Sites of cord insertion and delayed of the third stage of labor in singleton spontaneous delivery: a retrospective cohort study

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ABSTRACT

OBJECTIVE

To identify the association between sites of cord insertion and delayed of the third stage of labor in spontaneous delivery.

METHODS

We conducted a retrospective cohort study comparing duration of the third stage of labor between central and non-central cord insertion.The medical records of women admitted with singleton spontaneous delivery from July 2014 to December 2015 at Khon Kaen Hospital Thailand were reviewed for site of cord insertion and other variables. The primary outcome was delayed the third stage of labor. The secondary outcomes were postpartum hemorrhage, fetal sex, fetal birth weight, APGAR score, low placental weight, manual removal of the placenta and placental curettage.

RESULTS

A total of 1697 pregnant women with singleton spontaneous delivery were reviewed (296 in the central cord insertion group and 1401 in the non-central cord insertion group). There was no difference between the two groups in relation to delayed the third stage of labor; 23 women (7.4%) in the former group and 76 women (5.4%) in the latter group (adjusted odds ratio [AOR], 1.41; 95% confidence interval [CI], 0.86 to 2.34; P=0.178). There was also no difference between the two groups regarding rate of low birth weight of the infants (5.4% vs. 4.8%;AOR, 1.17; 95% CI, 0.66 to 2.09; P=0.594).

CONCLUSION

In women with singleton spontaneous delivery, we found no significant difference in delayed the third stage of labor between central cord and non-central cord insertion.

INTRODUCTION

Factors affecting delayed the third stage of labor include gestational age less than 36 week, longer latent phase of labor, second stage of labor, previous history of abortions three times or more, amnionitis, delivery not in hospital, augmented labor, preterm labor, parity of four or more and elderly mothers.[1–5] Duration of the third stage of labor especially more than 10 minutes increase risk for postpartum hemorrhage.[5–8] The range of prevalence rate of postpartum hemorrhage are varied from 18 to 21.4 percent, approximately 4 percent in vaginal deliveries. This is an obstetric emergency that can cause of maternal morbidity and mortality [6–11]

Sites of umbilical cord insertion are described as central and non-central insertion (i.e., paracentral or lateral, marginal and velamentous or membranous cord insertion).[13] More than 90% are central and paracentral cord insertion followed by marginal cord insertion, the least frequent of umbilical cord insertion is velamentous type[13] From real-time ultrasonographic technology performed in the third stage of labor, eccentric umbilical cord insertion can thicken placenta as well as increase intensity of uterine contraction that can later shorten the third stage of labor.[14–16] However, no study demonstrates the association between the site of cord insertion and delayed the third stage of labor, hence, the aim of the present study was to identify the relationship between various sites of cord insertion and delayed the third stage of labor in those with singleton spontaneous delivery.

METHODS

We conducted a retrospective cohort study comparing delayed the third stage of labor between those with central and non-central cord insertion in women with the singleton spontaneous delivery.

PATIENTS

We reviewed medical records of women with singleton spontaneous delivery at Khon Kaen Hospital, Thailand from July 2014 to December 2015. We excluded medical records of women with breech presentation, gestational diabetes mellitus, multiple pregnancy, eclampsia and complication of delivery such as who use vacuum or forceps in delivery.

DATA COLLECTION

All medical records of women with singleton spontaneous delivery were identified using the International Classification of Disease (ICD) 10 080.0. Those who admitted at Khon Kaen Hospital were reviewed. Variables including age, gestational age, gestational age, parity, previous abortion, previous cesarean section, preeclampsia, labor onset, rupture of membrane, augmented labor, accoucheur, anesthesia, amnionitis, hypertension and duration of the second stage of labor were recorded.

EXPOSURES

Various sites of cord insertion; central and non-central were considered as exposure in the present study.

