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Prevalence and risk factors for postpartum urinary retention after vaginal delivery in Japan: A case-control study

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Abstract

Aim: This study aimed to clarify the prevalence and risk factors of postpartum urinary retention after vaginal delivery. It also described the healing process of women who had postpartum urinary retention.

Methods: In this case-control study, 77 women who had postpartum urinary retention were matched by age and parity with 385 women as controls. Data were analyzed by conditional logistic regression analysis. Data were collected from the women in the case group regarding their healing process and conditions for urinary retention (overt or covert urinary retention).

Results: The prevalence of postpartum urinary retention was 1.2%. The adjusted odds ratio and the 95% confidence intervals for risk factors were as follows: epidural analgesia 4.72, 95% CI 2.38, 9.39; episiotomy 2.68, 95% CI 1.40, 5.13; length of second stage of labor 1.85, 95% CI 0.98, 3.49; labor augmentation 1.78, 95% CI 0.90, 3.51; instrument delivery 0.96, 95% CI 0.43, 2.17; and Kristeller maneuver 0.93, 95% CI 0.37, 2.37. Among 59 women with overt urinary retention, 29 (49.2%) transitioned to covert urinary retention within 10 days after delivery. More than half of the women were normal within 72 hr, but there were five women whose urinary retention did not resolve 11 days following delivery.

Conclusions: The statistically significant risk factors for postpartum urinary retention were epidural analgesia and episiotomy. Initiatives for the prevention and management of postpartum urinary retention are necessary.

KEYWORDS

case-control studies, postpartum period, risk factors, urinary retention

1 | INTRODUCTION

Postpartum urinary retention (PUR) is a common and transient health problem occurring in women immediately after giving birth, which usually resolves naturally within 72 hr. PUR is defined as an inability to void spontaneously or adequately after giving birth (Mulder et al., 2012). Although most cases of PUR are transient, it is well known that it may cause permanent voiding dysfunction and other long-term adverse effects (Mulder et al., 2014). Carley et al. (2002) reported that among 51 women with PUR, 45.1% had resolution of the retention by 48 hr after delivery, and 9.4% had resolution by 72 hr after delivery. However, prolonged PUR, defined as lasting for longer than 72 hr and requiring catheterization for a longer period, caused serious adverse effects such as stress incontinence, overactive bladder (Groutz et al., 2011) and urinary tract infections caused from catheterization (Humburg, Holzgreve, & Hoesli, 2007). In order to prevent or manage PUR, screening and early interventions are needed as standard postpartum care.

The major cause of PUR is thought to be neurological damage (i.e., neurogenic bladder) caused by hyperextension of the bladder at delivery and compression by the fetal head, resulting in minute nerve damage, urination attenuation/disappearance, and urinary retention (Sugo, Watanabe, Tsutsui, Sumikura, & Hayashi, 2010). Yet the precise pathology of PUR is still unknown.

There have been no changes in the PUR definition since Yip, Brieger, Hin, and Chung (1997) defined it and then classified it as overt (symptomatic) and covert (asymptomatic). Overt urinary retention was defined as the inability to void spontaneously within 6 hr after vaginal delivery or 6 hr after removal of an indwelling bladder catheter after cesarean section, requiring catheterization. Covert urinary retention was defined as a post-void residual bladder volume of more than 150 mL after spontaneous micturition, verified by ultrasound or catheterization. Many researchers have adopted these definitions. Based on the 1997 definition of Yip et al., a systematic review found that the prevalence of overt urinary retention ranged from 0.3 to 7.4%, and covert ranged from 0.4 to 45% (Mulder et al., 2014). In addition, the prevalence of prolonged PUR, which was defined as urinary retention lasting for longer than 72 hr and requiring catheterization for a longer period was 0.06% (Humburg, Troeger, Holzgreve, & Hoesli, 2011). In Japan the prevalence of PUR was reported to be 0.5% (Suenaga, Chisaka, & Okamura, 2008) to 0.9% (Wakayama, Shimabukuro, Moromizato, & Shiroma, 2010), but reports were few. No research was conducted to identify the prevalence for PUR divided by overt and covert urinary retention, or for prolonged PUR.

