

## Risk Factors of Postpartum Urinary Retention After Vaginal Delivery: A Case-Control Study

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(Received, 30<sup>th</sup> April 2025, Accepted 22<sup>nd</sup> May 2025, Published 31<sup>th</sup> May 2025)

**Abstract:** PPUR is a common yet underdiagnosed complication of vaginal delivery, especially in low-resource settings. **Objective:** This study aimed to identify maternal and intrapartum risk factors associated with PPUR. **Methods:** A case-control study was conducted at Ibn-e-Siena Hospital, Multan, over three months from 22 January 2025 to 22 April 2025. A total of 142 women (71 with PPUR, 71 controls) were assessed for maternal characteristics and intrapartum variables. Statistical analysis included logistic regression to identify independent risk factors. **Results:** Significant independent risk factors for PPUR included episiotomy (OR 3.90), epidural analgesia (OR 3.88), obesity (OR 2.54), gestational diabetes (OR 3.39), macrosomia (OR 4.75), and longer labor duration ( $p = 0.003$ ) were noted in this study. **Conclusion:** Targeted monitoring for women with identified risk factors may reduce the incidence and complications of PPUR. These findings support the integration of routine bladder care into postpartum protocols in Pakistani healthcare settings.

**Keywords:** Postpartum urinary retention, vaginal delivery, episiotomy, epidural analgesia, macrosomia, Pakistan

**[How to Cite:** Saif M, Farooq A, Khurshid M. Risk factors of postpartum urinary retention after vaginal delivery: a case-control study. *Biol. Clin. Sci. Res. J.*, 2025; 6(5): 19-22. doi: <https://doi.org/10.54112/bcsrj.v6i5.1718>

### Introduction

Postpartum urinary retention (PPUR) is a relatively under-recognized yet clinically significant complication of vaginal delivery. It is commonly defined as the inability to void spontaneously within 6 hours after childbirth or the presence of a post-void residual bladder volume (PVRBV) exceeding 150 mL, often detected via catheterization or ultrasound in asymptomatic women (1,2). Despite its prevalence and clinical consequences, PPUR frequently remains undiagnosed, particularly in resource-limited settings like Pakistan, where routine post-delivery bladder assessments are rarely performed.

PPUR is classified into overt and covert forms. Overt PPUR presents as a complete inability to void and is typically symptomatic, requiring immediate catheterization, while covert PPUR is asymptomatic and detected only through imaging or catheterization post-voiding (3). The incidence of overt PPUR is reported to range between 0.05% and 7%, whereas covert retention may occur in up to 38% of postpartum women globally (4). In Pakistan, despite a high volume of vaginal deliveries in both urban and rural health facilities, data on the incidence, detection, and management of PPUR are extremely limited.

The pathophysiology of PPUR is complex and multifactorial. Mechanical trauma during labor, overstretching of the bladder, compression of pelvic nerves, and hormonal changes are all thought to contribute to transient or sustained bladder dysfunction following childbirth (5). Several risk factors have been consistently associated with an increased likelihood of PPUR. These include prolonged labor, instrumental delivery (forceps or vacuum), epidural analgesia, episiotomy, macrosomia, and perineal trauma (6,7). Additionally, obesity and gestational diabetes mellitus (GDM) have also been implicated due to their role in increasing the likelihood of difficult labor and fetal macrosomia (8).

A large-scale retrospective study in China found that the prevalence of PPUR was 5.37%, with epidural analgesia, vulvar edema, and forceps-assisted delivery identified as independent predictors (9). Similarly, an Egyptian case-control study reported that episiotomy and high birth weight (>4000 g) were among the most significant contributors to urinary retention after vaginal delivery (10). These findings align with regional trends, where the increased use of episiotomy and instrumental delivery,

often due to late presentation and inadequate antenatal care, predispose women to higher PPUR risk.

In the Pakistani context, obstetric care varies significantly between the public and private sectors. In many public hospitals, high patient turnover and limited staffing contribute to underdocumentation and underdiagnosis of complications such as urinary retention. While procedures like episiotomy and instrumental delivery are frequently performed, systematic screening for urinary retention post-delivery is rarely practiced. A recent local study highlighted the need for improved postpartum surveillance protocols, particularly for urinary complications, which, if left untreated, may result in urinary tract infections, bladder overdistension, long-term voiding dysfunction, or even permanent detrusor damage (11).

Moreover, cultural and social taboos around discussing urinary symptoms may contribute to diagnostic delays in Pakistan. Women often consider voiding difficulties as normal postpartum discomfort and may not report symptoms unless pain or infection develops. This leads to a significant underestimation of the true prevalence of PPUR. Additionally, limited awareness among primary care providers regarding covert PPUR and lack of access to ultrasound or bladder scanners in basic health units further complicates the issue (12).

