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Comparison of early versus delayed urinary catheter removal in postoperative caesarean section patients: A retrospective observational study

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Abstract
Urinary catheterization is a standard intraoperative practice during cesarean sections to reduce the risk of bladder injury and to monitor urine output. However, the timing of postoperative catheter removal remains an area of clinical variability. Traditionally, many institutions have practiced delayed removal, often 24 hours after surgery to avoid complications such as urinary retention. This study aims to evaluate and compare maternal outcomes specifically urinary retention, urinary tract infections, time to mobilization, and patient satisfaction between early and late catheter removal in women undergoing elective lower segment cesarean section (LSCS). By analyzing these parameters, we aim to assess whether early removal offers clinical advantages without compromising patient safety.

Aim
1. To know the pattern of post-operative urinary catheter duration
2. To assess and compare the impact of early versus delayed urinary catheter removal on postoperative outcomes in patients undergoing cesarean delivery**.**

Methods & Statistics: This retrospective study was conducted at AJ Institute of Medical Sciences and Research centre, analyzing medical records of women who underwent cesarean delivery over a 3 month period (April 1st 2025 to June 30th 2025). Patients were divided into two cohorts based on timing of catheter removal: early removal group and delayed removal group. Primary outcomes assessed were incidence of urinary retention and catheter-associated urinary tract infection (CAUTI). Secondary outcomes included time to first ambulation and length of hospital stay.

Results: A total of 148 women were included in the study, with 32 women undergoing early catheter removal (≤6 hours post-op) and 116 women receiving delayed removal. The distribution of catheter removal timing was as follows: ≤6 hours - 32 (21.6%), 6-12 hours - 22 (14.9%), >12-24 hours - 56 (37.8%), and >24 hours - 38 (25.7%). Both groups were comparable with respect to age, BMI, parity, and gestational age at delivery.

There was no statistically significant difference between the groups in terms of irritative urinary symptoms, urinary retention, re-catheterization rates, or surgical site infections (SSIs).

Conclusion: Early catheter removal following cesarean section appears to be safe and is associated with reduced risk of CAUTI and faster postoperative recovery without increasing urinary retention. Adoption of early removal protocols may improve maternal comfort and support enhanced recovery practices.

Keywords: Cesarean section, catheter removal, urinary tract infection, urinary retention, early ambulation, retrospective study

Introduction

Cesarean section (CS) is the most common surgical procedure in obstetrics, with rates steadily increasing over the past decade. Although cesarean sections can enhance certain perinatal outcomes, they also pose risks for the mother, especially involving the urinary system [1].

Risk factors for bladder injury during cesarean section include previous cesarean delivery, adhesions, emergency cesarean delivery, and cesarean section performed at the time of the second stage of labor. To minimize the risk of urinary bladder injury during the uterine incision and to prevent urinary retention both during and after surgery, urinary catheters are routinely placed in nearly all patients undergoing a cesarean section. These catheters also facilitate monitoring of urinary output in the postoperative period. However, their use can result in complications such as urinary tract infections (UTIs), urethral discomfort, urinary retention, and delayed postoperative mobilization, potentially leading to prolonged hospital stays [2]. Delayed catheter removal is traditionally practiced with the intention of preventing postoperative urinary

retention and ensuring adequate bladder rest, especially in patients who have received regional anaesthesia. According to ERAS, in women who do not need ongoing strict assessment of urine output, the urinary catheter should be removed immediately after cesarean delivery, if placed during surgery [3]. Given the rising cesarean rates and the impact of postoperative practices on maternal recovery and satisfaction, establishing an evidence-based protocol for catheter removal is of clinical importance. This study is therefore undertaken to compare the maternal outcomes of early versus late catheter removal following LSCS with special reference to urinary tract infection, urinary retention, postoperative ambulation, and hospital stay.

Objectives

- To know the pattern of post-operative urinary catheter duration.
- To assess and compare the incidence of urinary retention, catheter associated urinary tract infection (CAUTI)
- To assess and compare the time to first ambulation and length of hospital stay.

Materials and Method

The OBG department at A J Institute of Medical Science and Research Centre has 4 units. There is a considerable variation in timing of catheter removal after caesarean section across different units. Typically, most units remove the catheter the day after the surgery in the morning around 6 am. In our unit, we adopted a protocol of early catheter removal at 6 hours post operation for all caesarean patients, following ERAS guidelines, unless otherwise specified.

