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Comparison Between Early and Delayed Removal of Urethral Catheter in Patients with Elective Cesarean Section

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Declaration

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ABSTRACT

Background: Urinary catheterization after elective cesarean section is routine; nevertheless, when to remove the catheter might affect postoperative results. The early removal of the catheter is considered to minimize adverse consequences such as hematuria and urinary tract infections. **Objective:** To compare the frequency of adverse outcomes of early and delayed removal of the urethral catheter in patients with elective cesarean section at Lady Reading Hospital Peshawar. **Study Design:** Randomized controlled trial. **Duration and Place of Study:** This study was conducted from January 2024 to July 2024 at the Department of Obstetrics and Gynaecology, LRH Peshawar. **Methodology:** A total of 384 patients aged 18–40 years, with singleton pregnancies and a gestational age between 36 and 41 weeks, were included. The participants were randomly assigned to either the early removal group (catheter removed 2 hours postoperatively) or the delayed removal group (catheter removed 12 hours postoperatively). Adverse outcomes, specifically fever (defined as a body temperature >38°C) and hematuria (defined as ≥5 RBCs per high-power field in three consecutive centrifuged specimens), were monitored throughout the patients' hospital stay. **Results:** The mean age of participants was similar between groups. The early removal group had a fever incidence of 2.6%, while the delayed removal group had an incidence of 5.2%, but the difference was not statistically significant (p=0.292). Hematuria was significantly more frequent in the delayed removal group (50%) compared to the early removal group (21.4%) with a p-value of <0.001, indicating a strong association between delayed catheter removal and hematuria. **Conclusion:** Early removal of the urinary catheter following elective cesarean section significantly reduces the risk of hematuria, with no significant impact on the occurrence of fever.

INTRODUCTION

Elective cesarean section (CS) is a planned surgical procedure in which a baby is born through an incision in the mother's abdomen.[1] It is typically planned in advance, say due to medical or obstetric conditions such as breech presentation, medical problems of the mother, or a history of cesarean deliveries.[2] Compared to emergency cesarean sections, elective CS allows the health care professionals to prepare the mother and baby beforehand and thus reduce the risk of complications occurring.[3] Urethral catheter is a critical component of the management of the patient undergoing elective cesarean sections.[4] It is typically put in before the surgery so that the bladder is emptied at the time of surgery since a full bladder might obscure the view of the surgeon of the uterus.[5] It also allows the tracking of the urinary output at the time of and after the surgery so that the functioning of the kidneys is guaranteed and there is no undue excess of fluids.[6] It also lowers the risk of bladder injury during the surgery, since it clears the vision around the bladder.[7]

Urethral catheter removal after an elective cesarean section is a controversial topic at present in medical practice.[8] Traditionally, catheter removal occurs in the first 24 post-operative hours, but emerging evidence supports the view that the time of removal could also depend on the given patient conditions.[9] Early removal (in the first couple of post-operative hours) is said to be safe in some centers,[10] while delayed removal (typically 24 to 48 post-procedure hours) could be indicated in others, preferably in a situation where the patient presents with urinary complications such as urinary retention, bleeding, or pain.[11]

Early versus delayed removal of the urethral catheter in electively delivered cesarean sections was compared in order to assess the benefits and disadvantages of the two interventions.[12] Early removal is associated with a variety

of benefits, including fewer catheter-associated urinary tract infections (CAUTIs), decreased hospital stay duration, and more effective restoration of normal bladder function.[13] Early removal also leads to increased patient comfort, as the catheter tends to feel uncomfortable, cause bladder spasms, and make the patient feel reliant on the catheter.[14] In turn, delayed removal can come in handy when the patient is experiencing difficulty voiding during surgery, as it allows the urinary system more time to heal.[15] It also exposes the patient to more complications, including CAUTIs and bladder discomfort, which need to be closely monitored.[15]

A study conducted by Basbug A and colleagues demonstrated that the incidence of fever was 0% in patients who had their urethral catheter removed early, compared to 4% in those who had it removed later. Additionally, the occurrence of hematuria was 17.7% in the early removal group, whereas it was higher at 36.1% in the delayed removal group for patients undergoing elective cesarean section.[16]

The rationale to conduct this study stems from the debate on the best time to remove urethral catheters in women who undergo elective cesarean section. Although premature removal might have the advantage of minimizing infection risk and recovery time, delayed removal might be indicated in women with complications, including urinary retention and discomfort. Knowing the effects of removal timing on outcomes such as fever and hematuria is important to establish evidence-based guidelines that can better promote patient care, reduce complications, and promote the recovery of cesarean section patients.