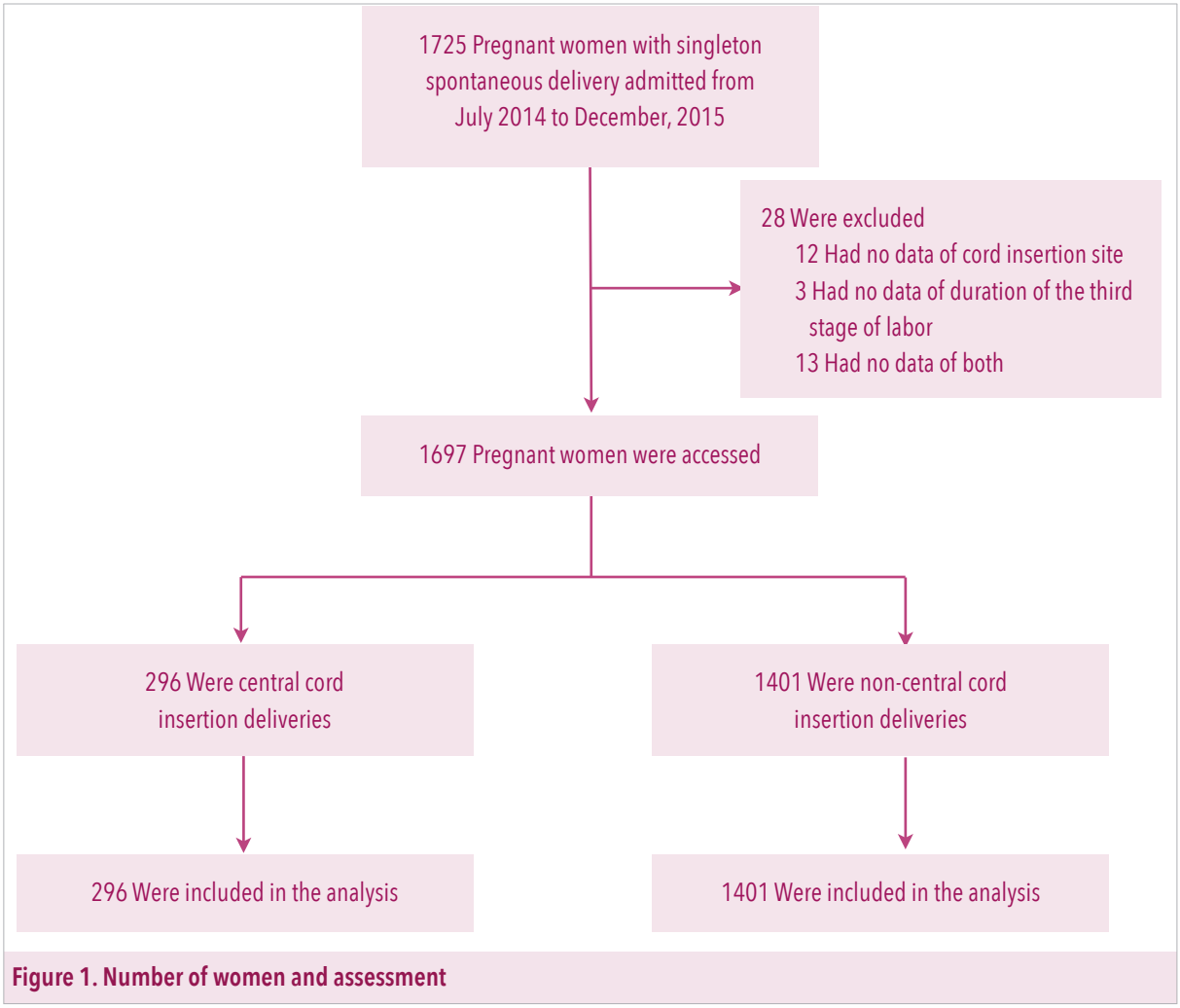


Figure 1. Number of women and assessment

OUTCOMES

The primary outcome was delayed the third stage of labor. The secondary outcomes were postpartum hemorrhage, fetal sex, fetal birth weight, APGAR score, low placental weight, manual removal of the placenta, placental curettage and placental separation.

