

A Brief Overview About Postpartum Urinary Retention

Dr. Asma Marwan Al-Rawi ^{1*} and Dr. Laila Yahya Al-Hubaishi²

¹Obgyn PGY-1 at Dubai Health, United Arab Emirates (UAE).

²Consultant Obgyn at Dubai Health, United Arab Emirates (UAE).

*Corresponding Author: Asma Marwan Al-Rawi, Obgyn PGY-1 at Dubai Health, United Arab Emirates.

Received date: July 01, 2024; Accepted date: July 10, 2024; Published date: July 22, 2024

Citation: Asma Marwan Al-Rawi and Laila Yahya Al-Hubaishi, (2024), A Brief Overview About Postpartum Urinary Retention, *J New Medical Innovations and Research*, 5(6); DOI:10.31579/2767-7370/111

Copyright: © 2024, Asma Marwan Al-Rawi. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract:

Background: Postpartum urinary retention (PUR) or puerperal urinary retention is quite a common obstetric condition affecting postpartum women. Despite its significance, ubiquity, and morbidity, it remains an under-discussed and poorly understood topic.

Objective: This literature review is aimed 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.

Conclusion: In conclusion, PUR is a complex condition with varying incidence and contributing factors. Understanding its pathophysiology, risk factors, and effective management strategies is essential for better outcomes in postpartum care.

Keywords: cesarean deliveries; postpartum; urinary retention; vaginal deliveries

Introduction

Urinary retention (UR) is the inability to empty the bladder normally. Postpartum voiding dysfunction is defined as failure to pass urine spontaneously within six hours of vaginal delivery or catheter removal [45]. Another common clinical definition of urinary retention is significant post-void residual bladder volume (PVRBV), where PVRBV is defined as the volume of fluid remaining in the bladder immediately following the completion of micturition [8, 30, 69]

The presence of PVRBV implies an imbalance between the forces of urine expulsion and the outflow resistance or a failure or decrease in detrusor contractility. Accordingly, a significant PVRBV represents an abnormality of bladder function and could be used as the definition of PUR. Postpartum urinary retention (PUR) is a common condition in obstetric units. It is also known as puerperal urinary retention or insidious urinary retention after vaginal delivery [61]. If postpartum voiding dysfunction is not diagnosed promptly, it can lead to bladder over-distension and activity, and prolonged voiding dysfunction, with sequelae such as incontinence and recurrent urinary tract infections (UTIs), [16].

The definition of PUR varies among studies. Yip et al. (1997) divided PUR into overt and covert urinary retention, with overt PUR defined as an inability to urinate autonomously 6 h after vaginal delivery or the need for re-catheterization 6 h after catheter removal following cesarean section. Carley et al. (2002) defined PUR as an inability to undergo spontaneous micturition within 12 h after vaginal delivery. However, other reports defined PUR as a symptom requiring at least one catheterization within the first 24 h postpartum [10,50].

Bladder symptoms that should raise clinical suspicion of voiding dysfunction include urinary frequency, voiding small amounts, slow or

intermittent stream, bladder pain or discomfort, straining to void, reduced sensation to void, incomplete emptying of the bladder and urinary incontinence [15, 17]. PUR can be silent, and some women may be unaware of the large volume of urine in the bladder or that they are unable to void to completion. This may occur because of reduced bladder sensation and contractility due to injury or trauma to the nerves supplying the bladder [43].

The reported prevalence of PUR varies widely ranging from 1.7%–17.9%. In a recent study, the overall prevalence of PUR was 12.9% [64]. There is increased risk of voiding dysfunctions leading to PUR in the postpartum period due to the physiological changes and traumatic events occurring during pregnancy and childbirth [47]. The reported incidence of postpartum voiding dysfunction varies considerably due to differences in the definition, methods of diagnosis, and mode of delivery. Overt UR incidences range from 0.45%, 1.7% to 17.9%, and from 0.05% to 37% have been reported [38].

The incidence of UR following cesarean section varies between 3.38% and 11.5% [60]. However, if post-void residuals are not checked and recorded, it may not be possible to identify these women. As a result, the actual incidence may be higher than reported, and as many as 5% of these women may have significant and long-term bladder dysfunction [32].

Classification

Two types of urinary retention can affect a woman in the postpartum period [59]. PUR is classified as overt, which is defined as the inability to void spontaneously within 6 h of either vaginal delivery or catheter removal after delivery [36]. Overt or symptomatic urinary retention is

easily detectable, with clear clinical appearance, and therefore is adequately treated (Figure 1), [19].

