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Does Immediate Removal of Urinary Catheter Prevent Urinary Morbidities Following Cesarean Section: A Prospective Randomized Study

Upasana Maskey, MD[1]; Rita Marahatta, MD[1]; Biloni Vaidya, MD[1]

1 Department of Obstetrics and Gynecology, Nepal Medical College and Teaching Hospital, Jorpati, Nepal

Corresponding Author:
Upasana Maskey, Department of Obstetrics and Gynecology, Nepal Medical College and Teaching Hospital, Jorpati, Nepal; Email: upasnamaskey@gmail.com

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Abstract

Objective: Urinary catheters are known cause of urinary morbidities. The longer the catheter is retained, the greater the risk for contamination and infection. An increasing body of literature suggests routine practice of catheterization and retaining it for 24 hours does not add any procedural advantage. Thus, we sought to study outcomes in relation to early vs. delayed removal of urinary catheters following cesarean section.

Methods: We randomly assigned 116 patients into early and delayed removal of urinary catheter groups. In the early group, catheter was removed immediately after the procedure and in the delayed removal group, catheter was removed 24 hours later. Clinical outcomes were measured in terms of significant bacteriuria 72 hours postop, voiding difficulties, urinary retention, mobilization time, length of hospital stay, and patient satisfaction.

Results: Study revealed higher incidence of bacteriuria in the delayed removal group (32.8% vs. 15.5%, P = 0.030). Urinary frequency was also higher (34.6% Vs. 8.6%, P=0.001). However, there were no difference between the two groups in other urinary complaints including dysuria and urgency (P = 0.103 & P = 0.087). Urinary retention was more frequent in the early group, but difference was not significant (P = 0.080). Patients with immediate removal of the urinary catheter had early ambulation and early discharge from hospital (P = 0.001 and P = 0.040) and were generally satisfied with the procedure (P= 0.010).

Conclusion: Our study showed that immediate removal of urinary catheter was associated with lower urinary complications, shorter length of hospitalization and associated cost.

Keywords: cesarean section, urinary catheterization, urinary tract infection

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Introduction

The past three decades have seen a significant rise in cesarean sections (CS) in both developed and developing countries.[1] Although CS has proved to be effective in preventing maternal and perinatal morbidity and mortality, it is associated with varied complications including infection & hemorrhage; and may lead to uterine rupture and placentation problems in future pregnancies.[2] Urinary tract infection (UTI) accounts for 40% of nosocomial infection in the peri-operative period, and 80% of UTIs are attributed to the use of urinary catheter.[3,4] In cesarean section, urinary catheterization is performed as a routine step in the preoperative preparation of the patient. The rationale for catheterization has been for adequate visualization of the lower uterine segment during surgery to prevent bladder injuries and to limit postoperative mobilization as patient recovers from effects of analgesia.[5] In addition to urinary contamination, catheters are associated with voiding problems, greater postoperative pain, delayed ambulation, a longer hospital stay, and higher associated costs.[6] Several recent studies have questioned the benefit of routine catheterization during CS.[7-14] An increasing body of literature suggest cesarean section can be performed without urinary catheterization without compromising procedural safety and with fewer urinary complications.[7-9] Urinary catheters are a known cause of bacteriuria.[15] The common practice to retain the catheter for 24 hours following cesarean section is a long term phenomenon that has not been backed by evidence based knowledge.[16] Longer duration of catheter use is associated with higher risk of infection, with a reported daily increase in risk ranging from 3-10%.[17]

Thus, we sought to compare immediate removal to delayed (24 hours postoperative) removal of urinary catheter and its association with urinary complications and postoperative outcomes

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Materials and Methods

This single-center, prospective, randomized controlled study was conducted at the Department of Obstetrics and Gynecology at Nepal Medical College and Teaching Hospital from 1st October 2016 to 30th September 2017. The study was approved by the Institutional Research and Review Committee of Nepal Medical College (Ref no. 93-069/070; Date 07/09/2016).

A total of 116 women were included in the study. The calculation of sample size was based on the urinary tract infection rate of 8% after cesarean section[18] and was calculated with the formula $n = 2(z^2pq/d^2)$ where, p = prevalence (8%), q = 1-p, d = error (7).