Mulder et al. (2012) conducted a systematic review to identify various risk factors for PUR. According to their findings, independent risk factors for overt PUR were epidural analgesia, instrument delivery, episiotomy and primiparity; however, for covert PUR no significant risk factors were found. In more recent studies, independent risk factors for covert PUR were episiotomy, epidural analgesia, and birth weight (Mulder, Oude Rengerink, van der Post, Hakvoort, & Roovers, 2016). According to Tiberon et al. (2018), risk factors for persistent PUR lasting more than 72 hr were cesarean delivery, perineal tear or episiotomy, and fluid administration in the delivery room. In Japan, although there have been case studies of PUR, there has not yet been any research on risk factors. In order to manage PUR and improve the quality of life of postpartum women, identification of risk factors are basic to prevent, screen and then to provide the appropriate interventions.

The aim of this study was to clarify the prevalence of overt and covert PUR and to identify the risk factors after vaginal delivery, and then to describe the healing process of women with PUR from delivery to 11 days after delivery.

2 | METHODS

The study design was a case-control study conducted in two hospitals in Tokyo, Japan. One was a central perinatal medical center (facility A) and the other was a regional perinatal medical center (facility B). Both were tertiary hospitals with neonatal intensive care units; however, intrapartum management differed between the facilities. In facility A, women were prohibited from walking while epidural analgesia was in use, and they had an indwelling bladder catheterization or intermittent catheterization. In facility B intrapartum women were able to walk if there was no numbness of the lower limbs and were able to use the toilet to urinate. Intermittent catheterization was performed when women could not urinate.

In this study, a diagnosis of overt PUR after vaginal delivery was the inability to void spontaneously within 8 hr after vaginal delivery. A post-void residual bladder volume of more than 150 mL after spontaneous voiding, verified by catheterization within 8 hr after vaginal delivery, was defined as covert PUR. We used 8 hr after vaginal delivery as the definition of overt and covert PUR instead of 6 hr after vaginal delivery (Yip's definition) because in one facility they used 8 hr as the marker. The definition of healing process was the number of hours or days until complete recovery from overt and covert PUR.

The case group included women who had PUR and: (a) a diagnosis of urinary retention, dysuria, or urination disorders at the postpartum period; (b) could not urinate on their own for about 8 hr after vaginal delivery (defined as overt urinary retention); (c) could urinate by themselves within 8 hr after vaginal delivery but had a feeling of bladder fullness and more than 150 mL of residual urine by urethral catheterization (covert urinary retention). The exclusion criteria were women who received an indwelling bladder catheter for postpartum hemorrhage, surgical removal of a vaginal wall hematoma, or severe perineal damage. The control group was composed of women who had no urinary retention after vaginal delivery.

Data from women in the control group were extracted from those who gave birth at the same hospital as the case group (hospital control). Matching of the control was performed in 10-year age increments (20-29, 30-39, 40-) and by parity. The case-to-control ratio was 1:5.

We reviewed medical and nursing records for data on women delivered at facility A from April 1, 2015 to October 31, 2016, and at facility B from August 31, 2013 to August 31, 2016. Data from a total of 462 postpartum women's records were extracted, consisting of 77 women in the case group and 385 women in the control group. Data collected were: age, height, non-pregnant weight, parity, gestational age at delivery, instrument delivery (vacuum, forceps), use and type of analgesia (epidural, spinal), labor induction or

augmentation, length of first and second stages of labor, episiotomy, degree of perineal laceration, Kristeller maneuver, birth weight, head circumference, time of urination (pre-parturition, postpartum), uresiesthesia, and urinary volume (urethral catheterization). In addition, only in the case group data were the healing processes and conditions for urinary retention (overt or covert urinary retention), and use of indwelling bladder catheter collected. Other data were collected to describe the study setting of the hospitals: total number of deliveries, number of vaginal deliveries (number of vacuum extractions, number of forceps deliveries), number of cesarean sections, number of midwives, and number of obstetric beds. The data collection period was from October 25, 2016 to April 30, 2017. The university ethics review committee approved this study.

