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Factors affecting postpartum bladder recovery: A literature review

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Abstract

Background: Postpartum urinary dysfunction, particularly postpartum urinary retention (PPUR), is a common obstetric complication reflecting impaired bladder recovery in the early postpartum period. Postpartum urinary retention (PPUR) results from multifactorial mechanisms, including physiological changes during pregnancy, mechanical and intrapartum factors such as prolonged labor and obstetric interventions, and maternal characteristics.

Purpose: to evaluates the pathophysiology of PPUR and factors influencing postpartum bladder recovery.

Method: The literature search was carried out using several electronic databases, including PubMed, Scopus, ScienceDirect, and Google Scholar. Articles were searched using keywords adjusted to the research topic, including postpartum urinary retention, voiding dysfunction, postpartum bladder function, pregnancy, labor, and maternal and fetal factors on urinary retention. These keywords were combined using Boolean operators ("AND", "OR") to obtain relevant literature, either used individually or in combination

Results: Evidence indicates that unrecognized or poorly managed PPUR may lead to bladder overdistension, detrusor dysfunction, recurrent urinary tract infections, and long-term voiding impairment, although most cases resolve with timely and appropriate management.

Conclusion: A comprehensive understanding of these factors enables identification of high-risk women and implementation of effective bladder care strategies to reduce postpartum urological morbidity.

Keywords: Epidural Analgesia; Episiotomy; Instrumental Delivery; Postpartum Urinary Retention; Voiding Dysfunction.

INTRODUCTION

Lower urinary tract dysfunction is defined as the inability to void the bladder completely or only partially, which may occur due to increased resistance at the bladder outlet, decreased contractility, or both (Swathi & Samant, 2020). Voiding dysfunction, including postpartum urinary retention (PPUR), is a well-recognized complication that occurs quite frequently in the early postpartum period, with reported incidence ranging from 1.5% to 45% in postpartum women (Degasper, Späth, Fessler, Widschwendter, Azim, & Ritter, 2023). In the early postpartum phase, voiding dysfunction is common but often not optimally identified, despite its wide clinical impact (Zakzouk, Habib, Ezzat, &

Mohamed, 2023). To understand the occurrence of disorders and the process of recovery of bladder function in the postpartum period, it is important to review the physiological adaptations of the bladder that occur during pregnancy.

During pregnancy, various anatomical and physiological changes occur as an adaptation of the body to the demands of pregnancy and childbirth. Various organ systems are involved in this adjustment, including the cardiovascular, metabolic, renal, respiratory, and urogenital systems. In terms of bladder physiology, these adaptations are related to hormonal changes. During pregnancy, progesterone levels increase; in addition to maintaining pregnancy,

this hormone also affects bladder function by reducing muscle tone (Mulder, 2017). Anatomical changes in the bladder in early pregnancy are relatively minimal, but as the uterus enlarges and pelvic vascularization increases, structural adjustments of the bladder occur, continuing until late pregnancy and accompanied by an increase in intravesical pressure from early pregnancy until near delivery (Cunningham, Leveno, Bloom, Spong, Dashe, Hoffman, Casey, Sheffield, 2014).

During pregnancy, there is uterine pressure on the bladder. When the fetus begins to enter and descend into the pelvis, the pressure on the bladder increases, so its functional capacity decreases. The descent of the fetal head toward the birth canal further reinforces this compression (Minami, Kobayashi, Miyatake, Itani, Tateoka, Kubota, & Kawauchi, 2025).

Apart from the changes that occur during pregnancy, the labour process also makes an important contribution to bladder dysfunction and recovery of its function. During labour, injury to the pelvic floor muscles and nerves can occur (Al-Dujaili, Albayyaa, Al-Dujaili, & Alaf, 2025). Labour can also trigger edema in the periurethral and vulvar areas, which in turn can cause voiding dysfunction due to local obstruction (Mulder, 2017). In caesarean delivery, denervation can also occur, especially in cases accompanied by massive bleeding or when hysterectomy is required. During labour, the use of analgesia and episiotomy influences bladder function, and pain due to obstetric lacerations can interfere with relaxation of the pelvic floor muscles, which is the initial step in the mechanism of spontaneous bladder emptying (Nutaitis, Meckes, Madsen, Toal, Menhaji, Carter-Brooks, & Hickman, 2023).