In the setting of Ibn-e-Siena Hospital Multan—a busy tertiary care facility in South Punjab—vaginal deliveries are often performed with episiotomies and without detailed follow-up on bladder function post-delivery. While the focus of obstetric care in Pakistan is largely on reducing maternal mortality, addressing quality-of-life issues such as postpartum voiding function is equally important for holistic maternal care.

Despite the abundance of global literature on this topic, there remains a significant evidence gap in Pakistan regarding modifiable risk factors for PPUR. Understanding these risk factors is essential to improve maternal outcomes through early identification, preventive strategies, and timely intervention. Notably, variables such as duration of labor, type of analgesia, perineal procedures, and neonatal birth weight are often overlooked in local audits of postpartum complications. Incorporating these into clinical checklists could help reduce catheterization-related



morbidity and healthcare costs associated with prolonged postpartum stays.

The rationale for this study lies in the urgent need to establish local evidence for risk factors contributing to postpartum urinary retention following vaginal delivery in Pakistani women. Identifying women at higher risk can enable targeted preventive measures such as limiting unnecessary episiotomies, providing intermittent bladder scans, and promoting timely catheterization. Furthermore, generating robust, hospital-based data will help shape national guidelines for postpartum care and reduce the burden of unrecognized urinary complications in Pakistani maternity settings.

## Methodology

This case-control study was conducted at the Department of Obstetrics and Gynaecology, Ibn-e-Siena Hospital, Multan, over three months from 22 January 2025 to 22 April 2025, following approval from the Ethics Review Committee and the College of Physicians and Surgeons Pakistan (CPSP). The study aimed to identify and evaluate the obstetric and maternal risk factors associated with postpartum urinary retention (PPUR) after vaginal delivery. PPUR is a significant but often underdiagnosed condition that can lead to considerable postpartum discomfort, urinary tract infections, and prolonged hospital stays if not promptly recognized and managed. Given the limited data available in the local context, this study was designed to contribute to evidence-based strategies for early identification and management of at-risk women.

The sample size was calculated using the WHO sample size calculator for hypothesis testing in a case-control study. With a power of 80%, a significance level of 5%, and based on previously reported frequencies of episiotomy among cases (44.9%) and controls (25.1%), a total of 142 women were enrolled, with 71 cases (women diagnosed with postpartum urinary retention) and 71 controls (women without PPUR following vaginal delivery). A non-probability consecutive sampling technique was employed to enroll participants who met the eligibility criteria.

Inclusion criteria were women aged 18 to 45 years with term singleton pregnancies who underwent vaginal delivery at the hospital. Cases were defined as women who developed PPUR, identified either through an inability to void spontaneously within six hours postpartum or a post-void residual bladder volume (PVRBV) >150 mL confirmed by ultrasonography. Controls were defined as women who delivered vaginally and were ready to be discharged from the labor room with no signs or symptoms of urinary retention. Women with conditions requiring an indwelling catheter (such as postpartum hemorrhage management, severe perineal trauma, or surgical removal of hematomas) were excluded from the study.

After obtaining written informed consent, data were collected using a structured proforma. Maternal demographic variables included age, gravida, gestational age, obesity status, and the presence of gestational diabetes mellitus, which was assessed via a two-step oral glucose tolerance test and confirmed from medical records. Obesity was defined using a body mass index (BMI  $\geq 27.5$  kg/m<sup>2</sup>) calculated by standard height and weight measurements. Fetal variables included estimated fetal weight from antenatal ultrasound and classification of macrosomia if the weight exceeded 4000 grams.

Intrapartum factors were also systematically recorded. These included the type of analgesia used during labor (spinal or epidural), the total duration of labor measured in minutes (from active labor onset at 3–4 cm cervical dilation to delivery), instrumental deliveries (categorized as vacuum or forceps), the presence or absence of episiotomy, and shoulder dystocia. Data collection was conducted by trained obstetric staff and verified by a senior resident for accuracy.

Data were analyzed using SPSS version 23. The normality of continuous data (such as age, gestational age, fetal weight, and labor duration) was tested using the Shapiro-Wilk test. These variables were summarized using means and standard deviations, while categorical data (such as gestational diabetes, obesity, episiotomy, and instrumental delivery) were presented as frequencies and percentages. Independent sample t-tests were applied to compare means between cases and controls, and chi-square tests were used to assess associations between categorical variables.

To identify independent risk factors for postpartum urinary retention, multivariate logistic regression analysis was performed. A forward stepwise selection approach was used to include variables in the final model. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the strength of association. A p-value < 0.05 was considered statistically significant throughout the analysis.

