

Prolonged second stage of labor is associated with persistent urinary retention after forceps delivery

An observational study

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Abstract

The occurrence of urinary retention is significantly higher in women undergoing forceps-assisted midwifery. However, the majority of these women typically regain the ability to urinate spontaneously within 72 hours after delivery. Instances of persistent urinary retention beyond this timeframe are relatively uncommon and have been rarely documented. This study aimed to investigate the risk factors associated with the persistence of urinary retention after forceps-assisted midwifery. A retrospective analysis was conducted on women who underwent forceps-assisted deliveries at the Obstetrics and Gynecology Hospital of Fudan University (China) between August 1, 2019 and December 1, 2019. The study involved collecting general clinical information of these women. Based on the duration of ureter retention, women who had a retention time >72 hours were categorized into group A, while those with a retention time <72 hours were allocated to group B. After performing analysis on the risk factors of persistent urinary retention following forceps delivery, the *t* test was utilized for analyzing single factors, while logistic regression analysis was employed for assessing multiple factors. Univariate analysis revealed a significant difference in the duration of the second stage of labor between group A and group B. However, logistic regression analysis did not indicate any significant difference between the 2 groups. Further research is still required to determine whether the association between persistent urinary retention following forceps delivery and prolonged second stage of labor is significant, considering the limited number of cases available for analysis.

Abbreviation: PUR = postpartum urinary retention.

Keywords: forceps delivery, persistent urinary retention, second stage of labor

1. Introduction

The phenomenon of postpartum urinary retention (PUR) subsequent to vaginal delivery seems to arise from perineal nerve injury sustained during the delivery process. Studies have provided evidence that the postpartum perineal nerve terminal motor latency is extended, potentially enduring for a period of 2 to 3 months following childbirth. Typically, this issue is addressed through the temporary implementation of an indwelling catheter.^[1–3] Diverse delineations exist for PUR. Predominant PUR denotes the incapacity for autonomous urination within 6 hours subsequent to vaginal delivery or following urethral catheter removal after a cesarean section. Concealed PUR pertains to the circumstance wherein bladder residual urine volume measures equal to or surpasses 150 mL subsequent to voluntary urination, as ascertained through ultrasonographic assessment.^[4–7]

PUR represents a rare occurrence, manifesting in approximately 0.7 to 0.9 percent of vaginal deliveries. Risk factors encompass the utilization of epidural anesthesia, the occurrence of primary labor, protracted labor, instrumental delivery, and perineal tear. Notably, forceps-assisted delivery escalates the probability of pelvic floor dysfunction and subsequent PUR, which may be attributable to heightened damage inflicted upon the anal levator muscle.^[7–9]

Low and outlet forceps deliveries can give rise to maternal complications, including third to fourth-degree perineal tears, hematomas in the vulvar and vaginal regions, urethral injuries, PUR, and damage to the anal sphincter complex.^[10–14] Management typically entails intermittent catheterization for cleansing purposes, with recuperation generally occurring within a span of 72 hours. Instances of sustained urinary retention extending beyond 72 hours or enduring bladder atony are

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All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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exceedingly infrequent and scarcely documented in the existing literature. Two instances were documented wherein urethral catheters were effectively removed 24 days and 37 days after childbirth, respectively. The limited quantity of cases precludes the derivation of substantive inferences.^[15] In addition, the underlying pathophysiology contributing to PUR remains enigmatic. While bladder catheterization stands as the optimal therapeutic approach, the definitive course of treatment remains equivocal. Moreover, a universally acknowledged preventive strategy for this condition is currently absent.^[8,13,14,16,17]

Hence, this investigation centered on a comprehensive assessment of correlated risk factors contributing to sustained urinary retention subsequent to forceps-assisted deliveries. In accordance with pertinent literature, the persistence of catheterization beyond a 72-hour threshold delineates the presence of enduring urinary retention. A compilation of overarching clinical attributes was assembled, yielding outcomes of notable instructive value for the enhancement of clinical diagnostics and therapeutic approaches.

2. Methods

A retrospective analysis was conducted on women undergoing vaginal delivery at the Obstetrics and Gynecology Hospital of Fudan University (Shanghai, China) between August 1, 2019 and December 1, 2019. Within the cohort of 385 vaginal deliveries, a subset of 28 cases involved forceps-assisted deliveries. Data were gathered encompassing maternal age, delivery frequency, intraoperative hemorrhaging, fetal weight, durations of both the first and second stages of labor, along with the duration of urinary catheter retention. Women who sustained catheterization for a period surpassing 72 hours were allocated to group A, while those with catheterization duration <72 hours were allocated to group B. The SPSS 24.0 statistical software (IBM, Armonk, NY) was employed to conduct data analysis. Descriptive statistical techniques were utilized to characterize

the general attributes of clinical data. Univariate analysis was performed through *t* test. For multivariate analysis, logistic regression analysis was employed, utilizing odds ratios to ascertain the risk factors associated with sustained urinary retention. This study received ethical approval from the Ethics Committee of Obstetrics and Gynecology Hospital, Fudan University. All participants and their respective families provided informed consent and willingly participated in the study, as indicated by their signatures on the informed consent form.