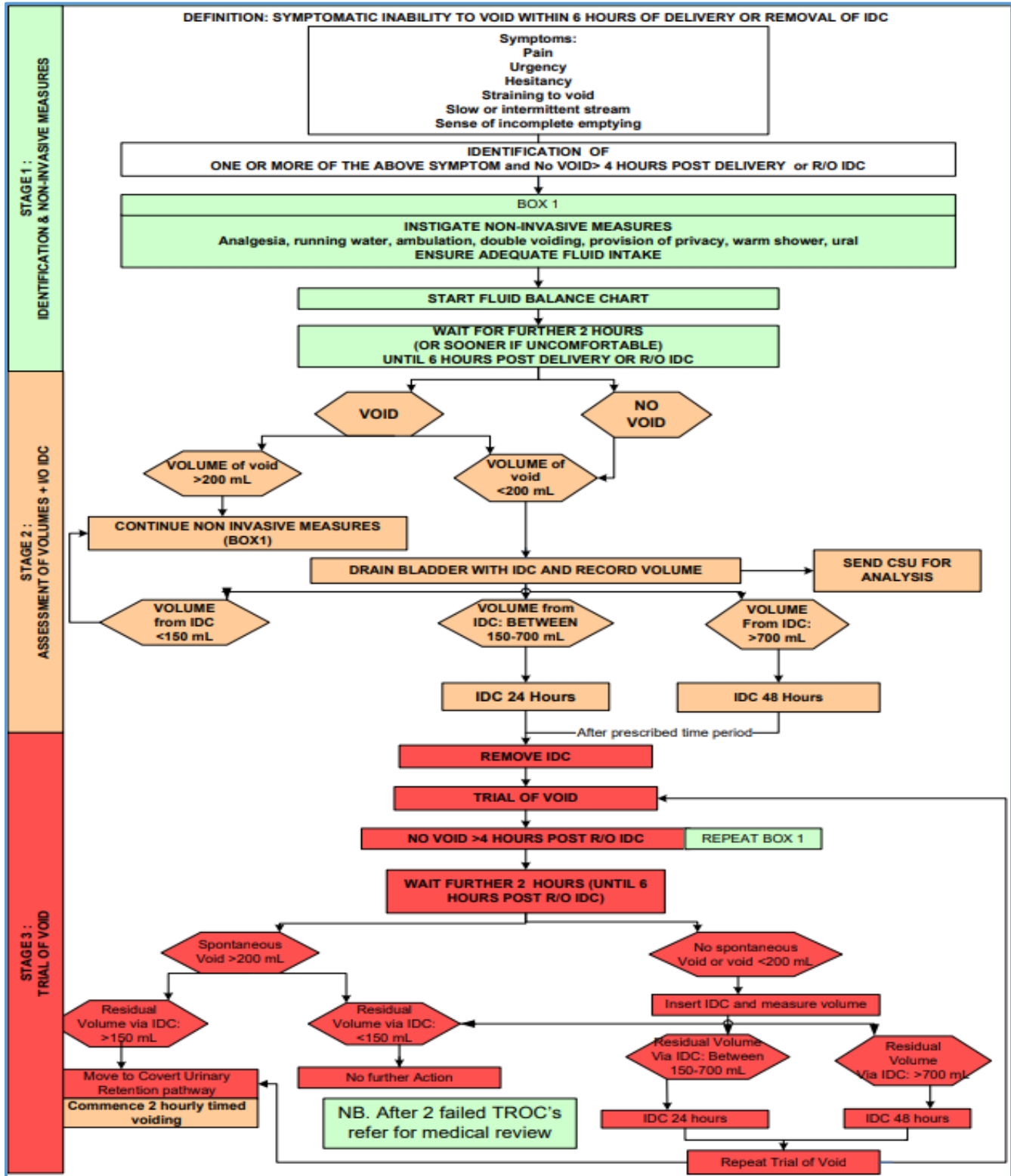


Figure 1: Postpartum overt urinary retention

The covert form can be identified by elevated post-voiding residual volume (PVRV) measurements, using ultrasound scanning or catheterization after urination [18]. It occurs when a woman passes small amounts of urine and has an elevated post-void residual urine volume greater than 150ml with no symptoms of UR (Figure 2), [21].