In addition to the influence of labour, maternal and fetal characteristics also contribute to postpartum bladder dysfunction and recovery of bladder function. Maternal factors such as parity, maternal age, and pre-pregnancy body weight play an important role. Primiparous women are at risk of stretching of the pelvic floor tissues and pudendal nerve injury during vaginal delivery, while older women tend to have a higher risk of voiding dysfunction due to decreased elasticity and contractile ability of the bladder (Budinurdjaja, Nizomy, & Sabaruddin, 2021). In most of the literature, women with a high BMI (>25) are associated with an increased risk of urinary

incontinence, while evidence regarding its association with PPUR is still limited and shows varying results. In addition, maternal obesity increases the likelihood of giving birth to a macrosomic baby, which may also increase the risk of voiding dysfunction (Liang, Chao, Chang, & Chiu, 2020).

Voiding dysfunction can cause a number of problems, including postpartum haemorrhage, urinary tract infection, fatigue during the puerperium, delayed breast milk production, upper urinary tract injury, persistent bladder dysfunction, and urinary retention (Djusad, Meutia, & Hakim, 2024; Li et al., 2020).

RESEARCH METHOD

This study used a literature review method. This approach aims to present and analyse various scientific findings relevant to the research topic through descriptive and interpretative explanation. This type of review allows the author to integrate research findings from various study designs in a comprehensive and contextual manner, without being bound to strict search and appraisal stages as in a systematic literature review.

The literature search was carried out using several electronic databases, including PubMed, Scopus, ScienceDirect, and Google Scholar. Articles were searched using keywords adjusted to the research topic, including postpartum urinary retention, voiding dysfunction, postpartum bladder function, pregnancy, labor, and maternal and fetal factors on urinary retention. These keywords were combined using Boolean operators ("AND", "OR") to obtain relevant literature, either used individually or in combination.

Article selection was conducted based on predetermined inclusion and exclusion criteria. The inclusion criteria were: (1) articles discussing physiological changes of the bladder during pregnancy and labour as well as factors influencing the return of postpartum bladder function; (2) scientific publications published within the last five years (2020–2025), except for key references or guidelines that remain relevant; (3) articles available in full-text form; and (4) original research articles or review articles written in Indonesian or English. The exclusion criteria were: (1) articles that primarily focus on obstetric or neonatal outcomes without linking

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them to maternal voiding function or dysfunction; and (2) articles discussing voiding disorders outside the context of pregnancy and childbirth.

Articles that met the criteria were then analysed by emphasizing topic relevance, research methods, and the main relevant findings. The synthesis results are

presented in descriptive form to describe the relationship between physiological changes in pregnancy, the labour process, and maternal and fetal factors with the recovery of bladder function in the postpartum period.