3. Results

There were a total of 385 women who underwent vaginal delivery, with 28 of them requiring forceps deliveries, making up 7.3% of the total. All 28 forceps deliveries utilized exit forceps, with the fetal head rotation angle being <45 degrees. Prior to delivery, there was no history of urinary retention, urinary infection, or urinary obstruction in any of these women. The 28 forceps delivery cases were all primiparous, and all of them had vulva incisions. Among these cases, 12 women had catheters in place for more than 72 hours and were categorized as group A, accounting for 3.1% of the total vaginal delivery cases. The other 16 cases had catheters in place for <72 hours and were categorized as group B. Following discontinuous attempts at catheterization, they were able to urinate smoothly.

Out of the 28 women who underwent forceps delivery, 22 (78.6%) received epidural anesthesia. All women in group A received epidural anesthesia. The average age of women in group A was 31 (31 ± 2.8) years old, while the average age of women in group B was 29 (29.2 ± 4.8) years old. The average amount of blood loss in group A was 496 (496 ± 290.8) mL, whereas in group B it was 332 (332 ± 121.2) mL. The mean fetal weight in group A was 3335 (3335 ± 327.8) g, while it was 3233 (3233 ± 363.8) g in group B. Additionally, the average duration of first labor was 570 (570 ± 260.1) min in group A versus 464 (464 ± 273.9) min in group B.

Table 1

General clinical characteristic of women after forceps delivery.

	Number	Epidural anesthesia	Primipara	Age	Bleeding (mL)	Fetal weight (g)	First stage of labor (min)	Second stage of labor (min)
Group A	1	yes	yes	32	220	3300	360	77
	2	yes	yes	32	1100	3100	375	34
	3	yes	yes	33	780	3460	810	155
	4	yes	yes	30	880	3340	1160	32
	5	yes	yes	29	350	2780	450	36
	6	yes	yes	33	330	2860	570	133
	7	yes	yes	26	200	3110	300	56
	8	yes	yes	28	210	3690	435	150
	9	yes	yes	32	350	3900	480	77
	10	yes	yes	37	450	3450	420	88
	11	yes	yes	32	460	3550	420	111
	12	yes	yes	30	630	3480	660	30
Group B	13	yes	yes	24	240	2730	165	30
	14	yes	yes	26	240	3930	855	60
	15	yes	yes	28	290	3520	145	74
	16	no	yes	30	460	3160	630	63
	17	no	yes	22	350	3460	60	12
	18	yes	yes	34	44	2990	850	30
	19	no	yes	28	190	2650	450	17
	20	yes	yes	37	430	3500	440	21
	21	yes	yes	36	320	3010	330	56
	22	no	yes	25	290	3020	340	38
	23	yes	yes	32	500	3630	255	52
	24	no	yes	30	450	3690	600	76
	25	yes	yes	37	260	3170	870	40
	26	no	yes	26	400	2830	145	56
	27	yes	yes	25	400	3160	580	14
	28	yes	yes	28	450	3290	720	98

The results of the univariate analysis revealed that all the aforementioned variables in group A were larger than those in group B; however, there was no significant difference. On average, the duration of the second labor in group A was found to be significantly longer than that in group B ($P = .03$), as indicated in Tables 1 and 2 and Figure 1. Subsequently, these variables were involved in the logistic regression analysis. The analysis demonstrated that the duration of the second labor in group A was significantly longer than that in group B, and the risk of persistent PUR in group A was 1.035 times higher than in group B (odds ratio = 1.035, 95% confidence interval: 0.999–1.073, $P = .057$), as shown in Table 3.

4. Discussion

Multiple studies have been conducted examining PUR, including retrospective analysis that investigated various factors, such as age, weight, height, body mass index, fetal birth weight, and

head circumference. This analysis revealed an exceptionally low incidence of persistent urinary retention, approximately accounting for 0.06%. However, due to limited data availability, it only concluded that persistent urinary retention was rare among women who had natural births or episiotomies and experienced second prolonged labor. Additionally, it was noted that maternal fetal head circumference mostly exceeded 36 cm, and a majority of women received epidurals. These factors may contribute to the elevated risk of postpartum persistent urinary retention. Maternal age was identified as a risk factor for PUR in women who underwent vaginal delivery. Specifically, compared to women under the age of 30 years old, those who aged ≥ 30 years old had a significantly higher incidence of urinary retention.^[14] This finding was supported by a study conducted in Norway, which enrolled 13,000 women who aged under 50 years old. Comparing women who had spontaneous vaginal delivery to those who had forceps delivery, the study found that the risk of urinary retention was greater for women who underwent forceps delivery.^[18]