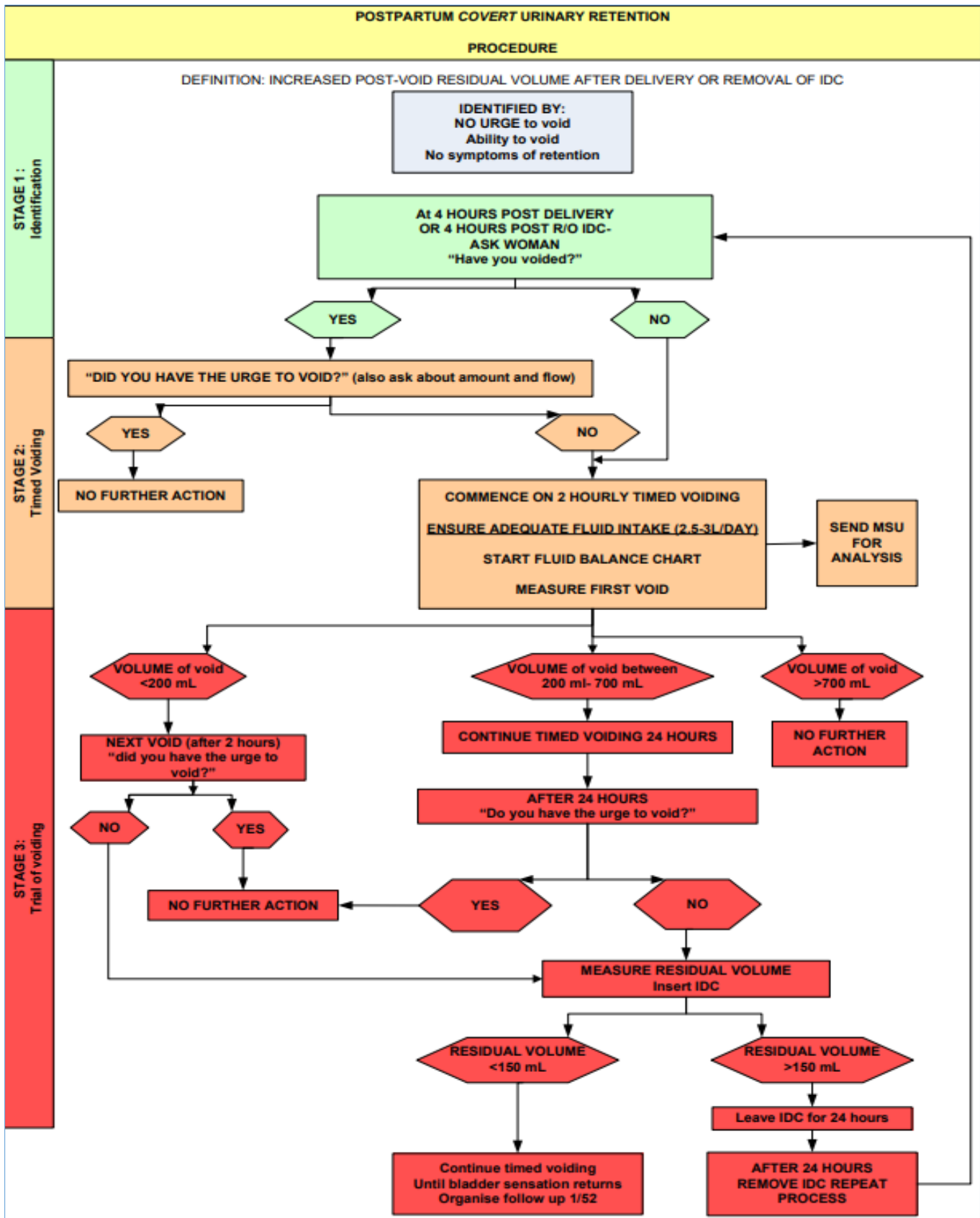


Figure 2: Postpartum covert urinary retention.

Pathophysiology

The pathophysiology of PUR is not well understood; however, several hypotheses exist regarding physiological, neurologic, and mechanical factors related to pregnancy and the immediate postpartum period [25]. The bladder is a hormone-responsive organ. Pregnancy-related changes, including increased progesterone, reduced bladder muscle tone, increased capacity, increased urethral length, and increased maximal urethral closure pressure may contribute to PUR development [40].

During pregnancy and immediately postpartum, increased progesterone levels inhibit smooth muscle tone and may contribute to detrusor inhibition [27]. Impaired detrusor contractility combined with a lack of urethral relaxation may explain a component of the urinary retention mechanism [9]. One study demonstrated that pregnancy induced a 50% decrease in bladder muscarinic receptor density, which correlated with a 50% decrease in the contractile response to bethanechol [43].

Another PUR mechanism involves pelvic, hypogastric, and pudendal nerve injury during delivery [2]. Neurologic consequences vary depending on the complex interactions of partial or complete injuries with the parasympathetic, sympathetic, and somatic nervous systems [67]. Sympathetic nerve injuries result in decreased bladder compliance and high storage pressures because of beta-adrenergic denervation, whereas parasympathetic nerve injuries produce a hypo contractile bladder with decreased sensation. These nerve injuries, which are typically transient in nature and resolve within three months postpartum, have been demonstrated through electrophysiological research [43].

During a vaginal delivery, ischemic nerve injury can occur from a prolonged second stage of labor, and direct partial or complete nerve transection can result from either spontaneous or operative birth trauma [55]. Denervation can occur during cesarean delivery in cases complicated by substantial hemorrhage or in those requiring a cesarean hysterectomy [55]. Regional analgesia acts as a potential iatrogenic contributor to PUR, directly affecting bladder sensitivity and contractility. It also temporarily disrupts afferent input arising from bladder stretch receptors, which may be damaged by overdistention intrapartum [46].

Periurethral and vulvar edema can lead to mechanical urethral obstruction and impaired voiding [9]. Pain associated with obstetrical lacerations may

preclude relaxation of pelvic floor muscles, which is the first step in initiating a spontaneous void. Furthermore, patient discomfort with voiding in unfamiliar locations and lack of privacy are possible contributors to PUR [33].

Risk Factors

Independent risk factors for PUR vary and are often limited by confounding factors. Frequently proposed risk factors include epidural anesthesia, operative vaginal delivery, prolonged labor duration, episiotomy, newborn macrosomia, nulliparity, and obstetric anal sphincter injury [5]. A systematic review of PUR risk factors found that operative vaginal delivery was the only clinical factor with a consistently strong association with PUR [39].

Operative vaginal delivery may result in direct pelvic floor and bladder trauma, edema that results in mechanical outlet obstruction, or impaired reflex and voluntary relaxation of the sphincter urethrae, periurethral muscles, and pelvic floor [4]. It is unclear whether operative vaginal delivery is an individual risk factor, or if it is confounded by other concurrent risk factors such as epidural, episiotomy, prolonged labor, and parity [43].

In a multivariate analysis, labor duration >700 minutes was the only factor that predicted PUR. Ultimately, multiple risk factors likely act synergistically to impair normal postpartum micturition processes > 700 minutes was the only factor that predicted PUR. Ultimately, multiple risk factors likely act synergistically to impair normal postpartum micturition processes [44].

The PUR was ascribed to maternal anxiety, nervousness, genital injuries, such as vulval and vaginal lacerations, and derangement of the neuromuscular innervation of the bladder. Some of these factors have been proven using urodynamics, electrophysiology, and histochemistry of the detrusor muscle. [30]

Diagnosis

The evaluation of the patient with suspected urinary retention should begin with a detailed history to elucidate the precise etiology, as summarized in **Table 1** [23]. The initial evaluation should also include a thorough medication history, including the use of over-the-counter medications and herbal supplements [58, 63].