Inclusion Criteria

Patients (age≥19) admitted to the prenatal wards for elective caesarean section and those undergoing emergency cesarean section in the 1st stage of labor were included in the study.

Exclusion Criteria

Patients with pre-existing UTI or lower urinary track symptoms, medical conditions necessitating strict input output monitoring, emergency CS in the 2nd stage of labor and previous CS. The enrolled patients were randomly allocated into 2 groups, early removal and delayed removal group in a 1:1 ratio by using a computer-generated randomization model (Research Randomizer Software). A written informed consent was obtained from all participants using a standardized consent form approved by the IRB (Appendix 1) and patients had all the rights to withdraw from the study at any point; patients who had refused consent were excluded from the study.

In all participants, a Foley urethral catheter (French size 16) was inserted under sterile conditions on the operating table before the procedure after spinal anesthesia was administered.

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Cesarean sections were performed using standard procedure with Pfannenstiel abdominal incision and transverse lower segment incision of the uterus after gentle and sharp dissection of the vesicouterine peritoneal fold. In early removal group, the catheter was removed immediately after the procedure during vaginal toileting. In the delayed removal group, the catheter was removed 24 hours later in the post-operative ward. Typically, all patients received the same regimen of 3L IV fluids, antibiotic prophylaxis and postoperative analgesia that included Inj Pethidine 50 mg+ Phenergan 25mg IV TDS with Inj Diclofenac 75 mg IM, as needed. Patients in the early removal group were asked to void upon feeling the urge. A bed pan was given or if they were able to move, then were helped to a nearby bathroom in the postoperative ward itself. If the patient had difficulty in passing urine after 6 hours and/or if abdominal examination showed palpable urinary bladder, re-catheterization was done. In the delayed removal group, the catheter was removed the following day, 24 hours later in the postoperative ward and the patients were transferred to the postnatal wards, where they were encouraged to pass urine upon feeling the urge. Likewise, if they did not pass urine for 6 hours or if there was a palpable bladder, re-catheterization was performed. The total urine output was measured in both groups. Vitals monitoring was done with pulse, blood pressure and temperature being recorded every 2 hours.

After 72 hours postoperatively, i.e. on the 3rd postoperative day, urine microscopy and culture was sent. The patients were discharged on either the third or the fourth day depending on their postoperative recovery and the absence of complications. The clinical factors considered for discharge were return of bowel function (determined by the presence of bowel sounds and passage of flatus), acceptance of oral feeds and absence of fever for 24 hours. Patient satisfaction

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data was collected at the time of discharge using a standardized questionnaire. A positive answer was scored 1 and negative answer 0 and a cumulative patient satisfaction score was calculated. All data were collected using a standardized proforma (Appendix 2).

Primary Outcomes

The primary outcomes of the study were significant bacteriuria defined as >100,000 bacteria of same colony per milliliter of urine in a sample of midstream urine collected 72 hours postoperatively,[15,16] urinary symptoms like frequency (>7 daytime void or >2 night-time void), dysuria (painful micturition), urgency (severe irresistible urge to urinate), and urinary retention - defined as the inability to void after 6 hours of catheter removal with a painful, (usually) palpable or percussible bladder and the need for catheterization to obtain relief[19].

Secondary Outcome

The secondary outcome was post-operative fever (temperature of 38°C or more on 2 occasions within 10 days of the procedure, excluding the first 24 hours), time of first voiding, post-operative ambulation time, length of hospital stay and patient satisfaction.

Statistical Analysis

Statistical analysis was performed using IBM SPSS version 16. Nominal variables were expressed as numbers and percentages (%) and the descriptive statistics for continuous variables were expressed as the mean ± standard deviation or median. Significant differences in mean values between the groups were evaluated using the Student's t-test, whereas significant differences in median values were evaluated using the Mann–Whitney U test. Test of significance for categorical variable was assessed using Chi-squared or Fisher's Exact test. A P value < 0.05 was considered statistically significant.