Statistical analysis was performed using EZR on R commander (programmed by Y. Kanda) version 1.35. The level of significance was set to 5% by the two-sided test. For the categorical variables, either the Chi-square (χ^2) test or Fisher's exact test was performed to analyze the association of two variables. To analyze the differences between continuous variables, the *t* test or Welch's *t* test was performed. Univariate analysis of categorical variables and continuous variables was also performed. Odds ratio and 95% confidence interval were calculated for categorical variables. In univariate analysis, all variables with a $p < .05$ excluding gestational age at delivery and head circumference were inputted to the conditional logistic regression model, and the adjusted odds ratio, 95% confidence interval, and *p* value were calculated.

3 | RESULTS

3.1 | Features of the medical facilities cooperating with the research

Table 1 shows the data on the cooperating medical facilities. The total number of deliveries at facility A was 4,049, the number of vaginal deliveries was 3,026 (74.7%), of which the number of vacuum extractions was 350 (11.6%) and that of forceps delivery was 79 (2.6%). The number of cesarean sections was 1,023 (25.3%). The average number of midwives was 36, and the number of obstetric beds was 45. The total number of deliveries at facility B was 4,599, the number of vaginal deliveries was 3,387 (73.6%), of which the number of vacuum extractions was 156 (4.6%) and that of forceps delivery was 44 (1.3%). The number of cesarean sections was 1,212 (26.4%). The average number of midwives was 53 and the number of obstetric beds was 33.

TABLE 1 Characteristics of the study site hospitals

	Facility A[a]	Facility B[b]
Total deliveries, *n*	4,049	4,599
Vaginal deliveries, *n* (%)	3,026 (74.7%)	3,387 (73.6%)
Vacuum, *n* (%)	350 (11.6%)	156 (4.6%)
Forceps, *n* (%)	79 (2.6%)	44 (1.3%)
Cesarean sections, *n* (%)	1,023 (25.3%)	1,212 (26.4%)
Midwives, *n*	36[c]	53
Obstetric beds, *n*	45	33

[a]Data on facility A (from April 1, 2015 to October 31, 2016).
[b]Data on facility B (from August 31, 2013 to August 31, 2016).
[c]Only the midwives of the postpartum ward.

Table 2 shows the percentage of women with vaginal deliveries who had urinary retention by facility. There were 49 and 28 postpartum women in the case group at facilities A and B, respectively. The frequencies of PUR at facilities A and B were 1.6 and 0.8%, respectively. At facility A in the case group, overt urinary retention occurred in 36 women and covert urinary retention in 13 women. At facility B in the case group, 23 women had overt urinary retention and five women had covert urinary retention.

3.2 | Prevalence of PUR

Among 6,413 vaginal deliveries at facilities A and B, 77 (1.2%) women had PUR. Of those, 59 (0.9%) women had overt urinary retention, and 18 (0.3%) women had covert urinary retention.

3.3 | Comparison of obstetric characteristics and delivery outcomes between the case and control groups

Table 3 shows the data on obstetric characteristics and delivery outcomes. The mean age was 33.1 years ($SD = 3.81$) in the case group and 33.0 years ($SD = 4.20$) in the control group. The number of primiparous women was 71 in the case group (92.2%) and 355 in the control group (92.2%). The height, non-pregnant weight, non-pregnant body mass index, length of first stage of labor (minutes), birth weight, labor induction, and degree of perineal laceration were comparable between the two groups. The mean gestational age at

TABLE 2 Comparison of urinary retention from vaginal delivery by facility

	Facility A	Facility B
	n (%)	*n* (%)
Vaginal delivery	3,026	3,387
Urinary retention	49 (1.6)	28 (0.8)
Overt	36 (73.5)	23 (82.1)
Covert	13 (26.5)	5 (17.9)

TABLE 3 Comparison of case and control groups by obstetric characteristics and delivery outcomes

