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Does timing of urinary catheter removal after elective cesarean section affects postoperative morbidity?: a prospective randomized trial

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ABSTRACT

Objective: To assess whether immediate (0 h), intermediate (after 6 h), or delayed (after 24 h) removal of an urinary catheter after elective caesarian section (CS) regarding, the rate of urinary retention with recatheterization, rate of symptomatic urinary tract infections (UTI), time of ambulation, and the length of hospital stay.

Methods: Prospective randomized controlled trial conducted at King Abd Al-Aziz Hospital, KSA. Two hundred twenty-one women underwent for term elective CS and were randomly allocated into three groups by simple randomization using computer-generated random numbers. Women in group A (73 patients) had their urinary catheter removed immediately after surgery. Group B (81 patients) had the catheter removed 6 h postoperatively while in group C (67 patients) the catheter was removed after 24 h. The following outcomes were assessed for each group: rate of recatheterization, symptomatic UTI, time of ambulation, and the length of hospital stay.

Results: All groups were matched regarding maternal age, body mass index, gestational age at delivery, and duration of surgery there was a significantly higher incidence of urinary retention needing recatheterization in the immediate removal group compared to the intermediate and delayed removal groups (13.6 vs. 2.5 and 0%, respectively). Delayed urinary catheter removal was associated with a higher incidence of UTI (13.4%), delayed ambulation time (10.3 h), and longer hospital stay (3.9 days) compared to the early (1.4%, 4.1 h, and 1.9 days, respectively) and intermediate (3.7%, 6.8 h, and 2.4 days respectively) removal groups.

Conclusion: Removal of the urinary catheter 6 h postoperatively appears to be more advantageous than early or late removal in cases of CS.

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KEYWORDS

Caesarian section; urinary catheter; urinary retention; urinary tract infections

Introduction

Cesarean section (CS) is considered as an international phenomenon as rates have been increasing all over the world. From the obstetricians' point of view, insertion of urinary catheter is a routine preparatory step in CS as keeping the urinary bladder continues empty during CS improves lower uterine segment exposure, eases the different operative steps, and prevents iatrogenic injury of the urinary bladder along with assessment of volume and color of the urinary output [1,2].

Traditionally speaking, after CS the catheter is left for 24 h to prevent postoperative urinary retention which can cause atonic bladder, which may increase long-term urinary problems such as voiding difficulties, detrusor over activity, and increased risk of urinary tract infection (UTI) [1,3]. On the other hand, prolonged insertion of urinary catheter may lead to late patient ambulation, increased urine bacterial colonization with subsequent UTI with prolonging hospital stay, leading to increased overall healthcare costs [4,5].

The duration of catheter use postoperatively is based on custom rather than evidence-based knowledge. Hence, the proper timing for removing the urinary catheter after CS is still controversial up till now [1,6]. The catheter is usually removed immediately after CS or delayed up to 12–24 h after surgery. All previous trials compared early versus traditional urinary catheter removal regimens following CS with variable findings [7–9]. Two large RCTs and one non-RCT suggested that the routine use of urinary catheters for cesarean delivery is not necessary and can be harmful. However, further trials were recommended to confirm these findings [10].

This has inspired us to conduct this study, to assess whether the immediate (0 h), intermediate (6 h), or delayed (24 h) removal of urinary catheter after elective CS in the rate of urinary retention with recatheterization, rate of symptomatic urinary tract infections, time of ambulation, and the length of hospital stay.

Materials and methods

This study was carried out in accordance with the ethical principles for medical research involving human subjects included in Helsinki declaration and was approved by Ethical Committee. This prospective randomized control study was performed at obstetrics and gynecology department of King Abd Al-Aziz Hospital, Jeddah, KSA from the start of September 2016 to the end of April 2018. All women fulfilling the study criteria were counseled to participate and informed written consent was obtained from all participants.

We included women with term singleton pregnancy prepared for term elective CS either primary or repeated. Timing of delivery was determined by completed weeks of gestation of reliable menstrual cycle if last menstrual period (LMP) was certain; if the LMP was not assured, ultrasound data were used, particularly the earliest ultrasound findings. Exclusion criteria were women who had urinary tract infections preoperatively confirmed by urine analysis \pm culture and sensitivity, women with iatrogenic bladder injury so that urinary catheter had to be kept postoperatively on the surgeon's decision, women with severe preeclampsia or eclampsia and/or any other conditions requiring postoperative monitoring of urinary output, and women who had spinal anesthesia by choice or contraindicated for general anesthesia.