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Results

A total of 116 women were enrolled in this study, with 58 women randomized in each group – Early removal group and Delayed removal group. The age range of the population studied was 26.03±4.13 years. Most common indication of cesarean section was fetal distress. There was no statistically significant difference between the two groups regarding maternal age (P = 0.263), Parity (P = 0.426), Gestational age (P = 0.673) and indication for CS (Table 1).

Table 1: Patient characteristics in the study groups

Variables	Group A (n = 58) (Immediate Removal)	Group B (n = 58) (Delayed Removal)	P-value
Maternal age (years)	25.60±4.07	26.47±4.19	0.263
Parity	1.45±0.82	1.59±1.03	0.426
Gestational age (weeks)	38.72±1.87	38.86±1.63	0.673
Indication for CS			
Fetal distress	24 (54.5%)	20 (45.5%)	0.440
Malpresentation	9 (39.1%)	14 (60.9%)	0.240
CPD	11 (55.0%)	9 (45.0%)	0.620
Oligohydramnois	5 (83.3%)	1 (16.7%)	0.090
Thick meconium stained liquor	5 (35.7%)	9 (64.3%)	0.250
Other	4 (44.4%)	5 (55.5%)	0.150

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The study revealed significant bacteriuria and frequency of urination were higher in the delayed removal group than in the early removal group (32.8% Vs. 15.5%, P=0.030; 34.6% Vs. 8.6%, P=0.001 respectively). The overall incidence of UTI was 24.0% with E coli being the most common organism isolated (64.3%). In the study, there was no significant difference between the two groups in other urinary complications such as dysuria and urgency (P = 0.103, P = 0.087, respectively). Although urinary retention was more frequent in the early removal group, the difference between the two groups was not significant (12.1% vs. 3.4%, P = 0.083). (Table 2) The mean amount that was drained following retention was 635±83 ml.

Table 2: Comparison of postoperative urinary complications in the study group

Variables	Group A (n=58) (Immediate Removal)	Group B (n=58) (Delayed Removal)	P-value
Significant bacteriuria	9 (15.5%)	19 (32.8%)	0.030*
Dysuria	8 (13.8%)	15 (25.9%)	0.103
Frequency	5 (8.6%)	20 (34.5%)	0.001*
Urgency	4 (6.9%)	10 (17.2%)	0.087
Urinary retention	7 (12.1%)	2 (3.4%)	0.083

*Variable is significant

This study also recorded various post-operative events. Although patients in the immediate removal group took longer to void than the delayed removal group (5.6 hrs vs 4.7 hrs;

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P = <0.001), patients with immediate removal of urinary catheter had early ambulation (17.62±2.71 hrs vs 22.38±2.41 hrs, P = 0.001) with early discharge (4.31±0.57 days vs 4.51±0.50 days, P = 0.040) from the hospital. The patients who had their catheter removed immediately were generally satisfied with the procedure compared to those who had their catheter removed after 24 hours (P= 0.010) (Table 3).

Table 3: Post-operative events in the study

Variables	Group A (Immediate Removal)	Group B (Delayed Removal)	P-value
Time till first void, hours	5.67±1.33	4.75±0.67	<0.001*
Time to patient ambulation, hours	17.62±2.71	22.38±2.41	<0.001*
Hospital stay, days	4.31±0.57	4.51±0.50	0.040*
Fever	9 (15.5%)	25 (43.1%)	0.001*
Patient Satisfaction	46 (79.3%)	34 (58.6%)	0.010

*Variable is significant

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Discussion

In the recent years, cesarean section has become a commonplace intervention with one in three women undergoing a cesarean delivery.[20]. Women who undergo these procedures often undergo urethral catheterization that may cause urinary tract infection. Furthermore, the routine practice to retain the catheter for 24 hours post-operatively further increases the risk because the longer the catheter remains in situ the greater the contamination. The risk increases with each passing hour with daily increase from 3-10%; roughly 85% of catheters are colonized with bacteria within 48 hours.[21,22]