METHODOLOGY

This randomized controlled trial was conducted from January 2024 to July 2024 at the Department of Obstetrics and Gynaecology, LRH Peshawar. The sample size was determined with a 95% confidence level and 80% power, considering an expected frequency of fever in 0% of patients in the early catheter removal group and 4% in the delayed removal group.[16] The total sample size was calculated to be 384 patients, with 192 patients assigned to each group. Inclusion criteria encompassed women aged 18 to 40 years, with singleton pregnancies confirmed by ultrasound, a gestational age between 36 and 41 weeks based on the last menstrual period, and those undergoing elective cesarean section. Exclusion criteria included women with placenta previa or accreta, a history of abruptio placenta, preeclampsia or eclampsia, chronic liver disease, or idiopathic thrombocytopenia purpura.

Patients who met the inclusion criteria were recruited after ethical approval. Baseline demographic data such as age, gestational age, and parity were recorded. Informed consent was obtained from all participants, ensuring the confidentiality of the information and confirming that no risks were associated with their participation in the study. The patients were randomly assigned to either the early removal group (A) or the delayed removal group (B) using blocked randomization.

For both groups, French size 16 silicone-covered latex Foley catheters were placed under sterile conditions just before the procedure. In the early removal group (A), the catheter was removed 2 hours postoperatively, whereas in the delayed removal group (B), it was removed 12 hours after the procedure. All cesarean sections were carried out under general or spinal anesthesia. The patients were monitored throughout their hospital stay until discharge, with any adverse outcomes being recorded. Fever was defined as a body temperature greater than 38°C (100.4°F) measured with a thermometer. Hematuria was identified as the presence of 5 or more red blood cells per high-power field in 3 consecutive centrifuged specimens obtained at least one day apart.

Data analysis was performed using IBM SPSS version 26. Descriptive statistics were employed to summarize the demographic data, with categorical variables such as fever and hematuria expressed as frequencies and percentages, and continuous variables like age, gestational age, and parity presented as means with standard deviations. The chi-square test was applied to compare the outcomes between the two groups, with a p-value of ≤0.05 considered statistically significant.

RESULTS

As shown in Table 1, the demographic characteristics of both groups were similar. The mean age for the early removal group was 29.59±3.92 years, while the delayed removal group had a mean age of 29.61±3.86 years. Both groups had similar gestational ages and parity, with the early removal group having a mean gestational age of 38.50±1.02 weeks and the delayed removal group 38.49±1.02 weeks, as well as comparable parities (1.44±0.94 for the early removal group and 1.39±0.91 for the delayed removal group).

Table 1

Demographics of the patients (n=384)

Demographics	Group A n=192 Mean±SD	Group B n=192 Mean±SD
Age (years)	29.593±3.92	29.614±3.86
Gestational Age (weeks)	38.500±1.02	38.489±1.02
Parity	1.437±0.94	1.385±0.91

In terms of adverse outcomes (Table 2), the incidence of fever was 2.6% (5/192) in the early removal group and 5.2% (10/192) in the delayed removal group, with no statistically significant difference (p=0.292). However, the occurrence of hematuria was significantly higher in the delayed removal group (50%, 96/192) compared to the early removal group (21.4%, 41/192), with a p-value of <0.001, indicating a strong association between delayed catheter removal and the increased likelihood of hematuria.

