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A Prospective Comparative Observational Study of Maternal Risk Factors for Postpartum Covert Urinary Retention by Ultrasonography

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A B S T R A C T

Introduction: Postpartum urinary retention (PUR) is defined as being unable to void completely after delivery .The covert PUR is described as "a post void residual bladder volume (PVRV) of ≥ 150 ml after spontaneous micturition, verified by ultrasound or catheterization".***Aims & Objectives***:The aim was to identify high risk factors for covert postpartum urinary retention after vaginal delivery by ultrasonography and objectivesare to study theprevalence of covert PUR and to assess the associated obstetric variables.***Material & Methods***: In this prospective observational descriptive study 250 postpartum women were taken who delivered vaginally without urinary symptoms.. The post void residual volume (PVRV) wasmeasured by ultrasonography urinary bladder region at the time of discharge. PVRV < 150 ml was considered as normal and treated asCONTROL GROUP; PVRV ≥ 150 ml was considered as STUDY GROUP.For all participants, maternalcharacteristics such as age and parity; gestational age at onset of labor; induction of labor, duration of second stage of labor; and episiotomy; were collected and statistically analysed.***Results***: The characteristics of the patients with or without covert PUR were compared gestational weeks (p = 0.043),induction of labour (p=0.003), duration of second stage of labor (p value <0.001); and need for episiotomy (p=0.003) werefound to be statistically significant between patients with PVRV under 150 mL and ≥150 mL. Age and parity were not foundto be statistically significant.***Conclusion***: In this study gestational weeks, induction of labour , duration of second stage of labor and need for episiotomy were identified as risk factors for covert post partum urinary retention. This study may help us to identify a high risk group for postpartum covert urinary retention.

Keywords: Postpartum urinary retention, Vaginal delivery, Covert Postpartum urinary retention, Post void residual volume.

INTRODUCTION

Postpartum urinary retention (PUR) is defined as being unable to void completely after delivery. The estimated prevalence of the PUR varies between 1.5% and 45%. In 1997, Yip *et al*., [1] proposed a distinction between these types, defining overt PUR as the inability to spontaneously void within six hours following vaginal delivery or caesarean section after catheter removal [2]. In contrast, covert PUR is characterized by a post-void residual bladder volume (PVRV) of 150 ml or more after voluntary urination, verified by ultrasound or catheterization [3].

Postpartum urinary retention pathophysiology has not been well established but it is known that hormonal changes due to the pregnancy and vaginal delivery related pelvic muscles damage may cause bladder insensibility [4, 5]. Risk factors for postpartum urinary retention are multifactorial, involving obstetric, anaesthetic and patient-related factors. Obstetric factors such as prolonged labor, instrumental delivery, and caesarean section have been consistently linked to an increased risk of PUR [6, 7]. Even a single episode of over-distension of bladder may cause long term

voiding difficulties, recurrent urinary tract infections and renal dysfunction. Persistent urinary retention can be a challenging condition requiring management to prevent morbidity such as micturition problems, detrusor failure, kidney failure, anuria, and hydronephrosis [8-10]. Moreover, complications such as urothelial lesions and urinary bladder rupture have been described. Numerous studies have shown spontaneous recovery after several days to a normal post void residual volume (PVRV) in women with covert PUR. A recent systematic review on the adverse effects of PUR has shown that there is insufficient evidence to state that covert PUR is harmless [11]. Post-void residual volume screening for covert PUR should be done for the women at risk to prevent long term complications. At standardized definition of postpartum urinary retention (PUR) has not been reached. This could be due to the fact that there is no agreement on the cut-off value for PVRV which ranges from 50 ml to 200 ml with various techniques of the measurement. However, PVRV value of 150 ml is widely used in literature to detect PUR using bladder scan by ultrasonography Covert PUR often remains undiagnosed as screening in post partum period is not routinely provided. This study may help us to identify a high risk group for postpartum covert urinary retention who could be targeted for early screening and treatment so as to prevent future voiding dysfunctions in this group [12].

MATERIAL & METHOD

This Prospective observational, descriptive, comparativestudy was conducted in theDepartment of Obstetrics and Gynaecology, SMS medical College, Jaipur (Rajasthan)[Mahila Chikitsaly] from March 2023 onwards till July 2024.