Potential etiology	History	Physical examination
Cystocele; rectocele; uterine prolapse	Pelvic pressure; palpation of a pelvic organ from the vagina	Prolapse of bladder, rectum, or uterus
Uterine fibroid, pelvic mass, or malignancy	Pelvic or lower abdominal pain, dysmenorrhea, bloating	Palpable uterus, ovaries, or adnexa
Vulvovaginitis	Vaginal discharge, vaginal itching, dysuria	Inflamed or erythematous vulva or vagina, vaginal discharge

Table 1: History and physical examination findings that suggest etiologies of urinary retention [54].

Physical examination should include a complete abdominal assessment, including palpation and percussion of the bladder and abdominal/ pelvic organs; evaluation for flank tenderness; a complete pelvic examination in women; and a neurologic evaluation to assess strength, sensation, muscle tone, and reflexes relative to lower thoracic, lumbar, and sacral spinal levels [53, 54]

Testing should include a postvoid residual (PVR) urine evaluation, which is a simple, noninvasive, and cost-effective volume measurement of urine within the bladder that can be performed with ultrasonography [12]. The bladder can be percussed when it contains 150 mL of urine and is palpated

with greater than 200 mL [65]. No evidence supports a specific PVR threshold for patients with chronic urinary retention; however, the American Urological Association has recommended using a value greater than 300 mL that has persisted for at least six months and has been documented on two separate occasions [1,57].

Postpartum evaluation of postpartum urinary retention

Patients should spontaneously void within 6 hours after the last bladder drainage or catheter removal [44]:

- All patients: the first 2 voids should be measured, and an ultrasound should be performed to assess PVR if the patient's initial attempts are unsuccessful, urine output is inadequate (<30 mL/h), or if clinical signs or symptoms of PUR are present [66]. The patient should enter the PUR management algorithm if the bladder volume is ≥ 150 mL on the scan [37].
- **Assessment of bladder urine volume:** this can be performed with a bladder scan to determine the urine volume, followed by catheter placement for more accurate measurement [41].
- **Active voiding trial (AVT):** perform after 24 hours of indwelling urethral catheter. We recommend an AVT because it provides a controlled, efficient approach to evaluate the adequacy of bladder emptying and reduces urinary tract injury (UTI) risk [35]. Drain the bladder completely into the urine collection bag. Disconnect the catheter from the urine collection bag and back-fill the bladder with 300 mL of sterile water or saline. If the patient has no sensation to void, volumes up to 500 mL can be instilled. For patients with increased bladder sensation or decreased capacity, volumes as low as 200 mL can be instilled [22]. The patient must void at least two-thirds of the instilled volume within 30 minutes of instillation [20].

If PVR evaluation cannot be obtained or is thought to be inaccurate, patients with suspected urinary retention should be catheterized for bladder decompression and accurate measurement of stored urine [54].

Treatment

Intermittent self-catheterization

When PUR is persistent, management with intermittent self-catheterization (ISC) or indwelling urethral catheter is indicated regardless of whether the patient is symptomatic [23]. This prevents further bladder injury by keeping the bladder decompressed while awaiting the return of normal bladder function [7]. The advantages of indwelling urethral catheter placement include complete bladder rest and lack of need for ISC teaching [6]. Disadvantages include increased infection risk, need for in-office voiding trials, and inability to monitor ongoing progress [44].

High fluid intake in mothers expressing milk coupled with postpartum diuresis and diminished bladder sensation may make it challenging to perform frequent self-catheterization and avoid overdistention [43]. To balance these challenges, we strongly recommend using an indwelling catheter for the first 5 to 7 days, followed by ISC if needed [42]. Whether to manage persistent PUR with ISC or with an indwelling urethral catheter is not well-studied, and no guidelines exist [24, 28].

Female urology referral

In some centers, urogynecology or female urology referral is placed when PUR is diagnosed or persists [34]. When these services are available, it is recommended that referral at the time of hospital discharge for women with unresolved PUR. These providers have AVT supplies, staff with expertise in teaching ISC, and the ability to perform additional testing. However, it is important to note that urodynamic testing and imaging studies are not routinely indicated for women with PUR and should be reserved only for women with atypical symptoms, a concerning history, or considerably prolonged PUR [37].

Acupuncture

Acupuncture has been studied for PUR treatment at the time of diagnosis in the immediate postpartum period. In a randomized trial of 55 women with PUR, 92% in the acupuncture group achieved spontaneous micturition within 1 hour following treatment [29].

Bethanechol chloride

Bethanechol chloride is a U.S. Food and Drug Administration-approved cholinergic medication for the treatment of acute postpartum nonobstructive urinary retention.³⁸ Dosing begins at 5 to 10 mg, 3 times per day with dose escalation as needed. Side effects of bethanechol include flushing, tachycardia, diarrhea, vomiting, and urinary urgency [43].

Tamsulosin

Tamsulosin, an alpha-adrenergic receptor antagonist acting at the level of the bladder, neck, and urethra, is efficacious in preventing postoperative urinary retention in an Ur gynecological population [13].

Postpartum prevention and management

Prevention of PUR requires avoiding bladder overdistention during labor [31]. The American College of Obstetricians and Gynecologists recommended assessing all women for bladder emptying in the first 24 hours postdelivery to avoid PUR [25]. Normal urine output is defined as 0.5 to 1.5 mL/kg/h.²⁷ We suggest inadequate urinary output be defined as 150 mL [26]. Either modality can be used to screen for an elevated PVR; however, precise bladder volumes should not be expected. For volumes ≥ 150 mL, a catheter should be used to assess the PVR accurately [14].