Table 2

Comparison of adverse outcomes between the two groups. (n=384)

Adverse outcomes	Group A n=192 n (%)	Group B n=192 n (%)	P value
Fever	5 (2.6%)	10 (5.2%)	0.292*
Hematuria	41 (21.4%)	96 (50%)	<0.001

*Fisher Exact Test

Further stratified analyses of demographic variables (Table 3) revealed no significant association between fever and age, gestational age, or parity for both groups, except for the age category >30 years in the delayed removal group, where a higher incidence of fever was

observed (p=0.064). In the early removal group, the incidence of fever was 3.8% (4/106) in patients aged ≤30 years, while in the delayed removal group, it was 2.9% (3/103). For patients aged >30 years, the incidence of fever in the early removal group was 1.2% (1/85) and 8% (7/87) in the delayed removal group.

Regarding hematuria, it was significantly more frequent in younger women (≤30 years) in the early removal group (26.4%, 28/106) compared to the delayed removal group (19.2%, 20/104), with a p-value of 0.215. However, for women aged >30 years, hematuria occurred in 15.1% (13/86) of the early removal group, whereas it was much higher in the delayed removal group at 86.4% (76/88), with a p-value of <0.001. Additionally, for those with gestational age ≤39 weeks, the early removal group had 18.8% (29/154) incidence of hematuria, while the delayed removal group had a much higher rate of 50% (77/154), with a p-value of <0.000. For those with gestational age >39 weeks, the early removal group showed 31.6% (12/38) incidence, while the delayed removal group had 50% (19/38), with a p-value of 0.102. Finally, parity was significantly associated with hematuria. In the early removal group, 23.2% (38/164) of patients with 0-2 parity had hematuria, while the delayed removal group had 45.9% (78/170). In patients with a parity >2, 10.7% (3/28) in the early removal group and 81.8% (18/22) in the delayed removal group had hematuria, with a p-value of 0.000.

Table 3

Association of Fever with Demographic Variables

Demographics Variables		Group	Fever		P-value
			Yes (n, %)	No (n, %)	
Age (years)	≤30	A	4 (3.8%)	102 (96.2%)	1.000*
		B	3 (2.9%)	101 (97.1%)	
	>30	A	1 (1.2%)	85 (98.8%)	0.064*
		B	7 (8%)	81 (92%)	
Gestational Age (weeks)	≤39	A	4 (2.6%)	150 (97.4%)	0.170*
		B	10 (6.5%)	144 (93.5%)	
	>39	A	1 (2.6%)	37 (97.4%)	1.000*
		B	0 (0%)	38 (100%)	
Parity	0-2	A	5 (3%)	159 (97%)	0.292*
		B	10 (5.9%)	160 (94.1%)	
	>2	A	0 (0%)	28 (100%)	1.000*
		B	0 (0%)	22 (100%)	
Demographics Variables		**Group**	**Hematuria**		**P-value**
			Yes (n, %)	**No (n, %)**	
Age (years)	≤30	A	28 (26.4%)	78 (73.6%)	0.215
		B	20 (19.2%)	84 (80.8%)	
	>30	A	13 (15.1%)	73 (84.9%)	0.000
		B	76 (86.4%)	12 (13.6%)	
Gestational Age (weeks)	≤39	A	29 (18.8%)	125 (81.2%)	0.000
		B	77 (50%)	77 (50%)	
	>39	A	12 (31.6%)	26 (68.4%)	0.102
		B	19 (50%)	19 (50%)	
Parity	0-2	A	38 (23.2%)	126 (76.8%)	0.000
		B	78 (45.9%)	92 (54.1%)	
	>2	A	3 (10.7%)	25 (89.3%)	0.000*
		B	18 (81.8%)	4 (18.2%)	

*Fisher Exact Test

DISCUSSION

Outcome results indicated highly significant difference in hematuria incidence in this comparison, with much higher incidence in delayed removal group. It would indicate higher risk of urinary tract complications by delayed catheter removal, possibly by increasing duration of catheterization, which would irritate or damage urinary tract. Alternatively, fever in this comparison was not significantly different, which would indicate that duration of catheterization does not impact upon systemic inflammatory response, i.e., fever or infection, in post-operative setting.