Inclusion Criteria

1. All postpartum women delivered vaginally without urinary complaints.
2. The women who understand and willing to participate in the study and give written and informed consent.
3. The women who were not a part of any other study.

Exclusion Criteria

1. Overt postpartum urinary retention
2. Incontinence surgery history
3. Women with indications for prolonged catheterization
4. Epidural analgesia.

SAMPLE SIZE

Sample size was calculated 215 as previous study shows 17.49% covert PUR at the time of discharge for 80% power and 0.05 α error with 5% absolute error. The sample size was 250 assuming 15% attrition in follow up.

METHODOLOGY

This study was conducted to determine the risk factors for covert postpartum urinary retention after vaginal delivery by ultrasonography. After applying inclusion and exclusion criteria informed written consent was taken and women willing to participate in the study were included. Approval from institutional research, review board and ethical committee was taken. [Ethics committee clearance number 413/MC/EC/2023]. All postpartum women who fulfilled the inclusion criteria were recruited in this study. The post void residual volume (PVRV) was measured by ultrasonography at the time of discharge. The transducer was placed in the midline on the top of the symphysis pubis to obtain the longitudinal and transverse scan of the bladder. The widest diameter in the transverse scan in cm (D1), the anteroposterior diameter in longitudinal scan in cm (D2), and the cephalo-caudal diameter in the longitudinal scan in cm (D3) wererecorded. Estimated PVRBV was calculated by using the **formula D1×D2×D3×0.7 = PVRV (in ml).** Based on post void residual volume study population was divided in two groups: **STUDY GROUP**:women having PVRV ≥ 150 mland**CONTROL GROUP**:women having PVRV < 150 ml. For all participants maternal (age, parity,gestational age at onset of labor; duration of the second stage of labor; episiotomy; and postpartum urinary symptoms like dysuria, frequent urge to urinate without being able to pass much urine, and feeling like bladder not completely empty werecollected and statistically analysed. The patients with PVRV ≥ 150 ml were advised to have urology consultation.

STATISTICAL ANALYSIS

Continuous variables were summarized as mean and standard deviation while nominal /categorical variables as proportion. Statistical comparison was carried out by chi-square (χ^2), Mann-Whitney U- test and independent sample t-tests where appropriate. Logistic regression model/ multivariate regression analysis were performed to analyse risk factors.The value $p<0.05$ was considered statistically significant. IBM SPSS (26.0 Version) was used for data analysis.

RESULTS & DISCUSSION

Table 1:Distribution of participants according to gestational age

Gestational Age	**<150 ml**		**≥150 ml**	
	No.	**%**	**No.**	**%**
35-36	20	9.43	0	0.00
37-38	135	63.68	13	34.21
39-40	48	22.64	18	47.37
≥41	9	4.25	7	18.42
Total	212	100.00	38	100.00
Mean±SD	37.90±1.41		39.93±1.43	

Chi- square- 25.893P < 0.001

The patients who had PVR ≥150 ml, majority (47.37) were in gestational age group of 39-40±6 weeks with the mean gestational age of 39.93±1.43wks.The difference was statistically significant (p<0.001). Similar results were also obtained byDolezal*et al*., (2022) [13] who did a prospective observational study on 926 primiparous women They observedin their study that the mean gestational age inthose having PVR value >100ml was 40.46 ±1.36 weeks while in control group mean gestational age was 40.10 ±1.36 weeks (p value 0.0167). The results of our study were different from the study done by Wen Szechoe *et al.*, (2018) [14]. They studied the association of various obstetrics parameters to post void residual volume. Residual volume of ≥150 ml was taken as a cut off value for postpartum urinary retention (PPUR). They observed that both the study group and control group had a similar mean gestational age of 39.2 (38.1,40.0) weeks (p 0.727). It was observed that higher gestational age was associated with greaterlikelihood of having covert postpartum urinary retention The higher gestational age is co-related with a larger baby may exert more pressure on the bladder and surrounding tissues during delivery, which can lead to bladder dysfunction related in ability to sense fullness and contract properly, Larger babies increase the risk ofperinealtears or episiotomies ,which can affect thepelvic floor muscles and nerves, impacting bladder control [15].