	Cases ($n = 77$)	Controls ($n = 385$)		
	Mean (*SD*)	Mean (*SD*)	*t*	*p* value
Maternal age	33.1 (3.81)	33.0 (4.20)	−0.11	.912
Height (cm)	160.8 (4.93)	160.0 (5.21)	−1.25	.211
Non-pregnant weight (kg)	51.8 (5.66)	51.1 (6.97)	−0.84	.403
Non-pregnant body mass index	20.0 (1.76)	20.0 (2.49)	−0.14	.892
Gestational age (weeks)	39.6 (0.93)	39.4 (1.02)	−2.03	.043*
First stage (min)	925.4 (811.0)	750.4 (655.1)	−1.78	.078
Second stage (min)	172.2 (135.0)	100.1 (87.9)	−4.50	<.001***
Birth weight (g)	3,172.6 (394.2)	3,086.0 (345.9)	−1.96	.051
Head circumference (cm)	33.8 (1.33)	33.5 (1.19)	−2.04	.042*
	n (%)	*n* (%)	χ^2	
Instrument delivery	24 (31.2)	53 (13.8)	12.77	<.001***
Vacuum	20 (83.3)	42 (79.2)		
Forceps	4 (16.7)	11 (20.8)		
Analgesia	58 (75.3)	122 (31.7)	49.56	<.001***
Epidural	56 (96.6)	115 (94.3)		
Spinal	1 (1.7)	1 (0.8)		
Combined spinal / epidural	1 (1.7)	6 (4.9)		
Primiparous	71 (92.2)	355 (92.2)		
Kristeller maneuver	16 (20.8)	32 (8.3)	9.42	.002**
Labor induction	10 (13.0)	45 (11.7)	0.02	.898
Labor augmentation	54 (70.1)	138 (35.8)	29.66	<.001***
Episiotomy	56 (72.7)	196 (50.9)	11.46	<.001***
Perineal laceration 0〜2nd[a]	60 (95.2)	340 (97.7)		
Perineal laceration 3rd/ 4th[a]	3 (4.8)	8 (2.3)		.386
Perineal laceration (missing)	14	37		

Note: The *t* test was used for continuous variables and χ^2 test was used for categorical variables.
[a]Fisher's exact test.
*$p < .05$.; **$p < .005$.
***$p < .001$.

delivery was 39.6 weeks ($SD = 0.96$) in the case group and 39.4 weeks ($SD = 1.02$) in the control group, showing a significant difference ($t = -2.03$, $df = 460$, $p = .043$) but has no clinical significance. The mean head circumference was significantly different ($t = -2.04$, $df = 460$, $p = .042$) between the case group at 33.8 cm ($SD = 1.33$) and the control group at 33.5 cm ($SD = 1.19$), but again had no clinical significance.

The following parameters showed significant differences between the case group and the control group: length of the second stage of labor (case group 172.2 min, control group 100.1 min, $t = -4.50$, $df = 89.32$, $p < .001$), instrument delivery (case group 31.2%, control group 13.8%, $\chi^2 = 12.77$, $df = 1$, $p < .001$), use of analgesia (case group 75.3%, control group 31.7%, $\chi^2 = 49.56$, $df = 1$, $p < .001$), labor augmentation (case group 70.1%, control group 35.8%, $\chi^2 = 29.66$, $df = 1$, $p < .001$), episiotomy (case group 72.7%, control group 50.9%, $\chi^2 = 11.46$, $df = 1$, $p < .001$), Kristeller maneuver (case group 20.8%, control group 8.3%, $\chi^2 = 9.42$, $df = 1$, $p = .002$).

3.4 | Predictive factors for PUR

After selection of possible risk factors through univariate analysis, conditional logistic regression analysis revealed epidural analgesia and episiotomy as independent risk

factors for PUR. We used six significant factors identified by univariate analysis in the conditional logistic regression model. Variable input to the model was carried out using a forced entry method. Table 4 shows the predictive factors for PUR. The crude odds ratios were as follows: length of the second stage of labor 3.28 (95% CI 1.83, 5.83), instrument delivery 2.83 (1.54, 5.13), use of analgesia 6.55 (3.66, 12.18), Kristeller maneuver 2.88 (1.39, 5.81), labor augmentation 4.19 (2.41, 7.48), and episiotomy 2.57 (1.46, 4.64).

From the conditional logistic regression analysis, the adjusted odds ratios were as follows: length of the second stage of labor 1.85 (95% CI 0.98, 3.49), instrument delivery 0.96 (0.43, 2.17), use of analgesia 4.72 (2.38, 9.39), Kristeller maneuver 0.93 (0.37, 2.37), labor augmentation 1.78 (0.90, 3.51), and episiotomy 2.68 (1.40, 5.13). Significant differences in the adjusted odds ratios were found in the use of analgesia 4.72 (2.38, 9.39) and episiotomy 2.68 (1.40, 5.13).