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RESEARCH RESULTS

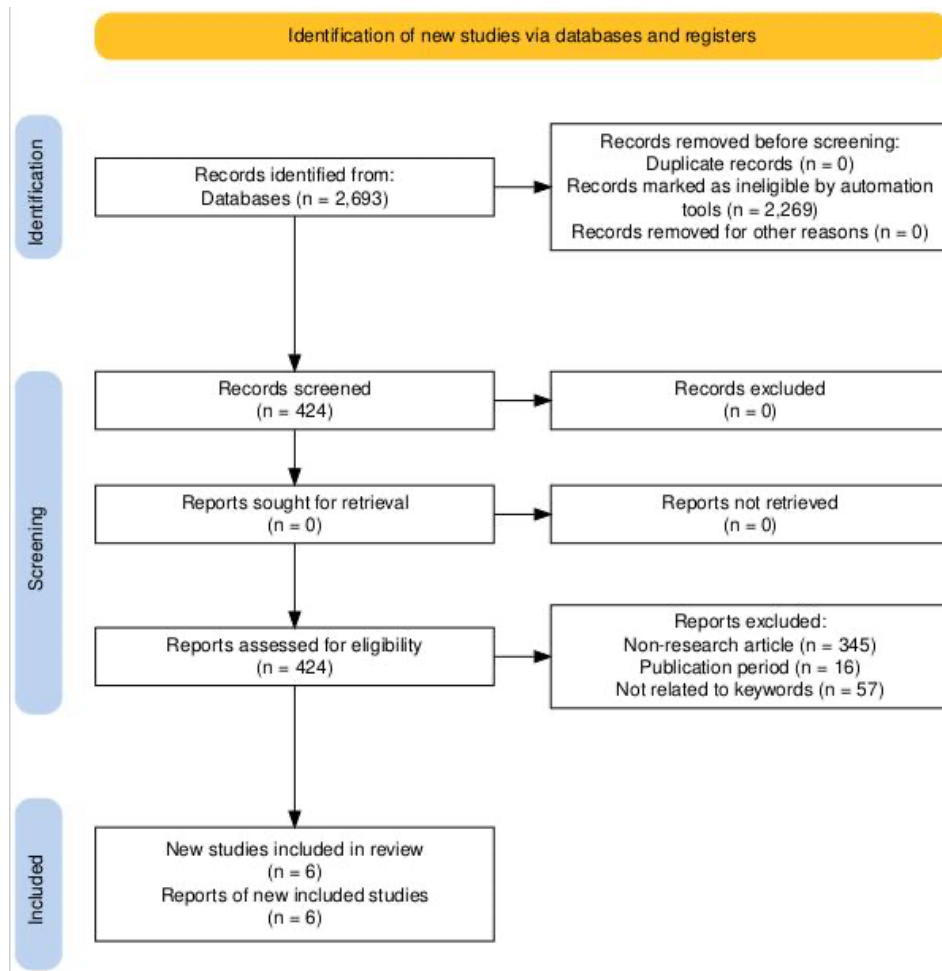


Figure 1. PRISMA Flow Diagram

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Table 1. Characteristics of the Included Studies

(Author, Year) Country	Purpose	Method	Final Results
(Cao et al., 2022) (China)	To assess the incidence of and risk factors for overt PUR after vaginal delivery.	This retrospective case-control study included all primiparas who delivered vaginally between July 1, 2017, and June 30, 2019, at our institution. The case group comprised 677 women diagnosed with overt PUR who required catheterisation after delivery. The control group comprised 677 women without overt PUR randomly selected in a 1:1 ratio matched for date of delivery and who delivered immediately after each woman with overt PUR to minimise the impact of variations over time in obstetric practice. Univariate and multivariate logistic regression analyses were performed to investigate the factors associated with overt PUR.	This cohort study found no significant differences between the RUPP group and controls in age, gestational age, pre-pregnancy BMI, or weight gain. Conversely, RUPP was more common in mothers with epidural analgesia, episiotomy, second-degree perineal tears, forceps deliveries, and vulvar edema, and in those with longer first and second stages of labor compared to the group without RUPP.
(Djusad et al., 2024)	to assess the incidence and potential contributing factors of PPUR among postpartum patients	A descriptive case-control study was conducted, including women who experienced urinary retention following vaginal delivery at Koja Hospital between September and December 2022. Residual urine volume was measured by catheterization 6 hours after delivery. Data analysis, performed using SPSS version 22, included patient demographics and clinical factors such as maternal age, parity, gestational age, neonatal birth weight, and postvoid residual urine	From this case-control study, the average age of mothers with postpartum urinary retention was younger than those without RUPP (26.9 vs 30.7 years), the average birth weight of infants was higher (± 2981 g vs ± 2839 g) and primiparas were also more frequently found in the RUPP group (62.8% vs 37.2%), while the gestational age in both groups was not significantly different (± 38.5 vs 38.3 weeks).