A total of 238 patients underwent elective CS. Seventeen patients were finally excluded from the study; five patients had intraoperative complications (iatrogenic bladder injury) and therefore an indwelling catheter had to be kept postoperatively on the surgeon's request while 12 did not complete the postoperative follow-up. The remaining 221 women were divided into three groups by simple randomization using computer-generated random numbers. Participants in group A (73 patients) had their urinary catheter removed immediately after surgery. In group B (81 patients); the catheter was removed 6 h postoperatively while in group C (67 patients) the catheter was left for 24 h after operation (Figure 1). The required sample size was calculated based on power of the study of 80% and α -error of 0.05 [11]. The expected incidence of symptomatic urinary tract infection after CS is estimated to be around 8% [8]. Hence, the least required sample size for each of the study arms would be 64 patients.

On the morning of surgery, all patients received a single dose of prophylactic antibiotic in the form of ceftriaxone 1 g intramuscularly. A size 12 silicone, two way Foley's catheter (manufactured by Jamjoom

Medical Industries, Jeddah, KSA) was introduced under aseptic technique after induction of general anesthesia. CS was performed in the usual manner. Then, on the basis of the study design, the catheter was removed either in the operating room immediately after the surgical procedure, at 6 or 24 h after the operation.

We opted to follow post CS urinary retention definition, as inability for spontaneous micturition within 6 h after the removal of urinary catheter [12]. Hence, after urinary catheter removal, all study participants whether immediate (0 h), intermediate (after 6 h), or delayed (after 24 h) groups were subsequently encouraged for spontaneously empty their bladders. If they could not void spontaneously 6 h after catheter removal and the bladder was full on clinical abdominal examination with palpable urinary bladder; a urinary catheterization with a sterile disposable female in-out catheter was carried out once [1]. Urinary catheter was inserted if the patient could not empty the bladder 12 h after catheter removal and/or there was a palpable distended urinary bladder by abdominal examination [1,7] and/or ultrasound evidence of urinary retention (urinary volume \geq 600 ml) [13]. All patients had a midstream urine sample taken on the second postoperative day for analysis and culture. In addition, a third sample of urine was obtained after 1 week of surgery.

The following outcomes were assessed for each group: rate of recatheterization, symptomatic UTI, time of ambulation, and length of hospital stay. The diagnosis of symptomatic urinary tract infection was based on the following criteria: significant bacteriuria with at least one of the following symptoms; dysuria, frequency of micturition, urgency, *supra* pubic pain, or burning sensation at micturition. The time to ambulation was defined as the period between the end of surgery and the time when the patient first walked supported by a nurse or relative. The length of hospital stay was defined as the time between the end of surgery and hospital discharge [14].

Gathered data were processed using SPSS version 17 (SPSS Inc, Chicago, IL, USA). Quantitative data were expressed as mean \pm SD while qualitative data were expressed as numbers and percentages (%). Student's *t*-test and the *F*-test were used to test the significant difference for quantitative variables while the chi-square and Fisher's exact tests were used to test the significance for qualitative variables. A probability value (*p*-value) $<$.05 was considered statistically significant.