TABLE 4 Predictive factors for PUR

Factors	Crude OR (95% CI)	Adjusted OR (95% CI)[a]
Length of the second stage of labor (180 min ≦)	3.28 (1.83, 5.83)	1.85 (0.98, 3.49)
Instrument delivery	2.83 (1.54, 5.13)	0.96 (0.43, 2.17)
Epidural analgesia	6.55 (3.66, 12.18)	4.72 (2.38, 9.39)
Kristeller maneuver	2.88 (1.39, 5.81)	0.93 (0.37, 2.37)
Labor augmentation	4.19 (2.41, 7.48)	1.78 (0.90, 3.51)
Episiotomy	2.57 (1.46, 4.64)	2.68 (1.40, 5.13)

Abbreviations: OR, odds ratio; PUR, postpartum urinary retention.
[a]Conditional logistic regression analysis. Variable input to the model was carried out in a forced entry method.

3.5 | Healing process and conditions of women who suffered PUR after vaginal delivery

Figures 1 and 2 portray the healing process and conditions of women who developed PUR after delivery. After delivery,

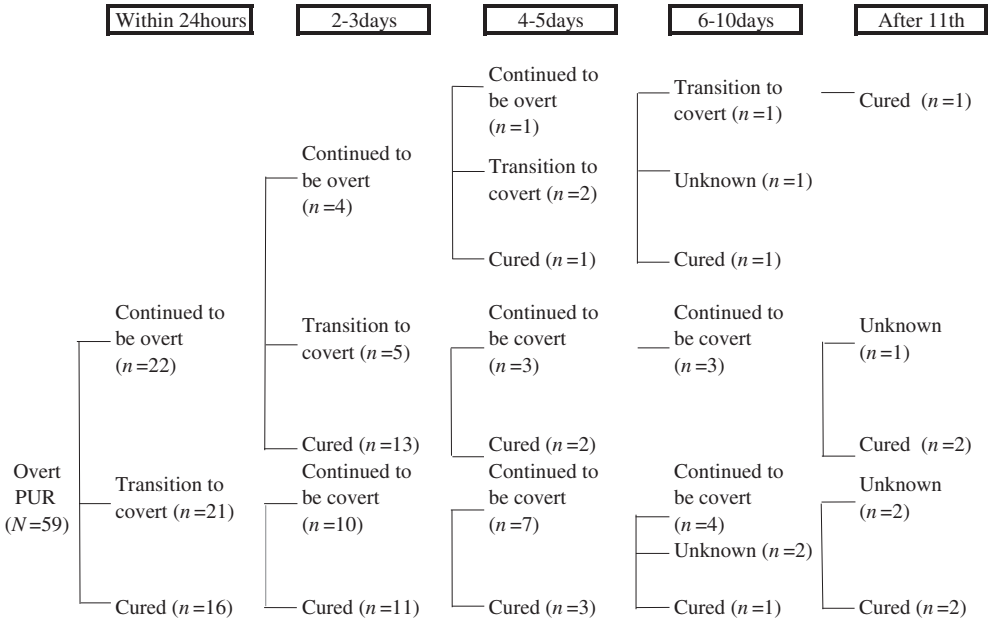

FIGURE 1 Healing process of women with overt postpartum urinary retention (PUR)

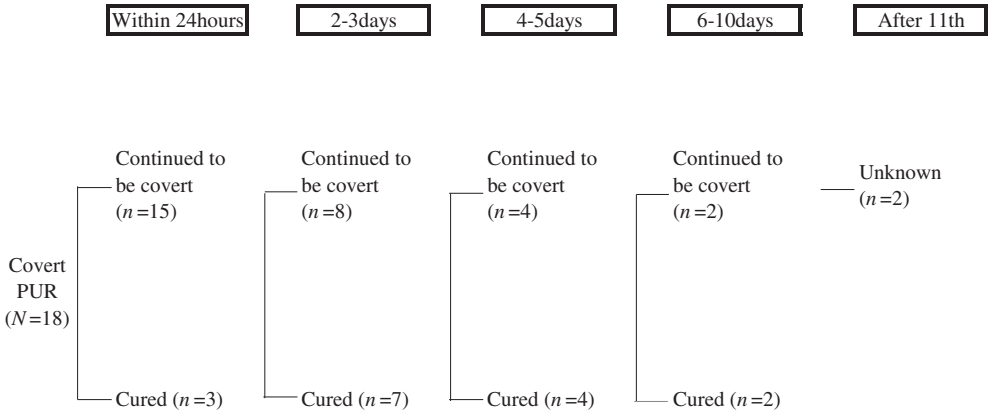

FIGURE 2 Healing process of women with covert postpartum urinary retention (PUR)