Figure 3 illustrates the postpartum bladder management protocol, developed by group consensus with the incorporation of a variety of protocols currently used nationally and internationally [62]. The algorithm begins with identifying overt or covert PUR, followed by step-by-step guidance for management and discharge disposition [43].

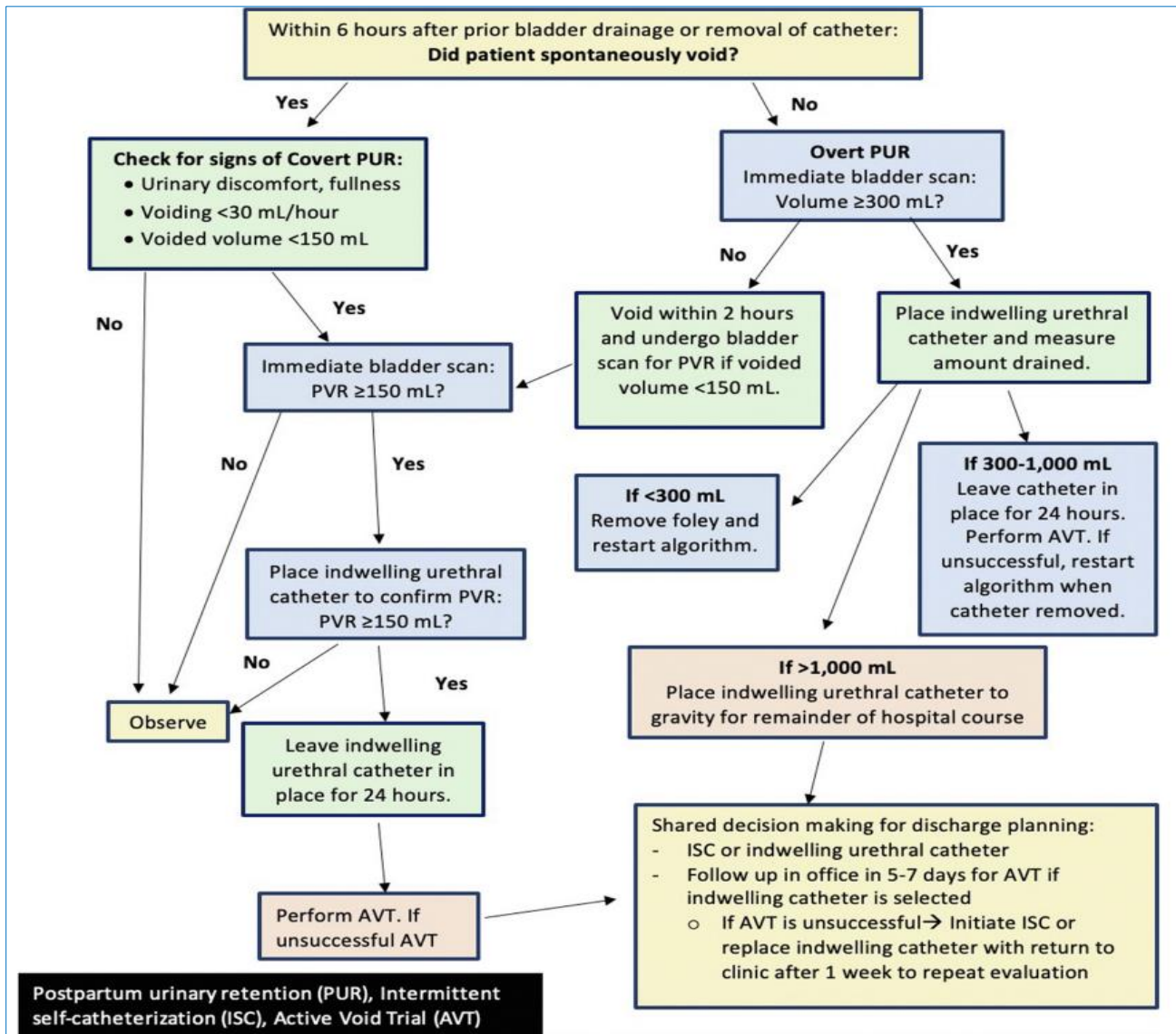


Figure 3: Postpartum bladder management protocol [43]

Postpartum voiding dysfunction following vaginal versus cesarean delivery

Labor is associated with pelvic floor disorders both voiding dysfunction and fecal incontinence [48]. Whether this is caused by pregnancy or delivery itself is unknown. The reported incidence of postpartum voiding dysfunction ranges between 1.7% and 43% following vaginal delivery [51]. Prolonged second stage, instrumental delivery, and high birth weight increase this risk [49].

Voiding assessment is a crucial part of postpartum care. This involves the determination of risk factors and early promotion of first urination. While most studies on postpartum voiding dysfunction were related to vaginal delivery, little is known about the effect of the mode of delivery (vaginal versus CD) on voiding dysfunction [69]. One study that compared postpartum PVRV in nulliparous following vaginal or CD, found that women after vaginal delivery had higher rates of PVRV compared to CD [3].

In elective CD, the operation is performed before uterine contractions and the fetal head is relatively high in the pelvis. Therefore, postpartum PVRV may be higher in the vaginal delivery group compared to CD. A recent study suggests that delivery adversely affects voiding function, and that

vaginal delivery is associated with more severe bladder dysfunction compared to elective CD [52].

