Taiwanese Journal of Obstetrics & Gynecology 54 (2015) 678–681

Contents lists available at ScienceDirect

Taiwanese Journal of Obstetrics & Gynecology

journal homepage: www.tjog-online.com

Original Article

Voiding dysfunction in women following cesarean delivery

Ching-Chung Liang [a, b], Ming-Ping Wu [c, d], Yao-Lung Chang [a, b], Ho-Yen Chueh [a, b], An-Shine Chao [a, b], Shuenn-Dhy Chang [a, b, *]

[a] Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital, Linkou Medical Center, Taoyuan, Taiwan
[b] College of Medicine, Chang Gung University, Taoyuan, Taiwan
[c] Division of Urogynecology and Pelvic Floor Reconstruction, Department of Obstetrics and Gynecology, Chi Mei Foundation Hospital, Tainan, Taiwan
[d] Department of Obstetrics and Gynecology, College of Medicine, Taipei Medical University, Taipei, Taiwan

ARTICLE INFO

Article history:
Accepted 21 August 2014

Keywords:
cesarean delivery
postoperative analgesia
urinary retention
voiding difficulty

ABSTRACT

Objective: This study was conducted to investigate the prevalence of *postpartum* voiding difficulty (PVD) in women after cesarean delivery that required urethral catheterization, and to illustrate its relationship with various relevant obstetric factors.
Material and methods: For this observational study, 489 pregnant women who had cesarean delivery at ≥ 36 gestational weeks were recruited in a tertiary hospital. Urethral catheterization was implemented in women who could not void spontaneously after cesarean delivery. Patient characteristics, obstetric parameters, and incidences of obstructive voiding symptoms at 3 months *postpartum* were compared between women who had PVD and no PVD.
Results: Fifty-six cesarean deliveries (11.5%) resulted in PVD. Maternal age > 35 years, emergency cesarean delivery, operation time > 60 minutes, and postoperative analgesia were significantly different between women with and without PVD. Logistic regression demonstrated that emergency cesarean delivery (odds ratio = 5.031, $p < 0.001$), operation time > 60 minutes (odds ratio = 2.918, $p = 0.002$), and postoperative analgesia (odds ratio = 7.610, $p = 0.007$) were independent risk factors of PVD. Nonetheless, all women had resolution of PVD by the time of hospital dismissal. At 3-month postoperative follow-up, three women (5.4%) had symptoms of straining and/or incomplete emptying.
Conclusion: Our results showed that emergency cesarean delivery, prolonged operation time and postoperative analgesia are the main contributing factors of PVD after cesarean delivery. If urinary retention can be detected in time, transient PVD is not detrimental to urinary function and does not subsequently lead to voiding problems.

Introduction

Urinary retention after vaginal delivery is a relatively common occurrence, with the reported incidence ranging from 1.7% to 17.9% [1,2]. Several clinical studies have demonstrated that *postpartum* urinary retention (PUR) is associated with various obstetric factors, including the use of epidural analgesia, primiparity, instrument-assisted vaginal delivery, long labor, and perineal trauma [3]. Experimental study revealed that urinary retention after vaginal delivery is related to the plasma progesterone level change and the expression of caveolin, caveolae, and nerve growth factor in bladder muscle cells [4], but its pathophysiology is still poorly understood. The diagnosis of PUR always relies on accurate estimation of the postvoid residual bladder volumes (PVRBV) by using bladder ultrasound [5–8]; however, there has been no consensus reached yet on a standardized definition of PUR. Actually, PUR does not reflect women who have inability to void after delivery because two-thirds of women with PUR had elevated PVRBV without urinary symptoms [9].

Although previous studies have suggested that the prevalence of retention of urine after cesarean delivery was higher than that after vaginal delivery [10], the relationships between cesarean delivery and PVD remains elusive. The role of cesarean delivery in PUR is difficult to delineate due to the effects of anesthesia and operation

* Corresponding author. Department of Obstetrics and Gynecology, Chang Gung Memorial Hospital, Linkou Medical Center, 5 Fu-Shin Street, Gueishan, Taoyuan, 333, Taiwan.
E-mail address: gene@cgmh.org.tw (S.-D. Chang).

http://dx.doi.org/10.1016/j.tjog.2014.08.011

both complicating *postpartum* bladder changes [10–12]. If urinary retention after cesarean delivery could be detected in time, appropriate catheterization may prevent long-term urinary problems. The objectives of this study were to assess the prevalence of *postpartum* voiding difficulty (PVD) after cesarean delivery and to demonstrate the relationships between various obstetric factors and PVD.