59 women developed overt PUR. At 24 hr after delivery, 22 (37.3%) continued to have overt PUR, 21 (35.6%) women reverted to covert PUR and 16 (27.1%) returned to normal. Only one woman who had overt PUR 24 hr after delivery continued to have overt PUR 4-5 days after delivery. Among the 22 women who continued to have overt PUR at 24 hr after delivery, three were cured and one woman could not be followed after discharge from the hospital at 11 days after delivery. Among the 21 women who reverted to covert PUR at 24 hr after delivery, seven continued with covert PUR beyond 72 hr after delivery. At 11 days after delivery, two women who had reverted to covert PUR at 24 hr after delivery were lost to follow-up. After day 11 of delivery one woman healed by the 19th day, one woman by the 24th day, one woman by the 29th day and two women by the 30th day.

Eighteen women had covert PUR at delivery. Among them 15 (83.3%) still had covert PUR at 24 hr after delivery. Four women remained with covert PUR beyond 72 hr and two women continued with covert PUR at 6-10 days after delivery. At 11 days after delivery, the two women were lost to follow-up.

4 | DISCUSSION

4.1 | Definition and prevalence of PUR

In this study, the prevalence of PUR was 1.2%: overt urinary retention was 0.92% and covert urinary retention 0.28%. Regarding the prevalence of PUR, the Yip et al. (1997) study found an overt urinary retention of 4.9%, Pifarotti et al. (2014) reported 0.8%, Carley et al. (2002) 0.45%, and Teo, Punter, Abrams, Mayne, and Tincello (2007) 0.2%. The prevalence of overt urinary retention in this study was similar to the frequency of 0.8% in Pifarotti et al. (2014), which was lower than that of 4.9% in Yip et al. (1997). It is considered that these differences were due to study design. Pifarotti et al. (2014) was a retrospective case-control study as was this study, but Yip et al. (1997) conducted a prospective study.

In this study covert urinary retention was only 0.28%, compared to Buchanan and Beckmann (2014) at 5.1%, using the same definition as Yip et al. (1997) with a finding of 9.7%. In the prospective study by Yip et al. (1997), residual urine volume was measured by ultrasound on the first day after vaginal delivery in all women surveyed except women with overt urinary retention who had a bladder indwelling catheter inserted. Even for women who had urinated after birth and had no reported problems, there have been cases in which a large amount of residual urine was confirmed by transvaginal ultrasound at the discharge examination on day four after vaginal delivery. Tanaka et al. (2015) stated residual urine could not be accurately documented by the midwife's voiding assessment alone, and urged the use of objective indicators such as ultrasound. Tanaka et al. also suggested that there are many women who have residual urine shortly after childbirth, and in the future it seems important to identify residual urine by ultrasound. Satoh, Goto, Herrera, Otsuka, and Ishikawa (2016) observed daily changes in postpartum residual urine volume by bladder scan. Satoh et al. (2016) reported that among 65 postpartum women, 12 (18.5%) on the first day and 20 (30.8%) on the third day had a residual urine of 150 mL or more. And among 65 women, 47 (72.3%) on the first day after vaginal delivery have reported reduced bladder sensation. Since postpartum women have diminished micturition desire because of vaginal delivery trauma, post-void residual urine measurement is used to confirm that the bladder is completely emptied. The post-void residual urine volume is considered of clinical significance. In Japan, after a vaginal delivery, women often walk to the bathroom at the latest 6-8 hr, hence a post-void residual urine measurement should be performed at that time. Women having reduced bladder sensation, straining to void and feeling of incomplete bladder emptying should be followed up for residual urine. In order to clarify the exact prevalence of PUR in Japan, a prospective study is needed that includes accurate data such as ultrasound measurement of the amount of residual urine in all postpartum women.