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		volume. These factors were analyzed to determine their association with PPUR.	
(Mu et al., 2025) (China)	to determine risk factors for postpartum urinary retention after vaginal delivery among primiparous women.	A retrospective, matched case-control study was conducted to identify risk factors for postpartum urinary retention in primiparous women after vaginal delivery between July 2016 and January 2024. All data were collected through our hospital's electronic medical record system. Demographic, pregnancy, and delivery characteristics were compared between groups using univariate and multivariate analyses to identify risk factors for postpartum urinary retention.	This retrospective case-control study on primiparous women undergoing vaginal delivery showed that maternal factors such as maternal age, gestational age, parity, pre-pregnancy and antenatal BMI, and gestational weight gain did not differ significantly between groups with and without PPUR. In contrast, obstetric factors including epidural analgesia, prolonged first and second stages of labour, episiotomy, assisted vaginal delivery, and postpartum haemorrhage were more frequently observed in the PPUR group, whereas manual placental removal was associated with a lower rate of PUR.
(Ren et al., 2024) (Indonesia)	to determine the influencing factors of PUR and to explore the relationship between them	A prospective, cross-sectional survey using self-made questionnaires was conducted among 372 puerperae in a Grade A hospital in Guangzhou, China, from April to September 2022. SPSS25.0 and AMOS24.0 were used for data analysis, and a path analysis model was established to determine the relationship between the influencing factors.	In this retrospective case-control study, the use of neuraxial anaesthesia/analgesia was found to be associated with an increased incidence of PPUR after both vaginal delivery and caesarean section. The effects of neuraxial anaesthesia often interact with other obstetric factors such as prolonged second stage, instrumental delivery, episiotomy, and perineal trauma, which further increase the risk of PPUR.

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(Al-Rawi, 2024) (USA)	to examine the latest research and findings in the field, with a focus on three key areas: the incidence and risk factors of PUR, the comparison of PUR in vaginal versus cesarean deliveries, and the management and prevention strategies. Since we believe it needs to receive more attention and awareness.	Recent research and findings in this area, focusing on three main areas: incidence and risk factors for PUR, comparison of PUR in vaginal delivery versus cesarean section, and management and prevention strategies.	This article explains that high progesterone levels during pregnancy and in the postpartum period inhibit smooth muscle tone and reduce detrusor contractility, thereby increasing the risk of impaired bladder emptying.
(Gupta et al., 2021) (India)	to study the incidence and risk factors associated with postpartum urinary retention in women undergoing instrumental delivery.	Pregnant women who had an instrumental delivery after 37 weeks of gestation at JIPMER, Puducherry, India, between January 2017 and June 2017 were included in the study. Postpartum urinary retention was defined as the inability to void spontaneously or ultrasonographic documentation of post-void residual volume of >150 mL, 6 hours after delivery. Demographic factors, clinical profile and follow-up of these patients were noted. Multivariate logistic regression analysis was performed to assess the risk factors associated with urinary retention and was presented as adjusted odds ratios (OR) with 95% confidence intervals (CI).	In this analytic cross-sectional study, the incidence of PPUR among women undergoing instrumental delivery reached 20.6%. The investigators specifically restricted inclusion to women who did not receive epidural analgesia in order to avoid confounding effects.

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DISCUSSION

The normal mechanism of voiding begins with relaxation of the pelvic floor muscles and urethral sphincter, occurring synchronously with increased detrusor muscle contraction and intra-abdominal pressure. Voiding may be impaired if detrusor muscle contraction is weakened, with or without accompanying urethral relaxation. Clinical findings in postpartum urinary retention include reduced urine output and/or signs of urinary retention such as suprapubic fullness, a palpable distended bladder, displacement of the uterine fundus, bladder discomfort, a sensation of bladder fullness or pain, dysuria, increased urinary frequency, passage of small amounts of urine, hesitancy, and a feeling of incomplete bladder emptying (Li, Zhu, & Xiao, 2020).

Postpartum urinary retention (PPUR) is the most common form of postpartum voiding dysfunction. PPUR is classified into overt (symptomatic) and covert (asymptomatic). Overt PUR is defined as the inability to void spontaneously within 6 hours after vaginal delivery, whereas covert PUR is characterized by a post-void residual urine volume of more than 150 mL after spontaneous micturition without symptoms, and is usually diagnosed only by catheterization or ultrasonographic assessment (Degasper, Späth, Fessler, Widschwendter, Azim, & Ritter, 2023).

Understanding the pathophysiology is relevant to explaining the mechanisms of postpartum voiding dysfunction, showing that recovery of bladder function is influenced by various clinical factors that may delay the return of normal bladder function. The pathophysiology of PPUR is not fully understood because it is a complex condition with variable incidence and associated factors, but several physiological, neurological, and mechanical factors related to pregnancy and the early postpartum period are thought to play a role in the development of voiding disorders (Nutaitis, Meckes, Madsen, Toal, Menhaji, Carter-Brooks, & Hickman, 2023).