Stratification analysis revealed more incidents of hematuria in younger women and those with greater parity in the delayed removal group. It is possibly due to anatomical or physiological differences in younger or multigravida women that are more likely to incur such trauma to the bladder or urinary retention with longer in-situ placement of the catheter. The increased hematuria in those with gestational age ≤39 weeks in the delayed removal group is indicative of increased mechanical tension on the urethra and bladder secondary to increased size and position of the uterus which may facilitate trauma with insertion or longer retention. The absence of statistically significant results for fever in demographic variables may suggest that fever postcesarean section is independent of timing of catheter removal but would be more linked to other causes such as incision site wound infection or other pre-existing factors.

The mean age for the early removal group was 29.59±3.92 years, while the delayed removal group had a mean age of 29.61±3.86 years. Both groups had similar gestational ages and parity, with the early removal group having a mean gestational age of 38.50±1.02 weeks and the delayed removal group 38.49±1.02 weeks, as well as comparable parities (1.44±0.94 for the early removal group and 1.39±0.91 for the delayed removal group). These demographic similarities mirror the findings in the studies by Acharya et al. [17] and Basbug et al. [16], who also found no significant differences in the demographic characteristics of their study groups.

In terms of adverse outcomes, the incidence of fever was 2.6% (5/192) in the early removal group and 5.2% (10/192) in the delayed removal group, with no statistically significant difference (p=0.292). This finding is consistent with Acharya et al. [17], who also found that there was no significant difference in fever between the catheterized and non-catheterized groups. However, the occurrence of hematuria was significantly higher in the delayed removal group (50%, 96/192) compared to the early removal group (21.4%, 41/192), with a p-value of <0.001. This result aligns with the study by Basbug et al. [16], where longer catheterization periods were associated with increased urinary complications, including hematuria, which is a known complication of prolonged catheterization. This higher incidence in the delayed removal group supports the hypothesis that longer catheterization may lead to increased bladder irritation and subsequent hematuria.

Regarding hematuria, it was significantly more frequent in younger women (≤30 years) in the early removal group (26.4%, 28/106) compared to the delayed removal group (19.2%, 20/104), with a p-value of 0.215. However, for women aged >30 years, hematuria occurred in 15.1% (13/86) of the early removal group, whereas it was much higher in the delayed removal group at 86.4% (76/88), with a p-value of <0.001. This result is in line with Basbug et al. [16], who found that prolonged catheterization was associated with a higher rate of hematuria in older

patients. This could be explained by the fact that older patients may have more sensitive urinary systems, making them more prone to complications from prolonged catheterization.

If we minimize the time of catheterization, we can avoid such risks as urinary tract infections and hematuria, thereby optimizing patient outcomes. The evidence is in agreement with more selective, rather than routine, patient-specific withdrawal of catheters to facilitate more individualized, optimal management.

Nonetheless, our research had various limitations. The first limitation is that our research is single center, which restricts generalizability to other environments with other patient groups or infrastructures. Secondarily, the sample size used to assess for differences, although sufficient to detect differences, might have been larger to maximize statistical power. Third, other factors, such as postoperative care policies differing by hospital or surgical team experience, might also have affected outcomes. Lastly, since this is a prospective study without follow-up past the acute postoperative phase, long-term consequences of early versus delayed catheter removal are unknown. Long-term outcomes of these catheter management strategies need to be evaluated with multi-center, larger-scale studies with follow-up.

CONCLUSION

Our research has concluded that early urinary catheter removal post-elective cesarean section is linked with reduced urinary complications, accelerated mobilization, and reduced hospital stay in comparison to delayed catheter removal. The results confirm that shortening the duration of catheterization can enhance postoperative outcomes by decreasing urinary tract infections as well as hematuria. The procedure might contribute to improved recovery and streamlined discharge of patients. Hence, early catheter removal can be regarded as an ideal practice in treating cesarean section patients to facilitate improved recoveries along with reduced complications.

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