Conclusion

In conclusion, PUR is a complex condition with varying incidence and contributing factors. Understanding its pathophysiology, risk factors, and effective management strategies is essential for better outcomes in postpartum care.

References

1. Abello A, DeWolf WC, Das AK. (2019). Expectant long-term follow-up of patients with chronic urinary retention. *Neurourology and Urodynamics*. 38(1):305-309.
2. Alas AN, Hurtado EA. (2015). Is postpartum urinary retention a neurogenic phenomenon? *Current Bladder Dysfunction Reports*. 10(4):318-324.
3. Al-Mandeel H, al-badr A, al-shaikh G. (2014). Incidence of early postpartum voiding dysfunction in primiparae: comparison between vaginal delivery and cesarean section. *LUTS: Lower Urinary Tract Symptoms*. 6(2):103-106.

4. Augustin G. (2023). Urinary Tract Obstruction or Rupture. In *Acute Abdomen During Pregnancy* Cham: Springer International Publishing. pp. 963-995.
5. Bączek G, Rychlewicz S, Sys D, Rzońca P, Teliga-Czajkowska J. (2022). Episiotomy for medical indications during vaginal birth-retrospective analysis of risk factors determining the performance of this procedure. *Journal of Clinical Medicine*. 11(15):4334.
6. Balhi S, Arfaoui RB. (2021). Barriers affecting patient adherence to intermittent self-catheterisation. *British Journal of Community Nursing*. 26(9):444-451.
7. Beal MW. (2018). Interventional management of urethral obstructions. *Veterinary Clinics: Small Animal Practice*. 48(5):863-874.
8. Beyazit A, Hakverdi AU, Gözükarar KH. (2023). The Effect of Pregnancy on Urinary Symptoms. *Cureus* 15(8).
9. Biurrun GP, Gonzalez-Díaz E, Fernández CF, Corona AF. (2020). Post-partum urinary retention and related risk factors. *Urology*. 143:97-102.
10. Cao D, Rao L, Yuan J, Zhang D, Lu B. (2022). Prevalence and risk factors of overt postpartum urinary retention among primiparous women after vaginal delivery: a case-control study. *BMC Pregnancy and Childbirth*. 22(1):26.
11. Carley ME, Carley JM, Vasdev G, Lesnick TG, Webb MJ, et al., (2002). Factors that are associated with clinically overt postpartum urinary retention after vaginal delivery. *American journal of obstetrics and gynecology*. 187(2):430-433.
12. Ceyhan E, Asutay MK. (2021). Standardization for reliable uroflowmetry testing in adults. LUTS: Lower Urinary Tract Symptoms. 13(1):45-50.
13. Chapman GC, Sheyn D, Petrikovets A, Mahajan ST, El-Nashar S, et al., (2020). Tamsulosin to prevent postoperative urinary retention after female pelvic reconstructive surgery. *Urogynecology*. 26(11):682-687.
14. Cho KJ, Kim JC. (2020). Management of urinary incontinence with underactive bladder: a review. *International neurourology journal*. 24(2):111.
15. Clothier JC, Wright AJ. (2018). Dysfunctional voiding: the importance of non-invasive urodynamics in diagnosis and treatment. *Pediatric Nephrology*. 33:381-394.
16. Cox S, Reid F. (2018). Urogynaecological complications in pregnancy: an overview. *Obstetrics, Gynaecology & Reproductive Medicine*. 28(3):78-82.
17. D'Ancona C, Haylen B, Oelke M, Abranches-Monteiro L, Arnold E, et al., (2019). The International Continence Society (ICS) report on the terminology for adult male lower urinary tract and pelvic floor symptoms and dysfunction. *Neurourology and urodynamics*. 38(2):433-77.
18. Dolezal P, Ostatnikova M, Balazovjechova B, Psenkova P, Zahumensky J. (2022). Covert postpartum urinary retention: causes and consequences (PAREZ study). *International urogynecology journal*. 33(8):2307-2014.
19. Dolezal P, Zahumensky J, Otapkova P, Papcun P, Krizko J. Covert postpartum urinary retention. Clinical study. 2019 673:675.
20. Dolgun NZ, Jones K, Harmanli O. (2021). Voided volume for postoperative voiding assessment following prolapse and urinary incontinence surgery. *International urogynecology journal*. 32:587-591.