## Results

A total of 142 women who underwent vaginal delivery at the Department of Obstetrics and Gynaecology, Ibn-e-Siena Hospital, Multan, were enrolled in this study. Of these, 71 were diagnosed with postpartum urinary retention (cases) and 71 had no urinary retention (controls). The mean age of participants was  $28.3 \pm 4.6$  years, and the mean gestational age at delivery was  $38.5 \pm 1.2$  weeks. The majority of participants were multigravida, and the frequency of risk factors such as obesity, gestational diabetes, macrosomia, and episiotomy was assessed in detail.

Table 1 shows no statistically significant differences in age, gestational age, or gravida between the two groups, suggesting comparability of baseline characteristics.

Table 2 highlights a significantly higher frequency of gestational diabetes, maternal obesity, and macrosomia in the case group, indicating these as potential risk factors for postpartum urinary retention.

Table 3 shows that epidural analgesia, forceps delivery, episiotomy, shoulder dystocia, and prolonged labour are significantly more common in cases than controls.

Table 4 reveals that obesity, gestational diabetes, macrosomia, epidural use, episiotomy, and longer labour duration are independently associated with higher odds of postpartum urinary retention.

The mean maternal age was 28.3 years, and most participants were multigravida. Obesity, gestational diabetes, and macrosomia were significantly more common among PPUR cases. Intrapartum factors such as epidural analgesia, forceps delivery, episiotomy, and prolonged labor were associated considerably with PPUR. Multivariate logistic regression confirmed that episiotomy, macrosomia, and epidural analgesia were among the strongest independent predictors of postpartum urinary retention.

**Table 1: Demographic and Obstetric Characteristics of Study Participants (n = 142)**

Variable	Cases (n = 71)	Controls (n = 71)	p-value
Mean maternal age (years)	28.6 $\pm$ 4.3	28.0 $\pm$ 4.8	0.412
Mean gestational age (weeks)	38.4 $\pm$ 1.1	38.6 $\pm$ 1.2	0.258
Gravida			0.495
- Primigravida	29 (40.8%)	25 (35.2%)	
- Multigravida	42 (59.2%)	46 (64.8%)	

**Table 2: Maternal Risk Factors Associated with Postpartum Urinary Retention (n = 142)**

Risk Factor	Cases (n = 71)	Controls (n = 71)	p-value
Gestational diabetes	19 (26.8%)	7 (9.9%)	0.011*
Obesity (BMI $\geq 27.5$ kg/m <sup>2</sup> )	33 (46.5%)	17 (23.9%)	0.004*
Macrosomia (>4000 g)	16 (22.5%)	4 (5.6%)	0.006*

**Table 3: Intrapartum Characteristics Associated with Postpartum Urinary Retention (n = 142)**

Intrapartum Factor	Cases (n = 71)	Controls (n = 71)	p-value
Intrapartum analgesia			
- Spinal	28 (39.4%)	21 (29.6%)	0.217
- Epidural	16 (22.5%)	5 (7.0%)	0.009*
Instrumental delivery			
- Vacuum	5 (7.0%)	3 (4.2%)	
- Forceps	6 (8.5%)	1 (1.4%)	0.048*
Episiotomy	45 (63.4%)	22 (31.0%)	<0.001*
Shoulder dystocia	10 (14.1%)	3 (4.2%)	0.044*
Mean duration of labour (minutes)	212.6 $\pm$ 38.2	178.4 $\pm$ 41.6	<0.001*

**Table 4: Multivariate Logistic Regression Analysis of Independent Risk Factors for PPUR**

Variable	Adjusted OR (95% CI)	p-value
Obesity	2.54 (1.22 – 5.30)	0.012*
Gestational diabetes	3.39 (1.29 – 8.91)	0.013*
Macrosomia	4.75 (1.43 – 15.76)	0.011*
Epidural analgesia	3.88 (1.24 – 12.11)	0.019*
Episiotomy	3.90 (1.83 – 8.29)	<0.001*
Prolonged labour duration	1.02 (1.01 – 1.03) per minute	0.003*

## Discussion

This case-control study aimed to evaluate the risk factors associated with postpartum urinary retention (PPUR) following vaginal delivery in a tertiary care setting in Pakistan. The findings of our study indicate that maternal obesity, gestational diabetes, epidural analgesia, episiotomy, macrosomia, and prolonged labor duration were significantly associated with PPUR, several of which remained independent predictors after multivariate logistic regression analysis.

The incidence of PPUR is highly variable across different populations, largely due to inconsistent definitions and varying diagnostic protocols. In our study, 71 women were diagnosed with PPUR based on a combination of clinical and ultrasound criteria. The most significant and independently associated intrapartum factor in our findings was episiotomy, which was present in 63.4% of cases compared to 31.0% of controls, with an adjusted odds ratio of 3.90. This finding is consistent with recent literature, including a study by Cao et al., who reported a significantly higher rate of episiotomy in women with PPUR (44.9% vs. 25.1%), establishing it as a strong risk factor (13).