The definitions of PUR have varied among studies despite the overall acceptance of Yip's definition. Carley et al. (2002) defined PUR as the inability to urinate spontaneously within 12 hr after vaginal delivery. Teo et al. (2007) defined covert PUR as a sudden inability to urinate and a residual urine volume more than 100 mL with ultrasound or more than 100 mL with catheter urine volume. Since the definition of PUR is different in the previous studies the prevalence of PUR in this study cannot be adequately compared. However, subjects' ages in this study, at time of labor, tended to be higher than the national average with the average age of women at delivery as 33.1 years for the case group, 33.0 years for the control group. The percentage of the primiparous women exceeded 90%. They were younger compared to the 2017 trend in Japan where the average age of mothers by birth order was 30.7 years for first child, 32.5 years for second child, and 33.5 years old for third child (Ministry of Health, Labor and Welfare, 2017 p. 10). Both A and B facilities were perinatal medical centers and it is conceivable that the mothers' average age at birth was higher than the national average and the proportion of high-risk pregnant women was also larger. Therefore, it is expected that the prevalence of PUR was somewhat higher than in facilities handling low-risk labor.

4.2 | Predictive factors for PUR

Overt and covert urinary retention factors were combined and analyzed with conditional logistic regression, which showed the use of epidural analgesia and episiotomy as risk factors of PUR. The adjusted odds ratio for use of epidural analgesia was 4.72, and was the largest result. In the systematic review and meta-analysis by Mulder et al. (2012), seven studies on the use of epidural analgesia (four prospective studies and three retrospective studies) were integrated, and the adjusted odds ratio was 7.7. As in the Mulder et al. (2012) review, the use of epidural analgesia in this study resulted in the risk factor of PUR. According to the Cochrane Systematic Review of Anim-Somuah, Smyth, and Jones (2011), epidural analgesia increased instrument delivery (relative risk [RR] 1.42, 95% CI 1.28 to 1.57, 23 trials, 7,935 women), urinary retention (RR 17.05, 95% CI 4.82 to 60.39, three trials, 283 women), longer second stage of labor (mean difference 13.66 min, 95% CI 6.67 to 20.66, 13 trials, 4,233 women), and oxytocin administration (RR 1.19, 95% CI 1.03 to 1.39, 13 trials, 5,815 women). It is clear that the use of epidural analgesia was a risk factor for PUR.

While the very nature of a vaginal delivery can be a risk factor for PUR, there are other factors to consider. One important one is the impact of epidural analgesia. During epidural analgesia, the local anesthetics ropivacaine and synthetic opioid fentanyl are used. Opioids have four classic side effects: pruritus, nausea / vomiting, urinary retention and respiratory depression. Epidural opioids act on opioid receptors in the sacral spinal cord, causing detrusor relaxation and maximal bladder capacity increase (Chaney, 1995). In addition to epidural analgesia weakening the contraction force of the detrusor muscles, excessive extension of the bladder occurs if a large amount of urine is stored due to an increase in maximum bladder capacity. For this reason, in women who received epidural analgesia, observations of the effect of anesthesia on the bladder and detrusor muscles and voiding assessment are crucial. As noted earlier, Sugo et al. (2010) explained that the cause of urinary retention after childbirth is due to nerve damage referred to as neuropathic bladder and is caused by hyperextension of the bladder during delivery. Pressure of the infant's head during descent can cause fine nerve injury, and urination attenuation or disappearance and urinary retention may occur.

In this study, another perceived risk factor was episiotomy. The adjusted odds ratio of episiotomy was 2.68. Mulder et al. (2012) conducted a systematic review and meta-analysis, which combined five studies (three prospective studies and two retrospective studies) together with episiotomies and perineal lacerations; their adjusted odds ratio was 4.8. Mulder et al. (2012) gave an adjusted odds ratio for perineal damage, with similar results obtained in this study.