In this study, we assessed the mean duration of bladder catheterisation, difference in the outcomes such as irritative urinary symptoms, urinary retention, re-catheterization rates, surgical site infections (SSIs), time taken for first void time taken for initial post-operative mobilization and length of post-operative hospital stay between early vs routine catheter removal in our hospital from 1/04/2025 to 30/06/2025.

In our hospital, a foley catheter is routinely inserted prior to spinal anaesthesia. Patients were categorized into two groups according to the time of catheter removal - those who had their catheter removed at 6 hours and those with removal after 6 hours.

- **Study Settings:** The study is retrospective and observational.
- **Study Period:** Three months (1/4/2025-30/6/25).
- **Study Subject:** All eligible pregnant woman who underwent caesarean delivery through the study period were included.

Inclusion Criteria

- Pregnant woman undergoing caesarean delivery between 36 and 40 weeks period of gestation
- Emergency and elective caesarean delivery.

Exclusion Criteria

- Patients with symptoms of UTI or significant bacteriuria preoperatively.
- Patients with conditions requiring prolonged urine output monitoring such as postpartum hemorrhage, preeclampsia and/ or eclampsia, or chronic kidney disease.

Data Collected Included

- Age
- Obstetric score
- Gestational age
- BMI
- Duration of hospital stay after caesarean
- Time of catheter removal
- Time taken for first voiding
- Time taken for ambulation
- Symptoms of UTI after surgey
- Need for re-cathterization
- Incidence of surgical site infection

Data Analysis

Data study is conducted using IBM SPSS for windows, version 26.0 for comparing qualitative variables a chi-square test or fisher's exact test was performed. In this study p value of <0.05 is taken as statistically significant.

Results

E denotes early catheter removal and D denotes late catheter removal. Among 148 patients in the study most of the patients were between 20-25 years of age. The mean age of the patients in early catheter removal found to be 27.2+/-5.23 years and in delayed group was 27.00+/-4.32. Difference is not statistically significant.

Table 1: Distribution of patients according to age

Age Group	Early (n)	Delayed (n)	Early (%)	Delayed (%)
20-25	14	50	43.75	43.1
26-30	13	78	40.62	67.24
31-35	5	14	15.62	12.07

Majority of the women were multiparous. Only 43.8 % of the women were primiparous in the early removal group. P value is Difference is not statistically significant.

Table 2: Distribution of patients according to parity

Parity	Early (n)	Delayed (n)	Early (%)	Delayed (%)
Primiparous	14	44	43.75	37.93
Multiparous	18	72	56.25	62.07

The mean gestational age in the study was found to not be statistically significant.

Table 3: Distribution of patients according to gestational age

Gestational age in weeks	Early removal (n, %)	Delayed removal (n, %)	P value
Term	28 (87.5%)	106(91.4%)	>0.05
Pre-term	4 (12.5%)	10(8.6%)	

BMI may influence postoperative outcomes such as urinary retention and mobility. In this study, most patients had a normal BMI. Since higher BMI can affect recovery, it may impact the timing and outcomes of catheter removal. This distribution is important when interpreting results between early and late catheter removal groups. The difference in BMI distribution between the two groups is not statistically significant.

Table 4: Distribution of patients according to BMI

BMI	Early	Delayed	P value	Mean+/-SD	
<18.5	2	2	0.055	Early removal	Delayed removal
18.5-24.9	28	88		21.80+/-1.82	22.93+/-2.53
>25	2	26			

The majority of the patients in both the groups were asymptomatic for urinary tract infection. The frequency of urinary symptoms such as dysuria, urgency was low and comparable between the two groups. No statistical difference between early and delayed catheter groups, suggesting that early catheter removal does not increase the risk of UTI.

Table 5: Symptoms of UTI

Symptom	Early (n)	Delayed (n)	Early (%)	Delayed (%)
Frequency	0	0	0.0	0.0
Urgency	0	0	0.0	0.0
Hematuria	0	0	0.0	0.0
Dysuria	6	1	18.75	0.86

Patients in early removal group had a significant shorter mean duration of hospital stay compared to delayed group, suggesting early catheter removal contributes to earlier discharge and better utilization of hospital resources.
There is no significant difference between the group in relation to urinary retention and need for re catheterization.