During pregnancy, anatomical and physiological changes occur in the urinary system. Before 12 weeks of gestation, anatomical changes in the bladder are generally minimal, but from that point until term, uterine enlargement, increased blood flow to pelvic structures, and hyperplasia of bladder muscle

and connective tissue cause elevation of the trigone and thickening of the posterior margin or intraureteric area, which becomes deeper and wider. Urethrocystometric studies have shown that bladder pressure in primigravida increases from about 8 cmH₂O in early pregnancy to about 20 cmH₂O near term (Cunningham et al., 2014).

Physiological changes during pregnancy include increased progesterone levels that persist for several weeks postpartum (Swathi & Samant, 2020). The bladder is highly sensitive to hormonal influences, so its functional pattern varies according to hormone levels. Pregnancy reduces the baseline response of the bladder and urethra to alpha-adrenergic stimulation and diminishes muscarinic effects on the bladder body, contributing to an increased risk of urinary retention (Djusad et al., 2024). One study in rabbit bladder showed that pregnancy causes an approximately 50% reduction in muscarinic receptor density, corresponding to an approximately 50% decrease in contractile response to bethanechol (Al-Rawi, 2024). Experimental research further demonstrated that progesterone induces relaxation and hypotonia of porcine bladder neck smooth muscle via the NO/cGMP pathway, by activating BKCa and KATP channels and inhibiting calcium influx through voltage-operated L-type calcium channels, all mediated by progesterone receptors in smooth muscle (Huang, Xiao, Lin, & Lu, 2025).

During pregnancy, physical pressure is exerted by the enlarging uterus as the fetus grows, compressing the bladder. In the second trimester, the bladder is displaced anteriorly and superiorly by the expanding uterus. By the third trimester, the bladder mucosa becomes hyperaemic and oedematous, making it more susceptible to trauma during delivery (Anggraini, Azizah, Mukhoiratin, Mahmud, Suryani, Sumaifa, & Aswan, 2023). When the fetus begins to engage and descend into the pelvis, the fetal head adds direct pressure to the bladder and further reduces its functional capacity, and descent of the head into the birth canal increases mechanical compression of the bladder (Minami et al., 2025).

Obstetric factors such as episiotomy, prolonged first and second stages of labour, instrumental delivery, and epidural analgesia show findings consistent with many previous studies, indicating that

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these are obstetric parameters associated with voiding dysfunction. A study from Pakistan showed that episiotomy is a significant obstetric factor and has an independent association with PPUR, with a prevalence of 63.4% in the case group compared with 31.0% in the control group (Saif, Farooq, & Khurshid, 2025). This is supported by earlier work reporting that women undergoing episiotomy are 1.8 times more likely to develop PPUR, although the association did not reach statistical significance (Oktharina, Fauzi, Bernolian, Theodorus, & Kesty, 2021). Pain from perineal trauma is thought to alter bladder sensation, induce central nervous system inhibition, and cause persistent urethral spasm (Li et al., 2020).

A systematic review of PPUR risk factors found that operative vaginal delivery is the only clinical factor consistently showing a strong association with PPUR (Nutaitis et al., 2023). Comparative studies have demonstrated statistically significant differences between women with spontaneous vaginal delivery and those with caesarean section in terms of time to first postpartum void, difficulty initiating voiding, and intermittent urinary stream ($p = 0.012$, 0.005 , and 0.015 , respectively), which are thought to result from birth trauma causing neurological impairment, perineal pain after repair of lacerations, and reflex urethral spasm contributing to voiding dysfunction (Zakzouk, Habib, Ezzat, & Mohamed, 2023).

Prolonged labour, particularly a prolonged second stage, has been identified as a predictor of PPUR. A correlation analysis showed a significant association between prolonged second stage and PPUR, with $p = 0.038$ (Septiani, Hariyono, & Rosyidah, 2021). This condition is thought to arise from prolonged fetal head pressure on pelvic floor structures during the second stage, affecting the nerve plexus in the pelvic soft tissues and causing tissue oedema or detrusor dysfunction due to neuropraxia, which leads to bladder disturbance (Oktharina et al., 2021).