STATISTICAL ANALYSIS

We used descriptive statistics to summarize baseline characteristics of women in each group; number and percent for categorical variable, mean with standard deviation (SD) for normally distributed continuous variable and median and interquartile range (IQR) for non-normally distributed continuous variable. Event rate of the primary and the secondary outcomes between the two groups was analyzed using relative risk. Later, adjusted odds ratio (AOR) from logistic regression analysis was used to identify the relationship between exposure and outcomes of the study. In additional, hazard ratio (HR) from the Cox model used to identify the associated between the exposures and placental separation.

RESULTS

CHARACTERISTICS OF THE PREGNANT WOMEN

From July 2014 to December 2015, a total of 1725 pregnant women were admitted and underwent singleton spontaneous delivery at Khon Kaen Hospital. Of these patients, 28 were excluded because the data of duration of the third stage of labor or sites of umbilical cord insertion were not available. Therefore the remaining 1697 pregnant women were included in the analysis. (Figure 1.)

The women delivered vaginally with the median age of 24.6 (IQR, 18.9 to 30.4). Most of the women were in their first (46.0%) or second pregnancies (36.8%). Most of them had no history of abortion (82.7%), one-fourth of them had once history of abortion. The median gestational age at the time of delivery was 272.11 (IQR, 261.11 to 283.11). Seventy eight (4.6%) of them were induced labor, 724 (42.7%) were augmented labor as well. One thousand two hundred and forty-seven (26.5%) of vaginal deliveries had done by nurse-accoucheur, 1,483 (87.4%) of deliveries use local anesthesia. The mean length of the second stage of labor was 15.7+16.4, almost were less than 1 hour (98.1%) while the remainder were within 1 to 2 hour. However, baseline demographic characteristics were similar in pregnant women whom central umbilical cord insertion and non-central umbilical cord insertion.

Comparing between central cord insertion and non-central cord insertion, the former tended to have more parity (P=0.03) and have higher proportion of those delivered by physician (P=0.011). However, there were no significant differences between the two groups regarding median age (P=0.052), median gestational age (P=0.583), proportion with induced labor (P=0.624), proportion with augmented labor (P=0.631), proportion of women with hypertension (P=0.225), proportion with local anesthesia (P=0.875), proportion with history of previous abortion (P=0.335) and mean duration of the second stage of labor (P=0.978) (Table 1`.).

STUDY OUTCOME

Delayed the third stage of labor 10 minutes or more was diagnosed in 99 postpartum vaginal deliveries. The median length of the third stage of labor in both groups were 4.0 minutes with IQRs of 3.0 to 6.0 (P=0.327). Comparing between central cord insertion and non-central cord insertion, there was no significant difference between the two groups in relation to delayed the third stage of labor (7.8% vs. 6.4%; RR 1.43, 95% CI, 0.91 to 2.24; P=0.118). There was no significant difference in term of volume of blood loss between the two groups (P=0.853) and no significant difference regarding proportion of male fetus between the two groups (50.0% vs. 51.8%; P=0.569). Low birth weight was diagnosed in 83 feti. The rate of this outcome was not significantly different between the two groups (5.4% vs. 4.8%; RR, 1.13; 95% CI, 0.66 to 1.92; P=0.652). The median of APGAR score at 1 minute in both groups were 9.0 with IQR 9.0 to 10.0 (P=0.535), at 5 minutes were 10.0 with IQR 10.0 to 10.0 (P=0.896), at 10 minutes were 10.0 with IQR 10.0 to 10.0 (P=0.914). Low placental weight was diagnosed in 45 women. The rate of this outcome was not significantly different between the two groups (3% vs. 2.6%) (Table 2).