To help combat urinary morbidities associated with the procedure, our study compared immediate removal of urinary catheter to removal of catheter 24 hours after the procedure and revealed that there was an increased incidence of bacteriuria on the 72 hour post-op urine MCS in those with delayed catheter removal, thus indicating that the duration of catheter use is an important factor for urinary contamination. The overall incidence of UTI was found to be 24%. Similar results were seen in prospective randomized trial conducted by Onile et al[9] and El Mazny et al[10]. Patients with delayed catheter removal had increased urinary frequency but there was no statistically significant difference between the two groups in terms of other urinary complaints such as dysuria and urgency. The discomfort caused by prolonged catheterization could lead to increased urinary frequency in these patients. These findings were similar to the study by Onile et al.[9]

One of the reasons that has been stated for the need to catheterize is to prevent post-operative urinary retention that varies between 3.3% to 39.0%.[11] In a study by Trankutal et al[23] a significantly large number of patients (39.2%) had urinary retention in those that had

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intermittent catheterization during CS. However, some studies have argued that urinary retention is rarely seen following a cesarean section irrespective of the time that it is retained.[5,7] In our study, there was a retention rate of 12% in the early removal group in contrast to 2% in the delayed removal group. In support of the previous argument, this finding however was not statistically significant. Similar findings were seen in the study by El Manzy et al[10] and Onile et al[9]. The reason for this could be that good postoperative analgesia would promote early ambulation and essentially makes it easier for patients to void preventing retention. In a systematic review comparing use versus non-use of catheter, Li et al revealed that caesarean section could be performed even without the use of urinary catheter significantly lowering the rate of urinary tract infection without risking accidental cystostomies and there were no significant difference in the urinary retention rate between the two groups.[12]

We also studied various post-operative events following catheter removal. The time for the first void was found to be longer in the immediate removal group, however, it was likely related to post-procedural pain in the early hours. These patients ambulated faster and were shifted to the postnatal wards where they could freely resume breast feeding and were also discharged earlier from the hospital reducing the hospital stay and associated costs. The findings were also similar to those noted by Nasr et al.[13] Early mobilization protects patients from the risk of post-operative venous thromboembolism and also gives them a sense of wellbeing, so every effort must be made to achieve it.[24] When Ghoreishi compared catheterized with non-catheterized group following CS, he also found reduced mean ambulatory time and time of hospital stay in favor of the non-catheterized group and those patients were generally pleased with the prospect of this method.[7] Similarly, higher number of patients (79.3%) in our study group

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were generally satisfied with the immediate removal of catheter because of relatively less discomfort, although this is a subjective variable that is difficult to quantify.

The limitation of this study could be the smaller sample size which limited the statistical power and probably resulted in a higher rate of UTI. Blinding of the participants and the research team was not possible for this study. Certain subjective variables were taken that are difficult to quantify and outcomes suggested are based on the feedbacks from the test subjects. The study did not consider other potential confounding factors such as socioeconomic status and pre-existing anemia, which may have affected the outcomes in the urinary tract infection rate among the patients. There are several strengths of the study including the randomized prospective design. Further, this study was performed in a resource limited setting of Nepal, thus results are applicable in resource constrained setting.

Conclusion

Early removal of urinary catheter after cesarean section is associated with deceased risk of post-operative urinary tract infection, shorter length of hospitalization, a lower cost of care, and improved patient satisfaction. Obstetricians should be judicious with urinary catheter use during and after cesarean section.

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Main messages:

- Urinary catheterization is performed as a routine preoperative procedure during cesarean section. However, catheters use increases risk of urinary tract infection and voiding difficulties.
- The duration that the catheter is placed in situ plays an important role in urinary contamination.
- Obstetricians should be judicious with urinary catheter use and use it only if absolutely required and for the shortest amount of time possible.

Current research questions:

- Can urinary catheterization be completely omitted as a routine preoperative requirement to prevent urinary morbidities following cesarean section?
- A study including a noncatheterized group along with early and delayed catheter removal group could give us a complete picture of the risks and benefits.
- Larger RCTs and metanalysis are required to fuel change in the policy and practice pertaining to catheter use and duration during cesarean section.

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Abbreviations

CS	cesarean section
UTI	urinary tract infection
Inj.	injection
IV	intravenous
IM	intramuscular
MCS	microscopy and culture
TDS	three times a day
SOS	if needed

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Declarations

Contributorship Statement: Dr Upasana Maskey collected the data, reviewed literature, conducted data analysis and drafted the paper. All authors revised and approved the final manuscript.

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