Approximately one in five (20.6%) women undergoing instrumental delivery with vacuum or forceps experience PPUR (Gupta et al., 2021). Instrumental delivery may cause more severe stretching and traction injuries to the perineum than spontaneous vaginal birth, so the resulting neuropraxia or oedema can impair bladder emptying ability in the early postpartum period (Mu et al., 2025).

Although epidural analgesia can help reduce labour pain, the bladder is simultaneously affected by the anaesthetic (Li et al., 2020). Most studies conclude that labour analgesia has an effect on bladder function and is associated with prolonged labour duration; the longer the duration of analgesia, the greater the accumulation of anaesthetic agents, leading to progressive inhibition of the bladder emptying reflex. This finding is supported by postoperative urinary retention studies showing that the risk of retention increases by about 11% for every additional 10 minutes of operative and anaesthetic time (Ren et al., 2024).

In a study of 12,609 primiparous women undergoing vaginal delivery, 677 developed PPUR, giving an incidence of 5.37% (Cao et al., 2022). Another study reported that the proportion of primiparous women was significantly higher in the PPUR group (62.8%) than in the non-PPUR group (37.2%) (Djusad et al., 2024). Primiparous women are at higher risk of more pronounced changes and damage to the pelvic floor muscles than multiparas as a consequence of anatomical adaptations during pregnancy and childbirth (Li et al., 2020).

A study from Pakistan showed that maternal obesity ($\text{BMI} \geq 27.5 \text{ kg/m}^2$) was more common in the case group and remained a risk factor for PPUR with an odds ratio of 2.54. Obesity is thought to increase PPUR risk through various labour complications such as prolonged second stage, increased need for instrumental delivery, and larger fetal size. Maternal obesity is associated with longer labour duration and higher rates of obstetric interventions, both of which contribute to PPUR (Saif et al., 2025).

Voiding dysfunction causes several problems, one of which is bladder overdistension. A single episode of bladder overdistension may lead to long-term voiding problems and recurrent urinary tract infections due to disruption of intercellular junctions involved in stimulus transmission between bladder smooth muscle cells (Gupta et al., 2021). Urinary tract infection also arises as a consequence of voiding dysfunction, because the urinary tract's ability to resist microbial infection depends on intact anatomical and physiological function, and disturbance of either increases infection and recurrence risk (Gupta et al., 2021). In very rare cases, postpartum urinary retention can progress to

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bladder rupture, a potentially life-threatening but entirely preventable complication (Nutaitis et al., 2023). Furthermore, bladder dysfunction can impair uterine contraction and lead to postpartum haemorrhage; urinary retention causes bladder distension that displaces the uterus upward and laterally, thereby inhibiting adequate uterine contraction (Hapitria, 2024).

CONCLUSION

The success of postpartum bladder function recovery can be assessed by the presence or absence of voiding dysfunction, particularly postpartum urinary retention (PPUR). Voiding recovery may be impeded by several factors described in the literature, including detrusor hypocontractility due to hormonal changes, neuropraxia of the pelvic plexus and pudendal nerve caused by a prolonged second stage or operative delivery, and functional obstruction resulting from perineal oedema and urethral spasm, all of which can delay the return of normal bladder function. If not recognized and managed adequately, voiding dysfunction may lead to bladder overdistension, urinary tract infection, bladder rupture, and postpartum haemorrhage.

Based on this literature review, it is concluded that early detection and management of voiding dysfunction are key components in supporting optimal postpartum bladder function recovery, with an emphasis on preventing overdistension, preserving detrusor function, and promoting rapid restoration of the micturition reflex. In clinical practice, maternal care facilities are advised to implement intrapartum and postpartum bladder monitoring protocols (for example, monitoring the timing and volume of the first void, applying a 6-hour time limit, and using ultrasound or catheterization when high residual volume is suspected), particularly in women with risk factors such as prolonged second stage, instrumental delivery, episiotomy, regional analgesia, and primiparity.

Further research is recommended using a systematic review design and, where possible, meta-analysis to integrate studies on risk factors for postpartum voiding dysfunction and their impact on bladder function recovery. Such an approach would enable more precise effect estimates (for example, for

second-stage duration, operative delivery, or bladder-management protocols) and help identify evidence gaps that require additional prospective studies.

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