Table 1. Characteristics of the Pregnant women

Characteristic	Central umbilical cord insertion	Non-central umbilical cord insertion	P Value
Maternal age-yr			0.052
Median	25.1	23.6	
Interquartile range	19.9-29.5	19.9-28.4	
Gestational age-day			0.583
Median	273.0	273.0	
Interquartile range	266.0-278.0	266.0-279.0	
Parity-no. (%)			0.003
0	120 (40.5)	660 (47.1)	
1	112 (37.8)	512 (36.5)	
2	48 (16.2)	185 (13.2)	
3	8 (2.7)	36 (2.6)	
≥4	8 (2.7)	8 (0.6)	
Previous abortion-no. (%)			0.335
0	237 (80.1)	1167 (83.3)	
1	51 (17.2)	211 (15.1)	
2	6 (2.0)	20 (1.4)	
≥3	2 (7.0)	3 (2)	
Induced labor-no. (%)	12 (4.1)	66 (4.7)	0.624
Augmented labor-no. (%)	130 (43.9)	594 (42.4)	0.631
Nurse accoucheur-no. (%)	200 (67.6)	1047 (74.7)	0.011
Local anesthesia-no. (%)	259 (88.7)	1224 (88.4)	0.875
Duration of the second stage of labor-min			0.866
Median	11.0	11.0	
Interquartile range	7.0-19.0	7.0-17.0	
Duration of the second stage of labor-hr-no. (%)			0.735
<1	288 (97.6)	1376 (98.3)	
1-2	6 (2)	20 (1.4)	
>2	1 (0.3)	4 (0.3)	

Table 2. The primary and the secondary outcomes in the third stage of labor according to cord insertion site

Outcome	Cord insertion site		Relative risk (95% confidence interval)	P Value
	Central cord	Non-central cord		
Delayed of the third stage of labor-no. (%)	23 (7.8)	76 (5.4)	1.43 (0.91-2.24)	0.118
Duration of the third stage-min				0.327
Median	4.0	4.0		
Interquartile range	3.0-6.0	3.0-6.0		
Postpartum hemorrhage-ml				
Mean+SD	144.7±25.7	144.3±26.3		
Median	150.0	150.0		0.853
Interquartile range	150.0-150.0	150.0-150.0		
Male fetus-no. (%)	148 (50.0)	726 (51.8)		0.569
Fetal birth weight-kg				0.413
Median	3.1	3.1		
Interquartile range	2.8-3.3	2.8-3.3		
Low birth weight*-no. (%)	16 (5.4)	67 (4.8)	1.13 (0.66-1.92)	0.652
APGAR score				
At 1 min				
Mean±SD	9.1±0.8	9.1±0.8		
Median	9.0	9.0		0.535
Interquartile range	9.0-10.0	9.0-10.0		
At 5 min				
Mean+SD	9.9±0.3	9.9±0.3		
Median	10.0	10.0		0.896
Interquartile range	10.0-10.0	10.0-10.0		
At 10 min				
Mean+SD	10.0±0.1	10.0±0.2		
Median	10.0	10.0		0.914
Interquartile range	10.0-10.0	10.0-10.0		
Low placental weight-no (%)	9 (3.0)	36 (2.6)	1.18 (0.58-2.43)	0.655

Table 3. Multivariable analysis of risk factors associated with delayed the third stage of labor