Materials and methods

In recent years, we have conducted a prospective study to evaluate the connection between various obstetric parameters and the urinary incontinence in pregnancy [13]. In the current study, we used the same cohort of women retrospectively to analyze the relationships between various obstetric factors and PVD after cesarean delivery. The Ethics Committee of Chang Gung Memorial Hospital in Taiwan approved the study protocol (No. 103-2986B). Inclusion criteria included all pregnant women who underwent cesarean delivery at $\geq$ 36 gestational weeks in our institution, a tertiary care hospital, between June 2005 and March 2006. Exclusion criteria were: (1) vaginal delivery; (2) multiple pregnancies; (3) previous surgeries for uterovaginal prolapse or urinary incontinence; (4) severe cardiopulmonary diseases or renal diseases; (5) preeclampsia; and (6) insulin-dependent diabetes mellitus. Indications for cesarean delivery included uterine scar, abnormal presentation of fetus, placenta previa, placental abruption, cephalopelvic disproportion, and emergency cesarean delivery (arrest of dilatation or descent and abnormality of fetal heart rate).

A 14-Charriere indwelling Foley catheter was inserted prior to cesarean delivery and then removed 24 hours after surgery. Postoperative analgesia was given for 24 hours by means of either an epidurally administered bolus of morphine (1.5 mg morphine with normal saline 5 mL every 12 hours) or patient-controlled epidural analgesia with 2.5 μg/mL fentanyl (Janssen, Cologno Monzese, Italy) and 0.067% ropivacaine (AstraZeneca, Södertälje, Sweden) 5 mL/h in those women requesting pain relief. According to the protocol, management of urinary retention after cesarean delivery in this study was repeated intermittent urethral catheterization every 6 hours after removal on Day 1 of the indwelling catheter in those women who had persistent PVD. The PVRBV of women with PVD were measured with a Bladder scan BVI 3000 (Diagnostic Ultrasound Corporation, Ijsselstein, The Netherlands). If PVD or the PVRBV $\geq$ 150 mL persisted into Day 2, an indwelling catheter was placed for 24 hours, and then intermittent urethral catheterization was performed again on Day 3. Except for those with serious *postpartum* complications, all patients with PVD were discharged from the hospital on Day 4 and instructed to perform intermittent self-catheterization at home. PVD was defined as no spontaneous micturition within 6 hours after the removal of an indwelling catheter (> 24 hours after cesarean delivery) [2]. Resolution of PVD was defined by the ability to resume spontaneous micturition and the PVRBV < 150 mL.

To ascertain whether women diagnosed with PVD subsequently developed obstructive voiding symptoms in the immediate *postpartum* period, all women were requested to complete the Liang et al [14] lower urinary tract symptoms questionnaire via a telephone interview by a research nurse at 3 months *postpartum*. The questionnaire includes eight questions that describes symptoms of nocturia, diurnal frequency of micturition, urgency, stress urinary incontinence, urgency urinary incontinence, incomplete emptying, voiding difficulty, and straining. All participating women answered the questions dichotomously, with yes or no responses. The focus stayed on the obstructive voiding symptoms in this study including straining, incomplete emptying, and voiding difficulty.

The data are summarized as means ± standard deviations or percentages, as appropriate. Student *t* test was used for statistical comparisons involving quantitative data. For comparisons involving qualitative data, χ^2 analysis was used. Logistic regression was applied to determine the covariates associated with PVD. A p value < 0.05 was considered significant. Statistical analysis was performed with SPSS version 15.0 for Windows (SPSS, Inc., Chicago, IL, USA).

Results

A total of 489 women with cesarean delivery were eligible. The overall prevalence of PVD after cesarean delivery was 11.5%. Table 1 summarizes the demographic, obstetric and fetal characteristics of the two groups of women, with PVD (n = 56) and without PVD (n = 433). There was no significant difference in PVD rate, whether general anesthesia or regional anesthesia was performed (2/19 vs. 54/471, $p > 0.05$), but postoperative analgesia increased the PVD rate after cesarean delivery (54/56 vs. 341/432, $p = 0.001$). Women receiving epidural anesthesia had a higher PVD rate than those receiving patient-controlled analgesia (36/195 vs. 18/200, $p = 0.017$). Of the 56 women who received intermittent urethral catheterization to relieve PVD, 49 (87.5%) experienced resolution of PVD within 24 hours after removal of the indwelling catheter, with intermittent catheterization performed once in 33 (58.9%), twice in 16 (28.6%) and more than three times in seven (12.5%). Owing to an inability to void spontaneously, four women (7.1%) required an indwelling catheter re-inserted, but all of these women recovered from PVD by the time of hospital dismissal.