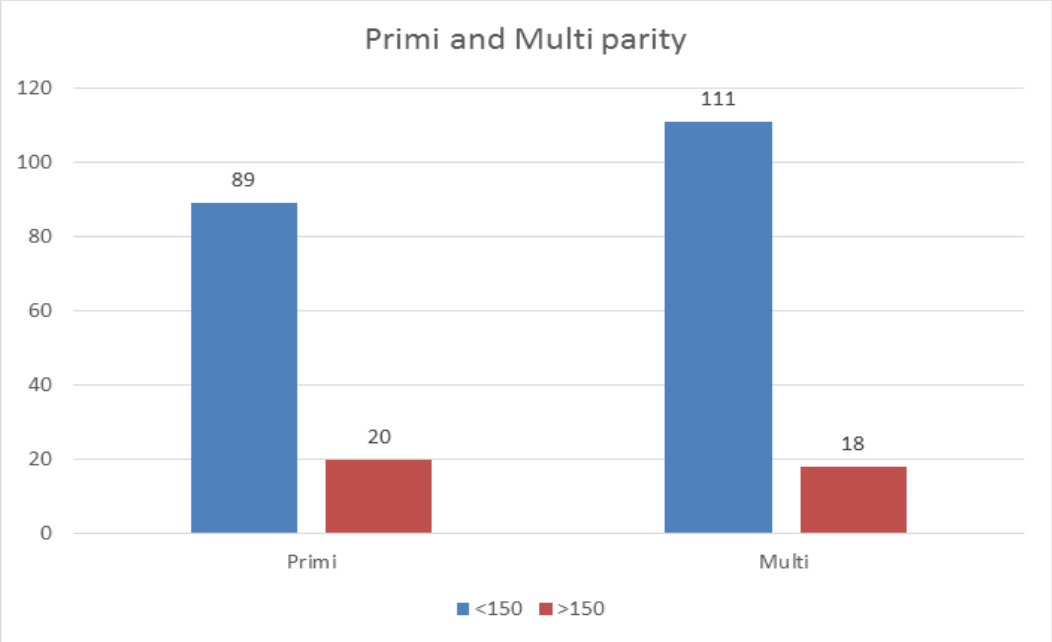

Figure 1: Distribution of cases according to parity

Out of 38 patients with PVR ≥150 ml, 20 (52.63%) patients were primipara and 18(47.37%) patients were multipara. While inpatients with PVR <150, 41.98%patients were primipara and 58.02%patients were multipara. The difference was statistically insignificant with regards to parity (p 0.456%). Dolezal *et al*., (2022) [13] carried out a prospective observational study including a total of 926 primiparous women. The results were similar to our study [p 0.7354].

In contrast to our study different results were found in a prospective observational study conducted by Wen Sze Choe *et al*., (2018) [14] and a study performed by Pifarotti *et al*., (2014) [16]in which a total of 155 patientswere

recruited [p 0.001]. Contrary toour study, in case group 86% were primiparous while in control group 56% were primiparous [p 0.04].This could be the reason that primiparity was significantly associated with covert PUR.