This study provided evidence that a longer duration of the second stage of labor was associated with a higher likelihood of postpartum women experiencing persistent urinary retention. However, no statistically significant difference was observed. Additionally, a prolonged second stage of labor was identified as one of the factors leading to the use of forceps during birth. In the field of obstetrics, there is a general consensus that, for first-time mothers (primiparas), if both the mother and fetus are in favorable conditions, the duration of the second stage of labor may extend up to 3 hours. For women who have previously given birth (multiparas), the second stage of labor can be up to 2 hours before a diagnosis of labor stagnation is made. A meta-analysis reported that around 11.5% of primiparas who received epidural anesthesia experienced a prolonged second stage of labor. Based on this, it is recommended to observe the second stage of labor for up to 4 hours for primiparas who received epidural anesthesia, and up to 3 hours for multiparas who received epidural anesthesia. It is essential to understand why women who received epidural anesthesia were more likely to experience postpartum retention compared to women who did not. This could be attributed to the fact that women who received epidural anesthesia had a longer second stage of labor, considering the priority of ensuring the safety of both mothers and babies.

Previous studies have indicated that a potential explanation for PUR caused by a prolonged second stage of labor is due to compression of the pelvis by the fetal head. This compression can potentially result in nerve and vascular damage. Animal models have demonstrated that both direct and indirect vaginal injuries can lead to urinary retention or stress urinary incontinence.^[19–23]

In the present study, we found that all mothers in group A had received epidural anesthesia, suggesting that prolonged second labor may be a potential factor contributing to persistent urinary retention. However, it is important to note that additional risk factors for persistent urinary retention still require further investigation. Furthermore, it is worth mentioning that all participants in this study were first-time mothers, therefore, the potential impact of multiple childbirths on urinary retention remains elusive. Consequently, it is essential to consider expanding the sample size in order to conduct a more comprehensive study.

The limitations of the present study should be clearly pointed out. Firstly, the sample size was limited and single-center design of the study hindered the generalization of the findings of the study. Secondly, this study did not concentrate on indicating whether women who received epidural anesthesia were more likely to experience postpartum retention versus others.

5. Conclusions

In conclusion, PUR is uncommon in vaginal delivery, and persistent PUR is particularly rare. It primarily occurs in deliveries

Table 2
T test of variables in group A and B.

	Group A	Group B	P
Age (yr)	31 $\pm$ 2.8	29.2 $\pm$ 4.8	.16
Bleeding (mL)	496 $\pm$ 290.8	332 $\pm$ 121.2	.22
Fetal weight (g)	3335 $\pm$ 327.8	3233 $\pm$ 363.8	.51
First stage of labor (min)	570 $\pm$ 260.1	464 $\pm$ 273.9	.60
Second stage of labor (min)	81 $\pm$ 46.5	46 $\pm$ 25.0	.03

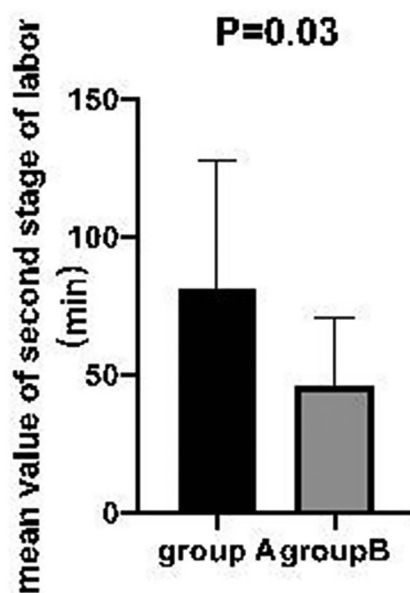


Figure 1. Mean value of the second stage of labor in groups A and B.

Table 3
Logistic regression analysis of variables and urinary retention in group A and B.

Characteristic	P	OR	95% CI	
			Lower limit	Upper limit
Second stage of labor (min)	.057	1.035	0.999	1.073
Bleeding (mL)	.086	1.005	0.999	1.011

CI = confidence interval, OR = odds ratio.

assisted by forceps, and prolonged second stage labor may contribute to persistent urinary retention in these cases. Notably, the results indicated that the duration of the second labor in group A was significantly longer than that in group B, and the risk of persistent PUR in group A was 1.035 times higher than in group B. Besides, a prolonged second stage of labor was identified as one of the factors leading to the use of forceps during birth. Further research is necessary to determine whether there are additional risk factors involved.

Author contributions

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