In addition to the complex effects on the urological and reproductive systems during delivery, edema and pain in the perineum also made it difficult to urinate. Larsson, Platz-Christensen, Bergman, and Wallstersson (1991) investigated perineal laceration and pain after birth using a visual analog scale. Women with mediolateral episiotomies had more pain on the first and third days after birth than the natural laceration group and no laceration group. They reported that it was about the same level on the fifth day. Irie et al. (1995) reported that voiding dysfunction appeared at a significantly higher rate in episiotomy groups. Episiotomy itself incurred the same degree of damage as a second-degree perineal laceration (Shimada, 2003), and it was unlikely that it was directly related to voiding dysfunction. Shimada (2003) suggested that in previous research there was a possibility that the sensation of pain in the perineum after delivery may differ between an episiotomy and perineal laceration. Irie et al. (1995) reported that a significant number of dysuria symptoms appeared in the episiotomy group and described the involvement of emotional factors. For example, urination could be difficult when the woman is anxious that it will increase the pain from her laceration or episiotomy or that it might make her wound dehisce. Women who had an episiotomy often feared urination itself might be painful. It is presumed that there is an influence on women's emotional state due to the episiotomy.

4.3 | PUR healing process after delivery

In this study, there were 59 women with overt urinary retention, and all were transitioning to covert urinary retention. In addition, within 72 hr after birth, 50 (64.9%) women had healed: 40 women (67.8%) with overt PUR and 10 women (55.6%) with covert PUR. Carley et al. (2002) reported that 23 (45.1%) of 51 women with overt PUR resolved by 48 hr postpartum and 15 (29.4%) were healed by 72 hr. As a result, 38 women (74.5%) with overt PUR were healed within 72 hr. In this study, similar to the results of Carley et al. (2002) about 70% of overt PUR healed within 72 hr. In this study, the number of women who had not healed at the time of discharge (vaginal delivery was usually 4-5 days) were 13 (22.0%) with overt PUR and four (22.2%) with covert PUR. There were 17 (22.0%) women who did not heal within 5 days after birth. Carley et al. (2002) reported that 13 (25.5%) did not heal after 72 hr, and 10 (19.6%) of 13 women were still unhealed at discharge. In the Carley et al. (2002) research about 20% of women with PUR had been discharged from the hospital without healing. The disparate reporting time frames of healing from PUR make it more difficult to compare the healing trajectories but a comparison suggests that this study and the Carley et al. (2002) study were similar.

Although the postpartum period is the time to acquire the mothering role, it is obvious that the burden increases with PUR. Therefore, midwives who support postpartum women need to know the healing process of women in PUR. Then, it is necessary to deepen their knowledge of PUR and to be able to make appropriate voiding assessments.

4.4 | Limitation of the study

The main limitation of this study was the data collection method using the chart review, and therefore there may have been charting inaccuracies and missing data in the medical and nursing records. Therefore, not all data could be collected. Also, since it was a retrospective study, the selection bias of controls was also a weak point of the research design. Although there was a possibility of selection bias, there was no significant difference in obstetric characteristics between the case group and control group. This study was a case-control study with chart review and had no memory bias. In addition, there was no factor for PUR to be declared directly by the subjects, and the factor that was exposed was the result of vaginal delivery and there was no information bias because it was not something that the subjects or staff could control. The risk factors were not clarified because the sample size was small at both hospitals, protocols for epidural analgesia were different; there was no national guideline for PUR in Japan. In the future, it is necessary to clarify the risk factors by increasing the number of facilities and subjects. Since the definition of PUR varied, we think that it is necessary to create a consensus of a definition and prepare protocols for postpartum voiding management. Finally, there could have been other factors such as birth position that contributed to the risk factors. However, the two facilities in this study both used the supine position for vaginal delivery. Despite the limitations, the strengths of this study should be noted. It is one of the few studies that described the healing process of PUR. While there are several studies on PUR risk factors, there are few studies that have followed the healing process. Knowing the day-to-day healing process of PUR should be useful for midwives in developing or refining clinical guidelines, making better clinical judgments and for postpartum women to ease their anxiety.

5 | CONCLUSIONS

In this case-control retrospective study the prevalence of PUR after vaginal delivery in two perinatal centers in Japan was 1.2%. The statistically significant risk factors for PUR were epidural analgesia and episiotomy. A significant difference in the adjusted odds ratio as a risk factor for PUR was found for epidural analgesia and episiotomy. There are no national guidelines in Japan for postpartum bladder care. Therefore, initiatives for the prevention and management of PUR are necessary.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

IK was involved in the design of the study, data collection, data analysis and manuscript writing. YK participated in the design of the study, data analysis and manuscript writing. Both authors read and approved the final manuscript.

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