Factor	Delayed of the third stage of labor			
	Crude odds ratio (95% CI)	P Value	Adjusted odds ratio (95% CI)	P Value
Central cord insertion	1.47 (0.90-2.38)	0.120	1.41 (0.86-2.34)	0.178
Maternal age-yr	1.02 (0.99-1.06)	0.182	1.01 (0.97-1.06)	0.516
Gestational age-day	1.00 (0.98-1.02)	0.847	1.00 (0.98-1.01)	0.636
Parity		0.062		0.884
0	1.00		1.00	
1	1.09 (0.68-1.76)		0.82 (0.47-1.44)	
2	2.04 (1.18-3.52)		1.06 (0.47-2.40)	
3	1.95 (0.66-5.74)		0.79 (0.20-3.13)	
≥4	2.79 (0.61-12.72)		1.20 (0.20-7.22)	
Previous abortion	1.88 (1.18-2.98)	0.007	1.87 (1.00-3.53)	0.052
Induction of labor	2.22 (1.07-4.58)	0.032	2.38 (1.13-5.04)	0.023
Augmentation of labor	1.08 (0.72-1.63)	0.712	1.12 (0.74-1.70)	0.593
Nurse-accoucheur	1.56 (0.93-2.60)	0.091	1.77 (1.03-3.05)	0.040
Non local anesthesia	1.93 (1.14-3.26)	0.014	1.77 (0.96-3.28)	0.067
Duration of the second stage of labor more than 1 hr	1.63 (0.49-5.45)	0.425	1.37 (0.31-6.18)	0.680

ADDITIONAL ANALYSES

From the logistic regression analysis, central cord insertion did not significantly increase rate of delayed the third stage of labor (AOR 1.14; 95% CI, 0.86 to 2.34; P=0.178). The factors significantly increased rate of delayed the third stage of labor were induction of labor (AOR 2.38; 95% CI, 1.13 to 5.04; P=0.023), nurse-accoucheur (AOR 1.77; 95% CI, 1.03 to 3.05; P=0.040). However, maternal age, gestational age, parity, previous abortion, augmented labor, non local anesthesia and duration of the second stage of labor were not associated with delayed the third stage of labor (Table 3.).

Central cord insertion did not significantly increase rate of low birth weight (AOR 1.17; 95% CI, 0.66 to 2.09; P=0.594). However, the gestational age significantly increased rate of low birth weight (AOR 0.98; 95% CI, 0.97 to 0.99; P=0.001) (Table 4.). In additional, rate of low birth weight was related to the number of parity, comparing with the nulliparous, the pregnant

Table 4. Multivariable Analysis of Risk Factors Associated with Low birth weight.

Factor	Low birth weight			
	Crude odds ratio (95% CI)	P Value	Adjusted odds ratio (95% CI)	P Value
Central cord insertion	1.14 (0.65-1.99)	0.652	1.17 (0.66-2.09)	0.594
Maternal age-yr	0.94 (0.90-0.98)	0.006	0.98 (0.93-1.02)	0.302
Gestational age-day	0.98 (0.97-1.00)	0.006	0.98 (0.97-0.99)	0.001
Parity		0.001		0.002
0	1.00		1.00	
1	0.41 (0.24-0.69)		0.40 (0.21-0.75)	
2	0.17 (0.05-0.54)		0.13 (0.03-0.55)	
3	1.29 (0.45-3.74)		1.24 (0.31-4.95)	
≥4	0.86 (0.11-6.65)		0.73 (0.08-7.08)	
Previous abortion	0.64 (0.33-1.26)	0.201	1.38 (0.54-3.51)	0.505

women with parity of one or two tended to have lower rate of low birth weight (AOR, 0.40; 95% CI, 0.21 to 0.75; AOR, 0.13; 95% CI, 0.03 to 0.55; respectively). Nevertheless, maternal age and previous abortion were not associated with rate of low birth weight.

From the Table 5 and Fig. 2, sites of cord insertion was not associated with the incidence density of placental separation (HR, 0.99; 95% CI, 0.87 to 1.12; P=0.850), only nurse-accoucheur was significantly associated with lower of the placental separation (HR, 0.66; 95% CI, 0.59 to 0.74; P<0.001). However, maternal age, gestational age, parity, induced labor, augmented labor, non local anesthesia, duration of the second stage and hypertension were found not to have the association with the placental separation.