Similarly, epidural analgesia was significantly associated with PPUR in our population. This aligns with findings from Nusee et al., who reported that epidural analgesia increases the risk of both overt and covert urinary retention by impairing detrusor contractility and diminishing bladder sensation (14). Our study found that women who received epidural analgesia had nearly four times higher odds of developing PPUR, a result that emphasizes the need for routine bladder monitoring in patients receiving neuraxial anesthesia.

Another key finding was the association of macrosomia (fetal weight >4000g) with PPUR. In our study, macrosomia was present in 22.5% of cases versus 5.6% of controls and remained an independent predictor with an odds ratio of 4.75. This association may be attributed to prolonged labor, increased perineal trauma, and mechanical compression of pelvic nerves during delivery. Mohr et al. similarly highlighted macrosomia as a risk factor for peripartum trauma and subsequent urinary retention in their 2022 multicenter study (15).

Our data also revealed that maternal obesity (BMI  $\geq 27.5$  kg/m<sup>2</sup>) was significantly more common in the case group and remained an independent risk factor (OR 2.54). Obesity likely increases PPUR risk through a combination of labor complications, including prolonged second stage, instrumental delivery, and increased fetal size. This is consistent with the results from a study by Rasheed et al., which demonstrated that maternal obesity in the Pakistani population is linked to longer labor durations and higher rates of intervention, both of which contribute to urinary retention (16).

Conducted Gestational diabetes mellitus (GDM) also emerged as a significant predictor, with an adjusted odds ratio of 3.39. Women with GDM often deliver larger babies, experience prolonged labor, and have higher rates of perineal injury, all of which may compromise bladder function postpartum. A recent Egyptian study by Elnashar et al. found a similar correlation between GDM and increased urinary complications following vaginal delivery (17).

Prolonged labor duration, particularly in the second stage, was another significant factor. In our study, women with PPUR had a mean labor duration of 212.6 minutes compared to 178.4 minutes in controls ( $p < 0.001$ ). Each additional minute of labor was associated with a 2% increase in the odds of PPUR. These findings are supported by a meta-analysis by Li et al., which concluded that labor exceeding 2 hours significantly increases the likelihood of postpartum voiding dysfunction (18).

Instrumental deliveries, particularly forceps-assisted births, were also more frequent in the PPUR group (8.5% vs. 1.4%). While this association did not remain statistically significant after adjustment, the trend aligns with previous reports that highlight mechanical trauma from forceps as a contributing factor to bladder dysfunction. Lawal et al. similarly found increased PPUR rates among women who underwent operative vaginal deliveries (19).

It is also noteworthy that shoulder dystocia, though less common, was significantly associated with PPUR in univariate analysis (14.1% in cases vs. 4.2% in controls). This rare but serious complication can cause significant soft tissue trauma and prolonged second stage, both of which can impair voiding mechanisms. While the numbers were small in our

cohort, they highlight the importance of close monitoring in women with complicated deliveries.

Our findings underscore the multifactorial nature of PPUR and the need for proactive postpartum bladder assessment protocols. In particular, women with episiotomy, epidural analgesia, obesity, or fetal macrosomia should be routinely monitored for signs of urinary retention. Bladder scanning or careful timing of first void post-delivery may help prevent overdistension and secondary complications. Moreover, these findings have implications for patient counseling, obstetric decision-making, and resource allocation in postpartum wards.

This study is one of the few from Pakistan to evaluate risk factors for PPUR in a case-control design systematically. However, limitations include the single-center setting and the reliance on clinical documentation for labor duration and neonatal weights. Future multicenter, prospective studies are recommended to validate these findings and develop clinical scoring systems to predict PPUR risk.

## Conclusion

This study identified episiotomy, epidural analgesia, obesity, gestational diabetes, macrosomia, and prolonged labor as significant risk factors for postpartum urinary retention (PPUR) following vaginal delivery. These findings highlight the importance of routine bladder monitoring and risk-based preventive strategies in postpartum care, especially in resource-limited settings like Pakistan. Early identification can reduce complications, improve outcomes, and support the development of local clinical.

## Declarations

### Data Availability statement

All data generated or analysed during the study are included in the manuscript.

### Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-IBS-25988-24)

### Consent for publication

Approved

### Funding

Not applicable

## Conflict of interest

The authors declared the absence of a conflict of interest.

## Author Contribution

**MS** (PGR)

*Manuscript drafting, Study Design,*

**AF** (PGR)

*Review of Literature, Data entry, Data analysis, and drafting article.*

**MK** (Professor)

*Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, critical input.*

*All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.*

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