21. Doumouchsis SK, de Tayrac R, Lee J, Daly O, Melendez-Munoz J, et al., (2023). An International Continence Society (ICS)/International Urogynaecological Association (IUGA) joint report on the terminology for the assessment and management of obstetric pelvic floor disorders. *International urogynecology journal*. 34(1):1-42.
22. Ganguly A, Tyagi S, Chermansky C, Kanai A, Beckel J, et al., (2023). Treating Lower Urinary Tract Symptoms in Older Adults: Intravesical Options. *Drugs & aging*. 40(3):241-261.
23. Gomelsky A, Steckenrider H, Dmochowski RR. (2022). Urgency and urgency incontinence following stress urinary incontinence surgery: A review of evaluation and management. *Indian Journal of Urology*. 38(4):268-275.
24. Gupta A, Pampapati V, Khare C, Murugesan R, Nayak D, et al., (2021). Postpartum urinary retention in women undergoing instrumental delivery: A cross-sectional analytical study. *Acta Obstetrica et Gynecologica Scandinavica*. 100(1):41-47.
25. Hickman LC, Yao M, Propst K. (2022). Protracted postpartum urinary retention: incidence, risk factors, and natural history of a rare postpartum urinary retention subtype. *Urogynecology*. 28(12):887-893.
26. Jensen JT, Klarskov N, Lauenborg J. (2020). Validity of bladder volume measurement by ultrasound in women postpartum. *International Urogynecology Journal*. 31:643-649.
27. Kashif U, Riaz N, Ramasubramanian SP, Iles D. (2021). Urogynaecological complications in pregnancy. *Obstetrics, Gynaecology & Reproductive Medicine*. 31(2):42-47.
28. Lamblin G, Chene G, Aeberli C, Soare R, Moret S, et al., (2019). Identification of risk factors for postpartum urinary retention following vaginal deliveries: a retrospective case-control study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 243:7-11.
29. Lauterbach R, Sokolovski CF, Rozenberg J, Weissman A. (2018). Acupuncture for the treatment of post-partum urinary retention. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 223:35-38.
30. Lawal OO, Morhason-Bello IO, Atalabi OM, Ojengbode OA. (2022). Incidence of postpartum urinary retention in a tertiary hospital in Ibadan, Nigeria. *International Journal of Gynecology & Obstetrics*. 156(1):42-47.
31. Li S, Zhang X, Liu Y, Wang Y, Zheng X. (2023). The Occurrence and Factors Associated with Overt Urinary Retention Among Postpartum Women After Vaginal Delivery with Labor Epidural Analgesia. *International Journal of General Medicine*. Dec 31:5333-5341.
32. Lukacz ES, Santiago-Lastra Y, Albo ME, Brubaker L. (2017). Urinary incontinence in women: a review. *Jama*. 318(16):1592-1604.
33. Meister MR, Sutcliffe S, Badu A, Ghetti C, Lowder JL. (2019). Pelvic floor myofascial pain severity and pelvic floor disorder symptom bother: is there a correlation? *American journal of obstetrics and gynecology*. 221(3):235-e1.
34. Mevorach Zussman N, Gonen N, Kovo M, Miremberg H, Bar J, et al., (2020). Protracted postpartum urinary retention—a long-term problem or a transient condition? *International Urogynecology Journal*. 31:513-519.
35. Mills JT, Rapp DE, Shaw NM, Hougren HY, Agard HE, et al., (2020). Effect of active versus passive void trials on time to patient discharge, urinary tract infection, and urinary retention: a randomized clinical trial. *World Journal of Urology*. 38:2247-2252.
36. Miyamoto K, Komatsu H, Nagata H, Nagira K, Motomura E, et al., (2024). Prolonged second stage of labor in delivery using epidural analgesia is a risk factor for postpartum urinary retention. *Journal of Obstetrics and Gynaecology Research*. Mar;50(3):424-429.
37. Mohr S, Raio L, Gobrecht-Keller U, Imboden S, Mueller MD, et al., (2022). Postpartum urinary retention: what are the sequelae? A long-term study and review of the literature. *International urogynecology journal*. 33(6):1601-1608.
38. Moosdorff-Steinhauser HF, Berghmans BC, Spaanderman ME, Bols EM. (2021). Prevalence, incidence and