When comparing the obstetric and fetal characteristics of women with and without PVD, maternal age > 35 years, emergency cesarean delivery, operation time > 60 minutes, and postoperative analgesia were found to be significantly different between the two groups (Table 1). Multivariable logistic regression showed that emergency cesarean delivery (odds ratio = 5.031, $p < 0.001$), operation time > 60 minutes (odds ratio = 2.918, $p = 0.002$), and postoperative analgesia (odds ratio = 7.610, $p = 0.007$) were associated with PVD after cesarean delivery (Table 2).

Table 1
Comparison of various obstetric and fetal characteristics between PVD and non-PVD groups.

Variable	PVD (n = 56)	Non-PVD (n = 433)	p [a]
Maternal age (y)	30.7 ± 4.15	31.7 ± 4.52	0.951
Parity	1.48 ± 1.3	1.61 ± 1.4	0.116
BMI at delivery (kg/m^2)	27.4 ± 4.25	29.8 ± 18.73	0.328
Blood loss (mL)	460.7 ± 198.2	515.3 ± 258.3	0.128
Operation time (min)	49.3 ± 10.8	48.5 ± 12.7	0.632
Newborn birth weight (g)	3116.4 ± 399.2	3163.5 ± 468.5	0.473
HC of newborn (cm)	33.9 ± 1.4	34.3 ± 1.5	0.207
Hospital stay (d)	4.7 ± 4.3	4.9 ± 4.6	0.176
Age > 35 y	8 (14.3)	123 (28.4)	0.035
BMI > 30 kg/m^2	20 (35.7)	138 (31.9)	0.548
Nulliparity	29 (51.8)	202 (46.7)	0.481
Emergency cesarean	21 (37.5)	41 (9.5)	<0.001
General anesthesia	2 (3.6)	21 (4.8)	1.0
Blood loss > 500 mL	10 (17.9)	85 (19.6)	0.859
Operation time > 60 min	17 (30.4)	62 (14.3)	0.006
Postoperative analgesia	54 (96.4)	341 (78.8)	0.001
Newborn birth weight >3500 g	14 (25)	94 (21.7)	0.608
HC of newborn > 36 cm	10 (17.9)	77 (17.8)	1.0

Data are presented as mean ± standard deviation or n (%).
BMI = body mass index; HC = head circumference; PVD = postpartum voiding difficulty.
[a] Calculated by Student *t* test or χ^2 test.

Table 2
Logistic regression analyses of risk factors for PVD following cesarean delivery.

Variable	OR	95% CI	*p*
Age > 35 y	0.503	0.244–1.130	0.096
Operation time > 60 min	2.918	1.477–5.763	0.002
Emergency cesarean	5.031	2.594–9.758	< 0.001
Postoperative analgesia	7.610	1.755–33.007	0.007

CI = confidence interval; OR = odds ratio; PVD = *postpartum* voiding difficulty.

At the 3-month postoperative follow-up, three women (5.4%) continued to experience one of the obstructive voiding problems, including straining in two (3.6%) and incomplete emptying in three (5.4%), but none had voiding difficulty symptoms.

Discussion

The bladder capacity is increased throughout pregnancy, beginning at 3 months and lasting through to 6–8 weeks *postpartum* [15]. Furthermore, the bladder remains hypotonic in the immediate *postpartum* period after the gravid uterus–bladder capacity-limiting effect is gone, which may contribute to PUR. Detection of PUR as early as possible is important because a single episode of overdistension can irreversibly damage the bladder structures [16]. In 2010, the International Continence Society and International Urogynecological Association revised the definition of acute retention of urine as a generally painful, palpable, or percussable bladder, when the patient is unable to pass any urine with the bladder full [17]. PUR has been classified into covert and overt forms by some investigators [5,9,18], although no standardized definition exists currently. The covert form can be identified by elevated PVRBV, either with catheterization or with ultrasound scanning [5]. Clinically overt PUR indicates the inability to void spontaneously after delivery [5,9,18].

Our results showed that the overall incidence of PVD after cesarean delivery was 11.5%. The incidence of acute urinary retention after cesarean delivery in this study was higher than that of previous reports [10,19]. Kermans et al [10] suggested that the prevalence of retention of urine after caesarean delivery was higher than that after vaginal delivery (3.2% vs 2.1%). In a prospective study, 3.4% of 207 women experienced PUR after cesarean delivery, which was defined as PVRBV of > 150 mL. The inconsistency in these results could be due to the different criteria used for patient recruitment. Currently there is no standardized definition of PVD after cesarean delivery. Prior studies have indicated that PUR after cesarean delivery was defined as PVRBV of > 150 mL by using a bladder ultrasound after spontaneous voiding 6 hours after removal of Foley catheter [10,19]. However, our patients received urethral catheterization if they had no spontaneous micturition after catheter removal. Furthermore, unlike previous reported data that also included preterm deliveries, our series only comprised women with no less than 36 weeks of gestation, which could have positively created more emergency cesarean delivery situations and hence elevated the PVD rate as a result.