DISCUSSION

PRINCIPAL FINDINGS

In this study, we found no significant difference in delayed the third stage of labor between central cord and non-central cord insertion. There were also no significant difference in rate of low birth weight, rate of postpartum hemorrhage, proportion of male fetuses, median fetal birth weight, rate of low placental weight, rate of manual removal of the placenta and rate of placental curettage. However, nurse accoucheur and induced labor significantly increased rate of delayed the third stage of labor. Regarding to the gestational age significantly increase rate of low birth weight, conversely more number of parity tended to have lower rate of low birth weight.

Table 5. Factors associated with placental separation

Factor	Hazard Ratio (95% CI)	P Value
Central cord insertion	0.99 (0.87-1.12)	0.850
Maternal age-yr	0.99 (0.98-1.00)	0.196
Gestational age-day	0.99 (0.99-1.00)	0.440
Parity		0.503
0	1.00	
1	1.10 (0.97-1.24)	
2	1.13 (0.93-1.39)	
3	1.36 (0.92-2.00)	
≥4	1.18 (0.66-2.10)	
Previous abortion		0.125
0	1.00	
1	0.88 (0.75-1.04)	
2	0.63 (0.41-0.98)	
≥3	0.58 (0.22-1.51)	
Induced labor	0.89 (0.71-1.13)	0.335
Augmented labor	0.92 (0.83-1.01)	0.087
Nurse-accoucheur	0.66 (0.59-0.743)	<0.001
Non local anesthesia	0.87 (0.73-1.03)	0.107
Duration of the second stage		0.269
<1 hr	1.00	
1-2 hr	1.08 (0.73-1.61)	
>2 hr	2.04 (0.84-4.93)	
Hypertension	0.50 (0.12-2.07)	

STRENGTHS AND LIMITATIONS OF THE STUDY

Our study has several strengths. Firstly, the design of the study is retrospective cohort, more clearly to clarify the sequence between the exposure and outcomes. Secondly, we include all the women with singleton spontaneous delivery who has the record of sites of cord insertion and duration of the third stage of labor, minimize selection bias. Thirdly, Baseline characteristics between central cord insertion and non central cord insertion were balance, allowed us to decrease confounding bias in interpreting results. Fourthly, we did several statistic analysis leading to increase reliable.

Our study also has some limitations. We used the data from medical records to perform a retrospective cohort. As a result, some data may lose and increase missing bias. Inability to access the large sample size as computed from Winpepi due to the short duration. Our inability to detect significant difference sites of cord insertion and delayed of the third stage of labor may result from inadequate statistical power. Another limitation was the generalizability of these study is singleton pregnancy those excluded breech presentation, vacuum or forceps delivery thus we were unable to adjust these factors.

COMPARISON OF THE OTHER STUDIES

Our study had a cut point of delayed the third stage of labor at 10 minutes, the median of maternal age was 24.6 years old with IQR 18.9 to 30.4, consequently, we found not the association between the maternal age and delayed the third stage of labor. In contrast, the previous study clarified prolonged the third stage of labor as 30 minutes or more, as a result, the pregnant women

whom 30 years old or more tended to have prolonged the third stage of labor[1].In additional, nurse-accoucheur increased rate of prolonged the third stage of labor. In comparison, our study revealed the relation between nurse-accoucheur and delayed the third stage of labor as well. Our study found that delayed the third stage of labor was not associated with augmented labor, parity of one, two, three and four or more, history of previous abortion, in contrast with two studies, increasing rate of prolonged the third stage of labor associated with augmented labor, nulliparous and history of previous abortion[1,2].

Another study, the primiparous and the parity of two were a significantly increased rate of low birth weight[21], our study is similarly to the previous one as well. Maternal age was not associated to low birth weight but the previous one found extremely maternal age significantly increased rate of low birth weight.

CONCLUSION AND IMPLICATION

In summary, our study did not support the association between sites of cord insertion and duration of the third stage of labor. Though our study had a limitation in population size, extensive studies with larger sample size are required to clearly clarify the association between delayed the third stage of labor and sites of umbilical cord insertion. Moreover, we propose that umbilical cord insertion diagnosis during pregnancy should be performed.

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