Table 6: Other Parameters

Parameter	Early	Delayed	P-value
Time taken for first void ≤1h	30 (93.8%)	110 (94.8%)	>0.05
Time for ambulation ≤12h	28 (87.5%)	18 (15.5%)	>0.05
Duration of hospital stay (mean)	4.0 ± 0.5 days	5.0 ± 0.6 days	<0.05
Urinary retention	0	0	-
Need for re-catheterization	0	0	-
Surgical site infection	0	1 (0.9%)	>0.05

Discussion

Routine indwelling urinary catheterization during cesarean delivery has traditionally been justified for accurate monitoring of urine output, minimizing urinary tract injury risks, and reducing postoperative retention. Yet prolonged catheter use is increasingly recognized as potentially delaying ambulation, extending hospital stay, and increasing risks of urinary tract infections (UTIs), discomfort, and related complications [4-6] for accurate monitoring of urine output, minimizing urinary tract injury risks, and reducing postoperative retention. Yet prolonged catheter use is increasingly recognized as potentially delaying ambulation, extending hospital stay, and increasing risks of urinary tract infections (UTIs), discomfort, and related complications.

Evidence from Randomized Trials and Meta-Analyses

A randomized controlled trial by Basbug *et al.* [7] compared catheter removal at 2 hours versus 12 hours post-elective cesarean (n=134). Early removal significantly reduced urinary frequency (p=.04), microscopic hematuria (p=.04), mobilization time (p = .01), and hospital stay (p = .009), with no increase in bacteriuria, dysuria, urinary retention, or delayed first voiding.

Complementing this, a meta-analysis by Menshawy *et al.* [8] incorporating three RCTs (early removal: n=298; delayed removal: n=311) demonstrated that early catheter removal significantly lowered rates of dysuria (RR = 0.60; p = .03), urinary frequency (RR = 0.32; p = .002), and significant bacteriuria (RR = 0.49; p = .007).
Another randomized study (El-Mazny *et al.*) [9] similarly found that immediate catheter removal after elective cesarean was associated with a lower risk of urinary infection and earlier ambulation. An earlier trial by Onile *et al.* [10] indicated that immediate postoperative removal had no significant difference in retention, dysuria, or length of stay compared with 24-hour removal, and even showed a trend toward lower positive urine cultures (8.1% vs 11.2%, though not statistically significant).
A recent observational finding [11] echoed this: reducing the duration of urinary catheterization corresponded with shorter time to postoperative mobilization.

Local RCT from South Asia (Early vs Delayed Removal)

More recently, a randomized controlled study from Pakistan [12] compared catheter removal at 2 hours versus 12 hours post-elective cesarean (n=384). Early removal was associated with significantly lower hematuria (21.4% vs 50%; p<.001), while there was no significant difference in postoperative fever incidence (p = 0.292).

Synthesis & Implications for Practice

Cumulatively, the evidence from randomized trials and systematic review/meta-analysis consistently suggests that early catheter removal-within a few hours post-cesarean-helps reduce irritative urinary symptoms (e.g., dysuria, frequency), bacteriuria, hematuria, mobilization times, and hospital length of stay, without compromising safety in terms of urinary retention or requiring re-catheterization.
From a clinical perspective, this aligns with enhanced recovery protocols in cesarean care. Early catheter removal not only enhances patient comfort and reduces infection risks, but may also support faster ambulation, lower hospital resource usage, and potentially decreased costs.

Conclusion: Early removal of urinary catheters after lower segment cesarean section was associated with earlier ambulation, reduced duration of hospital stay, and improved overall patient comfort compared to delayed removal. Importantly, early catheter removal was not linked to a higher incidence of urinary retention or need for re-catheterization. By reducing postoperative immobility, early removal may also lower the risk of thromboembolic events, promote early mother-infant bonding, and enhance breastfeeding initiation. In addition, limiting unnecessary catheterization may decrease the risk of urinary tract infections and reduce patient discomfort, thereby improving maternal satisfaction. Our findings support the incorporation of early catheter removal into routine post-cesarean care protocols, provided close monitoring is ensured.

Limitations of the study: This study was conducted at a single tertiary-care center with a relatively small sample size, which may restrict the generalizability of the findings. The study also did not assess patient-reported outcomes such as quality of life and satisfaction scores in a structured manner. Variations in surgical technique, anesthetic practices, and postoperative care across institutions were not accounted for, which may influence results.

Future Prospects

Further multicenter studies with larger sample sizes and longer follow-up are warranted to validate the benefits and safety of early catheter removal. Inclusion of additional parameters such as urinary infection rates, surgical site infection, maternal satisfaction, breastfeeding outcomes, and cost-effectiveness would provide a more holistic evaluation. Strong evidence from such studies could guide the revision of existing protocols and national guidelines, thereby encouraging early ambulation, reducing hospital stay, optimizing use of limited healthcare resources, and improving overall obstetric care.

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