Chai et al [19] found that lack of progress of labor was the only significant associated factor. In our series, multivariable logistic regression demonstrated that PVD after cesarean delivery correlated with three parameters: cesarean delivery for emergency indications (arrest of dilatation or descent and fetal distress); operation time > 60 minutes; and postoperative analgesia. These findings were similar to what had been reported by Kermans et al [10] who demonstrated cesarean delivery for arrest of dilatation, the use of epidural analgesia and nulliparity were significantly more prevalent among women with postcesarean urinary retention. However, when removing the influence of epidural anesthesia as adjusting for a multivariate analysis, they found that women with cesarean delivery did not register an increased prevalence of PUR, which might be due to a limited sample size [10].

Some investigators have suggested that the prevalence of retention of urine after cesarean delivery was higher than that after vaginal delivery [10,19], but how cesarean delivery and PVD are related remains elusive. Two plausible reasons have been presented [19]: (1) the indications of cesarean delivery *per se* pose greater risk for postoperative urinary retention, including protracted labor and difficult delivery; (2) immobility after surgery and wound pain may further increase the risk of PUR. In our series, emergency cesarean deliveries included arrest of dilatation or descent and abnormality of fetal heart tracing. As opposed to not in labor, during labor, the presenting part of the fetus may exert pressure on the pelvic floor and the pelvic soft tissues, including the pelvic nerve plexus, which may subsequently lead to either urinary outflow obstruction by tissue edema, or detrusor dysfunction due to neurapraxia [6]. In addition, we found that prolonged operation time increases urinary retention risk; cesarean delivery itself causes bruising and edema of the bladder near the uterovesical area [19], especially in those cases with prolonged operation time, thereby elevating the incidence of PVD.

The negative impact of postcesarean analgesia on the *postpartum* bladder has been reported [11,12]. Evron et al [11] investigated PUR in 120 women undergoing cesarean delivery and found that 57.5% of women receiving postoperative epidural morphine for pain relief needed urethral catheterization due to voiding dysfunction after cesarean delivery. Epidural analgesia with morphine was significantly associated with postcesarean urinary retention, but it was not detrimental to later urinary function [11]. Liang et al [12] reported that the incidence of PUR was higher in the group given epidural bolus morphine administration (33.3%) than the groups receiving patient-controlled epidural analgesia with ropivacaine–fentanyl (15%) or intramuscular pethidine (16.7%). Our results showed that postoperative analgesia increased the PVD rate after cesarean delivery. Women receiving epidural anesthesia were found to have a higher PVD rate than those receiving patient-controlled analgesia. The mechanism underlying the high incidence of urinary disturbances that occur as a result of postoperative epidural morphine is still obscure. However, it is noteworthy that many factors are involved in micturition, including elastic tension of the bladder wall, its neural control, tonicity of the smooth muscle of the bladder neck and of the abdominal muscle wall, and nervous system control [20,21].

In our series, 56 women needed catheterization to resolve their voiding problems during the immediate *postpartum* period. Fortunately, 87.5% ($n = 49$) of these women resumed spontaneous micturition after catheterization twice and all had recovered from PVD at the time of hospital discharge. Women with PVD may be at risk of developing obstructive voiding problems later, but studies in this regard have been scarce. Andolf et al [18] investigated a small group of covert PUR for 4 years after vaginal delivery and found voiding difficulties in one-third. In a contrary study, Yip et al [22] evaluated covert PUR women after vaginal delivery 4 years later and found no higher prevalence of urinary symptoms than in the general population. Our data showed that only 5.4% of women had persistent obstructive voiding symptoms at 3 months postcesarean follow-up. These results suggest that establishing a diagnosis of PUR and following up for obstructive voiding symptoms at 3 months *postpartum* may be crucial in terms of predicting long-term urination-related outcome. Special attention can then be paid to those that have an increased likelihood of developing subsequent urinary problems.

In conclusion, the prevalence of PVD after cesarean delivery in our study was found to be 11.5%. Emergency cesarean delivery, prolonged operation time, and postoperative analgesia are the

main contributing factors to PVD after cesarean delivery. By identification of these risk factors, urinary retention after cesarean delivery could be detected in time and treated early. Although a transient PVD might exist, it was not detrimental to urinary function, but future development of serious voiding problems could consequently be avoided.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

This work was supported by the Medical Research Project, Chang Gung Memorial Hospital, Taoyuan, Taiwan (grant numbers CMRPG3C1271 and CMRPG33048).