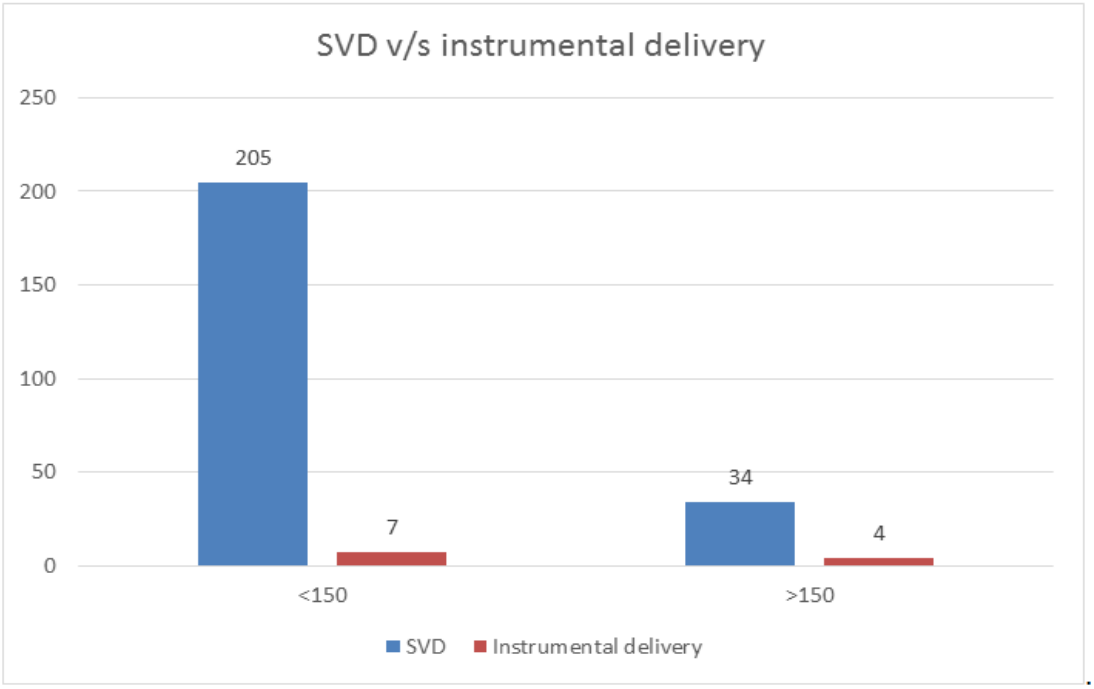

Figure 2: Distribution of cases according to mode of delivery

The above figure shows distribution of participants according spontaneous vaginal delivery v/s instrumental delivery of the individuals women having PVR≥150 ml 89.48% delivered spontaneouslyand 10.52% delivered by assisted delivery using forceps/vacuum. Statistical analysis revealed a significant difference between the groups (p 0.007). Similar results were also obtained in a cross sectional analytical study, that was performed by Ghanbarpour *et al.*, (2023) [17]. This study recruited 1040 women who hadnormal delivery.In their study group5.2% women had instrumental delivery as compared to control group, in which only 0.1% had instrumental delivery. Instrumental delivery was significantly associated with covert PVR (p<0.001). Pifarotti *et al.*, (2014) [16] carried outa retrospective case control study.in which Vacuum assisted delivery was found to besignificantly associated with covert postpartum urinary retention (p <0.001)in their study. In contrast to our study, In a prospective observational study done by Dolezal *et al.*, (2022) [13]. There was no significant difference with regards to instrumental delivery in both study groups (p value was 0.1927). Mechanical trauma from instrumental delivery is capable of damaging the urethral sphincter and pelvic floor muscles to a certain extent that can lead to aggravated perineal edema which restrains bladder voiding and traction by forceps may injure pelvic floor pubic muscles and pudendal nerve resulting in impairment of afferent innervations of urinary bladder and obstruct reflex relaxation of pelvic floor muscles and urethral sphincter. Besides, the traction of forceps even cause organ edema or congestion and damage to the perineum nerve and pelvis nerve, leading to impaired voluntary urination. It is imperative for the operator to clearly identify the indications for using forceps, master the corresponding operating techniques, avoid violent pulling during the operation, and move gently to avoid damage to maternal soft tissues.

Table 2: Distribution of cases according to Duration of second stage of labour

Second stage of labour	**<150ml**		**≥150ml**	
	No.	**%**	**No.**	**%**
<60 min	190	89.62	15	39.47
>60 min	22	10.37	23	60.52
Total	212	100.00	38	100.00
Mean±SD	20.59+-13.05		41±54.65	

Chi-square = 51.561;P value <0.001

In PVR ≥150 ml group 60.52% patients had duration of second stage of labor more than 60 minutes. The mean duration of second stage of labor was higher (41±54.65) as compared to control group in which it was 20.59±13.05. The difference was statistically significant (p <0.001). Similar results were also obtained by Ghanbarpour *et al.*, (2023) [18] who conducted a cross sectional analytical study. They includedatotal of1040 postpartum womenand found that the