- bothersomeness of urinary incontinence between 6 weeks and 1 year post-partum: a systematic review and meta-analysis. *International Urogynecology Journal*. 32(7):1675-1693.
39. Murphy DJ, Strachan BK, Bahl R, Royal College of Obstetricians and Gynaecologists. (2020). Assisted vaginal birth: green-top guideline no. 26. *BJOG: An International Journal of Obstetrics & Gynaecology*. 127(9): e70-112.
 40. Murray I, Hendley J. (2020). Change and adaptation in pregnancy. *Myles' Textbook for Midwives E-Book: Myles' Textbook for Midwives E-Book*:197.
 41. Nasrabadi MZ, Tabibi H, Salmani M, Torkashvand M, Zarepour E. (2021). A comprehensive survey on non-invasive wearable bladder volume monitoring systems. *Medical & Biological Engineering & Computing*. 59:1373-1402.
 42. Newman DK, New PW, Heriseanu R, Petronis S, Håkansson J, Håkansson MÅ, et al., (2020). Intermittent catheterization with single-or multiple-reuse catheters: clinical study on safety and impact on quality of life. *International urology and nephrology*. 52(8):1443-1451.
 43. Nutaitis AC, Meckes NA, Madsen AM, Toal CT, Menhaji K, et al., (2023). Postpartum urinary retention: an expert review. *American journal of obstetrics and gynecology*. 228(1):14-21.
 44. O'Kane M, Rantell A. (2023). Intrapartum and postpartum bladder management: the poor relation of modern obstetrics. *Obstetrics, Gynaecology & Reproductive Medicine*. 33(7): 190-196.
 45. Pan WL, Chen LL, Wang CH, Mu PF, Tsay SF, et al., (2023). Enhancing bladder management for intrapartum/postpartum women at a maternity hospital in Taiwan: a best practice implementation project. *JBIG evidence implementation*. 21(3):197-207.
 46. Panicker JN, Anding R, Arlandis S, Blok B, Dorrepaal C, et al., (2018). Do we understand voiding dysfunction in women? Current understanding and future perspectives: ICI-RS 2017. *Neurourology and Urodynamics*. 37(S4): S75-85.
 47. Paola DR, Noemi G, Valeria B, Lorena C, Manara DF, et al., (2022). Risk factors and management of postpartum urinary retention: A scoping review. *International Journal of Urological Nursing*. 16(2):87-104.
 48. Peinado-Molina RA, Hernández-Martínez A, Martínez-Vázquez S, Rodríguez-Almagro J, Martínez-Galiano JM. (2023). Pelvic floor dysfunction: prevalence and associated factors. *BMC Public Health*. 23(1):2005.
 49. Pergialiotis V, Bellos I, Antsaklis A, Papapanagiotou A, Loutradis D, et al., (2020). Maternal and neonatal outcomes following a prolonged second stage of labor: A meta-analysis of observational studies. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 252: 62-69.
 50. Rosenberg M, Many A, Shinar S. (2020). Risk factors for overt postpartum urinary retention—the effect of the number of catheterizations during labor. *International Urogynecology Journal*. 31:529-33.
 51. Sadiq G, John S. (2020). Effects of Mode of Delivery and Perineal Injury on the Prevalence of Urinary and Fecal Incontinence. *Journal of The Society of Obstetricians and Gynaecologists of Pakistan*. 10(1):56-61.
 52. Salman L, Shmueli A, Aharony S, Pardo A, Chen R, et al., (2022). Postpartum voiding dysfunction following vaginal versus caesarean delivery. *Journal of Obstetrics and Gynaecology*. 42(2):256-60.
 53. Selius BA, Subedi R. (2008). Urinary retention in adults: diagnosis and initial management. *American family physician*. 77(5):643-650.
 54. Serlin DC, Heidelbaugh JJ, Stoffel JT. (2018). Urinary retention in adults: evaluation and initial management. *American family physician*. 98(8):496-503.
 55. Shehata IM, Barsoumv S, Elhass A, Varrassi G, Paladini A, et al., (2021). Anesthetic Considerations for Cesarean Delivery After Uterine Transplant. *Cureus*. 13(3).
 56. Sleutel MR, True B, Webb J, Valdez E, Tran MV. (2020). Integrative review of lower extremity nerve injury during vaginal birth. *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 49(6):507-524.
 57. Stoffel JT, Peterson AC, Sandhu JS, Suskind AM, Wei JT, et al., (2017). AUA white paper on nonneurogenic chronic urinary retention: consensus definition, treatment algorithm, and outcome endpoints. *The Journal of Urology*. 198(1):153-160.
 58. Storm S, MacVicar S. (2024). Management of stress urinary incontinence associated with perimenopause. *Journal of Prescribing Practice*. 6(2):68-74.
 59. Suar G, Cevik F, Simal Yavuz N, Ozerdogan N. (2023). Urinary incontinence in the postpartum 1-year period: Its prevalence and effect on the psychosocial status of women. *LUTS: Lower Urinary Tract Symptoms*. 15(5):191-199.
 60. Sudhakaran P. (2019). Urinary retention in pregnancy and puerperium: acupuncture treatment. *Medical Acupuncture*. 31(5):269-273.
 61. Swathi HV, Samant PY. (2020). Postnatal bladder dysfunction. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 9(7):3026.
 62. Tiberon A, Carbonnel M, Vidart A, Halima MB, Deffieux X, et al., (2018). Risk factors and management of persistent postpartum urinary retention. *Journal of Gynecology Obstetrics and Human Reproduction*. 47(9):437-441.
 63. Trowbridge ER, Hoover EF. (2022). Evaluation and treatment of urinary incontinence in women. *Gastroenterology Clinics*. 51(1):157-175.
 64. ul Ain Q, Shetty N, Supriya K. (2021). Postpartum urinary retention and its associated obstetric risk factors among women undergoing vaginal delivery in tertiary care hospital. *Journal of Gynecology Obstetrics and Human Reproduction*. 50(2):101837.
 65. Veronica M, Tirkey RS, Varunashree N, Mathews JE, Thenmozhi M. et al., (2023). Diagnostic Accuracy of Urine Volume Estimation by Ultrasound to Prevent Unnecessary Catheterisation in the Intrapartum Period: A Cross-sectional Study. *Journal of Clinical & Diagnostic Research*. 17(5).
 66. Wessells H, Angermeier KW, Elliott S, Gonzalez CM, Kodama R, et al., (2017). Male urethral stricture: American urological association guideline. *The Journal of urology*. 197(1):182-190.
 67. Wulf MJ, Tom VJ. (2023). Consequences of spinal cord injury on the sympathetic nervous system. *Frontiers in cellular neuroscience*. 17:999253.
 68. Yip SK, Brieger G, Hin LY, Chung T. (1997). Urinary retention in the post-partum period: the relationship between obstetric factors and the post-partum post-void residual bladder volume. *Acta obstetrica et gynecologica Scandinavica*. 76(7):667-672.
 69. Zakzouk NA, Habib FM, Ezzat R. (2023). Voiding Dysfunction between Women Following Vaginal Vs Cesarean Section Delivery: A Comparative Study. *Menoufia Nursing Journal*. 8(3):217-233.



This work is licensed under Creative Commons Attribution 4.0 License

To Submit Your Article Click Here:

Submit Manuscript

DOI:[10.31579/2767-7370/111](https://doi.org/10.31579/2767-7370/111)

Ready to submit your research? Choose Auctores and benefit from:

- fast, convenient online submission
- rigorous peer review by experienced research in your field
- rapid publication on acceptance
- authors retain copyrights
- unique DOI for all articles
- immediate, unrestricted online access

At Auctores, research is always in progress.

Learn more at: <https://auctoresonline.org/journals/new-medical-innovations-and-research>