References

[1] Saultz JW, Toffer WL, Sbackles JY. *Postpartum* urinary retention. J Am Board Fam Pract 1991;4:341–4.
[2] Yip SK, Sahota D, Pang MW, Chang A. *Postpartum* urinary retention. Acta Obstet Gynecol Scand 2004;83:881–91.
[3] Liang CC, Wong SY, Tsay PK, Chang SD, Tseng LH, Wang MF, et al. The effect of epidural analgesia on *postpartum* urinary retention in women who deliver vaginally. Int J Obstet Anesth 2002;11:164–9.
[4] Liang CC, Lin YH, Chen TC, Chang SD. How *antepartum* and *postpartum* acute urinary retention affects the function and structure of the rat bladder. Int Urogynecol J 2014;25:1105–13.
[5] Carley ME, Carley JM, Vasdev G, Lesnick TG, Webb MJ, Ramin KD, et al. Factors that are associated with clinically overt postpartum urinary retention after vaginal delivery. Am J Obstet Gynecol 2002;187:430–3.
[6] Yip SK, Fung TY, Chung TKH. Ultrasonographic estimation of *postpartum* postvoid residual bladder volume: a comparison between transabdominal and transvaginal ultrasonography. Int Urogynecol J 1998;9:9–12.
[7] Liang CC, Wei TY, Chang SD, Hsieh CC. Bladder volume determination: two-dimensional versus three-dimensional transvaginal ultrasound. Taiwan J Obstet Gynecol 2009;483:258–61.
[8] Barrington JW, Edwards G, Ashcroft M, Adekanmi O. Measurement of bladder volume following cesarean section using Bladderscan. Int Urogynecol J 2001;12:373–4.
[9] Yip SK, Brieger G, Hin LY, Chung T. Urinary retention in the *postpartum* period: the relationship between obstetric factors and the *postpartum* postvoid residual bladder volume. Acta Obstet Gynecol Scand 1997;76:667–72.
[10] Kermans G, Wyndaele JJ, Thiery M, De Sy W. Puerperal urinary retention. Acta Urol Belg 1986;54:376–85.
[11] Evron S, Samueloff A, Simon A, Drenger B, Magora F. Urinary function during epidural analgesia with methadone and morphine in post-cesarean section patients. Pain 1985;23:135–44.
[12] Liang CC, Chang SD, Wong SY, Chang YL, Chen SH, Cheng PJ. Effects of postoperative analgesia on *postpartum* urinary retention in women undergoing cesarean delivery. J Obstet Gynecol Res 2010;36:991–5.
[13] Liang CC, Chang SD, Lin SJ, Lin YJ. Lower urinary tract symptoms in primiparous women before and during pregnancy. Arch Gynecol Obstet 2012;285:1205–10.
[14] Liang CC, Tseng LH, Horng SG, Lin IW, Chang SD. Correlation of pelvic organ prolapse quantification system scores with obstetric parameters and lower urinary tract symptoms in *primiparae postpartum*. Int Urogynecol J 2007;18:537–41.
[15] Muellner RS. Physiological bladder changes during pregnancy and the puerperium. J Urol 1939;41:691–5.
[16] Hinman F. Postoperative overdistension of the bladder. Surg Gynecol Obstet 1976;142:901–2.
[17] Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association/International Continence Society joint report on the terminology for female pelvic floor dysfunction. Int Urogynecol J 2010;21:5–26.
[18] Andolf E, Iosif CS, Jörgensen C, Rydhström H. Insidious urinary retention after vaginal delivery: prevalence and symptoms at follow-up in a population-based study. Gynecol Obstet Invest 1994;38:51–3.
[19] Chai AH, Wong T, Mak HL, Cheon C, Yip SK, Wong AS. Prevalence and associated risk factors of retention of urine after caesarean section. Int Urogynecol J 2008;19:537–42.
[20] Torda TA, Mack AJ. A study of human bladder detrusor muscle. Br J Urol 1969;41:448–54.
[21] Ghoneim MA, Tretin JA, Gagnon DJ, Susset JG. The influence of vesical distention on urethral resistance to flow: the expulsion phase. Br J Urol 1975;47:663–70.
[22] Yip SK, Sahota D, Chang AMZ, Chung TKH. Four-year follow-up of women who were diagnosed to have *postpartum* urinary retention. Am J Obstet Gynecol 2002;187:648–52.