length of secondstage of labor (in minutes) in case group was 33.40 ±12.16 minutes while in controlit was 38.37 ±11.48 minutes[p< 0.001].Polat*et al*., (2018) [19]carried outa retrospective case control study on 560 womenand found that the mean duration of second stage of labor was46.25±55.09 minutes in study group as compared to 34.16±37.05 minutes in control group (p 0.055). Contrary to our results, Dolezal *et al*., (2022) [13] who performed a prospective observational study on926primiparouswomen. They observed that mean duration of second stage of labor (in minutes) was 22.95 (18.42) in study group and 26.67 (26.12) in control group [p 0.1023]. The bladder may become over distended during a prolonged labor, especially if the woman is unable to void due to discomfort. This can lead to bladder muscles (detrussor) dysfunction, which may persist postpartum. The pudendal nerve may be stretched or compressed during a prolonged second stage of labor, which can impair bladder sensation and function, making it difficult to recognize the need to urinate.

Table 3: Presence or absence of episiotomy

Episiotomy	**<150**		**≥150**	
Yes	52	24.52	22	57.89
No	160	75.47	16	42.10
Total	212	100.00	38	100.00

Chi-square =15.652; P value <0.001

The above table shows distribution of participants according to need of episiotomy. In the study group, 57.89% required episiotomy whereas 42.10% delivered without episiotomy. Statistical analysis revealed a significant difference between the two groups (p < 0.001). Similar results were also found in a prospective observational study carried out by Wen Sze Choe *et al*., (2018) [14] in which a total of 155 patients were recruited. He observed that all (100%)women required episiotomy in PVR ≥150 ml group [p < 0.001]. Ghanbarpour *et al*., (2023) [18] they conducted a cross sectional analytical study and found the similar results. Femke E. M. Mulder (2015) [20] performedacross-sectional study. A total of 745 postpartum women were included in their study. In multivariate regression analysis, episiotomy was found to be anindependent risk factor for covert PUR (p <0.05). Contrary to our finding, the results varied in aprospective observational studycarried out by Dolezal*et al*., (2022) [13]. Theyincludeda total of 926 primiparous women [p 0.1389]. An episiotomy involves cutting through the muscles and tissues of pelvic floor .this can cause trauma to muscles and nerves that control bladder function, leading to bladder dysfunction. The incision from episiotomy can cause significant pain and discomfort, this pain can inhibit women's ability to relax her pelvic floor muscles and reflux urethral spasm, making it more difficult to urinate and potentially leading to urinary retention.

Table 4: Multivariate analysis by Binary logistic regression

Clinical Factor	**OR**	**95% C.I.**		**P value**
		Lower	**Upper**	
Gestational age/ weeks	1.31	0.80	1.10	<0.001
Instrumental delivery	1.13	0.96	1.23	0.008
Duration of second stage	1.11	1.15	1.40	0.871
Episiotomy	1.12	0.79	1.23	0.263

We applied logistic regression to identify independent risk factors. Using the four significant risk factors identified by bivariate analysis, we found that gestational age (<0.001), and instrumental delivery (0.008) were significantly independent risk factors for covert postpartum urinary retention.

LIMITATION

In this study we have not done follow up of the patients in our department. We have advised the patients having covert PUR to get urology consultation in urology department. To know the long term sequale of increased PVR, follow up of patients at least after 6 weeks and if possible up to 1 yearis recommended.So future prospective studies are needed to support this approach and clarify the risk factors and long-term effects of the covert PUR.

CONCLUSION

In this study maternal age, gestational weeks, parity ,need for episiotomy and duration of second stage of labor and instrumental delivery were studied and gestational weeks, need for episiotomy, duration of second stage of labor and instrumental delivery were identified as risk factors for covert post partum urinary retention. The maternal age and parity were not found to be risk factors for covert PUR.This study may help us to identify a high risk group for postpartum covert urinary retention who could be targeted for early screening by ultrasonography and treatment so as to prevent future voiding dysfunctions in this group. In conclusion, covert PUR is relatively common problem which can lead to permanent voiding dysfunction. Risk factors have not been established, so use of routine postpartum scanning for covert PUR may be offered as it is anon-invasive procedure and may prevent the bladder dysfunction. Future prospective studies are needed to support this approach and clarify the risk factors and long-term effects of the covert PUR.

Conflicts of Interest: The authors declare no conflicts of interest.

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