulder dystocia	42	3737	4	7.06	Observation for asphyxia	Intubated 1 day, no encephalopathy	Normal at 7 years 4 months

CPAP: continuous positive airway pressure; CT: computerized tomography; MAS: meconium aspiration; MRI: magnetic resonance imaging; PPHN: persistent pulmonary hypertension; RDS: respiratory distress syndrome; SVD: spontaneous vaginal delivery.



**Table 5. Death or permanent neurologic handicap among term cephalic babies admitted to NICU born to nulliparous women with a second stage of labour lasting less than three hours**

Case	Length of second stage, minutes	Mode of delivery	Gestational age, week	Birth weight, g	Five-minute Apgar score	Cord artery pH	Reason for NICU admission	NICU treatment/course	Long-term outcome
1	22	Vacuum/forceps	41	3803	3	6.86	Acidosis	No encephalopathy	CP at age 13, MRI Brain normal at 1 year
2	34	SVD	40	3500	4	6.83	Asphyxia MAS	Progressive respiratory failure	Died from respiratory failure
3	91	Low forceps	38	3574	7	7.26	Abnormal movements, apneic spells	Intubated 2 days; CT head—periventricular leukomalacia and thrombosis	Mild CP, thought to be caused by antenatal brain insult
4	92	Low forceps	—	4163	0	6.98	Resuscitation	Full resuscitation. First audible HR ~ 17 min of age, no spontaneous breathing, support withdrawn	Death at 2 hours of age

CP: cerebral palsy; HR: heart rate; MAS: meconium aspiration syndrome; MRI: magnetic resonance imaging; SVD: spontaneous vaginal delivery

In the current cohort, we wished to re-evaluate perinatal outcomes at our centre following this more conservative approach to the second stage of labour. Our focus was on the 1515 nulliparous women who had a second stage lasting more than three hours. Both encouraging and discouraging results emerged.

Encouragingly, there was still a greater than 70% chance of having a vaginal delivery, even after eight hours in the second stage. In our cohort, the overall rate of Caesarean section after three hours in the second stage was 16%, in contrast to a rate of 45% noted in a recent study by the National Institute of Child Health and Human Development Maternal-Fetal Medicine Unit Network.<sup>20</sup> In that study, the probability of having a vaginal delivery after four hours was only 45% and after five hours was 30%. In contrast, women in our cohort still had a 77% probability of a vaginal delivery after four hours and a 74% probability after five hours. These findings are comparable to the results of our previous report.<sup>12</sup> A prolonged second stage of labour might be tolerated if there are reasonable prospects for a safe vaginal delivery.

It is of particular concern that we identified worse neonatal outcomes than in our previous study.<sup>12</sup> In the current study, the probability of a neonate having a low five-minute Apgar score after three hours in the second stage was 5%, more than double the previous probability of 2%. The probability of a baby requiring admission to the NICU also doubled between the two periods (1.2% in the previous study and 2.4% in the current study).

Although it may be that these changes reflect the vagaries of Apgar score assignment or differences in criteria for NICU admission over time, it could also be that the results truly reflect changing facts. The better results in the earlier cohort may have been fortuitous, and the real risks of a prolonged second stage may have been revealed with examination of a larger cohort. It may be that we became complacent after our earlier reassuring findings, and as a result became less vigilant than we had been during 1988 to 1992; at that time, allowing very prolonged second stages of labour was considered outside the standard of care.

The most worrisome result in the present study was the long-term impairment of neurodevelopment in the infants born after a prolonged second stage. This outcome has not been previously addressed by other studies. The rate of impairment in our cohort was higher than the general rate of 1 to 2 per 1000 deliveries cited by others.<sup>23–28</sup> In another study at our institution, 20 cases of cerebral palsy that could be ascribed to perinatal events were identified from a cohort of 36 368 term neonates born over an 11-year period, giving a rate of cerebral palsy of 0.55 per 1000 deliveries.<sup>13</sup> Of these cases, only

six were deemed to have been potentially preventable by better obstetrical care.

How then should we manage a prolonged second stage of labour? Some authorities have proposed conducting a prospective randomized controlled trial of operative vaginal delivery versus expectant management in nulliparous women whose second stage has lasted two or three hours.<sup>29,30</sup> We suspect that this approach would lead to the same debate that occurred with respect to the 'Term Breech Trial'<sup>31,32</sup>; namely, trying to address differences in clinical skill and judgement by the blunt instrument of a randomized trial. A more aggressive approach, as suggested by the French guidelines<sup>11</sup> might increase the risk of traumatic fetal injury and maternal morbidity if instrumental delivery is attempted prematurely. In our cohort, the majority of women were spared a possibly difficult Caesarean section or a potentially more difficult operative vaginal delivery by allowing a longer second stage.

In our previous report, we stated that as long as the fetal condition is closely monitored and there is ready recourse to operative intervention if concerns arise, we can safely allow prolonged second stages of labour.<sup>12</sup> Others have also expressed the view that "continuous fetal surveillance"<sup>30</sup> or "careful fetal surveillance"<sup>33</sup> makes a prolonged second stage allowable. The ongoing challenge is that it is difficult to assess fetal well-being from FHR tracings in the first stage of labour,<sup>34</sup> but it is even more so in the second stage, when less than one quarter of FHR tracings are normal.<sup>1,35–37</sup> The appearance of the FHR tracings of acidotic and non-acidotic fetuses can have significant overlap.<sup>34–36</sup> Most acidotic fetuses in the second stage do not have tracings that are "abnormal" (SOGC) or "category III" (ACOG).<sup>35,36,38</sup> A five-tier classification of FHR tracings has been proposed for the second stage in order to identify the fetus at risk of asphyxia and potentially to guide management.<sup>35,38</sup> In one study, 45% of tracings were in the two most worrisome categories at some point in the second stage.<sup>39</sup> In another cohort, 21% of babies born with an umbilical cord pH < 7.0 did not have grossly abnormal FHR tracings based on this classification system.<sup>40</sup> Another obstacle is that the time between the identification of a pathological FHR tracing and the development of severe fetal acidosis may be too short to allow preventive intervention in as many as half of such cases.<sup>41</sup>

Once a prolonged second stage has been identified, the obstetrician is faced with a dilemma. An experienced clinician must assess the situation and provide ongoing review. If the fetal head has reached the pelvic floor and a

straightforward operative vaginal delivery is possible, then operative vaginal delivery may be preferable to prolonged maternal pushing efforts and the risk of fetal compromise. If operative delivery is likely to be more difficult and the FHR pattern is ambiguous, then a fetal scalp pH or lactate level could be obtained; this could potentially provide the reassurance to extend the duration of the second stage of labour. Clearly, more studies are required to determine the utility of such adjunctive tests in the management of prolonged second stage.

## CONCLUSION

Among nulliparous women, 84% were spared a possibly difficult Caesarean section in the second stage of labour or a potentially difficult operative vaginal delivery by allowing a longer second stage. However, surviving neonates had a higher risk of permanent neurologic handicap. Our study highlights that the second stage of labour remains a period of risk for the fetus and that the management of the second stage may affect the ultimate outcome in some cases. The optimal management of the second stage of labour remains controversial; however, once a prolonged second stage has been identified, intensified monitoring of the maternal–fetal condition is warranted.

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