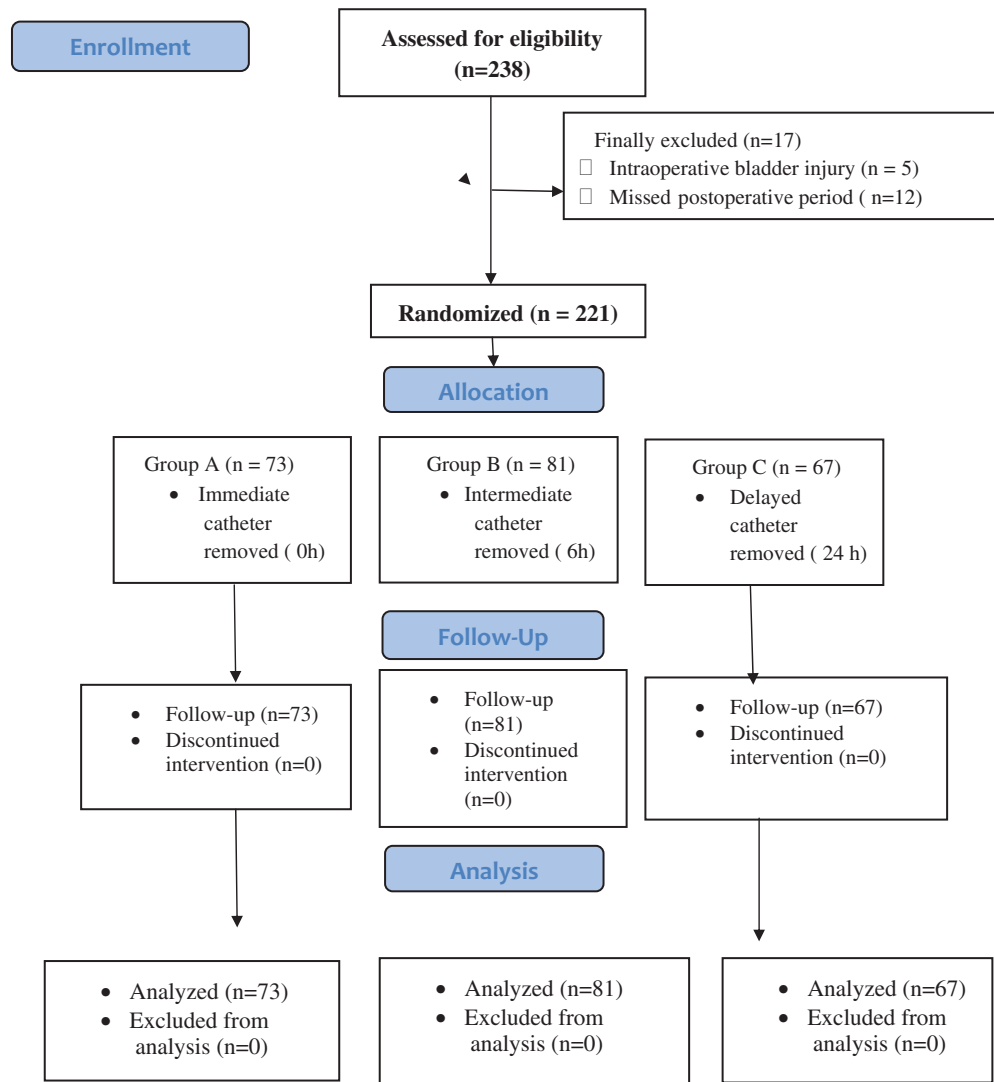


Figure 1. Consort flow chart.

Results

Baseline maternal characteristics at cesarean delivery in all groups are presented in Table 1. All groups were matched regarding maternal age, body mass index (BMI), gestational age at delivery, duration of surgery, and indications for CS. Of note, the most common indication for CS was found to be previous CS, which was the indication for more than half of all patients (53.4, 59.3, and 53.8% in groups A, B, and C, respectively) (Table 1).

The main outcome measures of the study are presented in Table 2. Regarding the incidence of urinary retention and recatheterization, patients in group A showed significantly higher occurrence when compared to patients in groups B and C (13.6 vs. 2.5% and 0%, respectively). However, 13.4% of the studied patients in group C had symptoms suggestive of UTI as opposed to only 1.4% and 3.7% of patients in

groups A and B, respectively (p -value = .005). Also, cultures of urine samples received one day after catheter removal showed that 11.9% of patients in group C had positive cultures versus 1.4% of patients in group A and 3.7% of patients in group B. It was found that patients in group C had prolonged hospital stay with a mean duration of 3.9 days, which is significantly longer than the other two groups (1.9 and 2.4 days in groups A and B, respectively). Also, it was observed that patients in group C had delayed first ambulation time (10.3 vs. 4.1 h in group A and 6.8 h in group B) (p -value = .001).

One week after removal of the catheter, it was found that 18–24% of patients in group C had symptomatic lower UTI (dysuria, frequency, and urgency) while 2.9% of the same group had symptoms suggestive of nephritis (fever and loin pain), whereas in groups A and B only two and three patients (1.4% and

Table 1. Baseline characteristics of the study groups.

	Group A (n = 73)		Group B (n = 81)		Group C (n = 67)		p-Value
Age (years)							
Mean ± SD	26.1 ± 4		25.3 ± 2		25.6 ± 3		.6 (NS)
BMI (kg/m ²)							
Mean ± SD	29.5 ± 2.9		29.4 ± 2.7		30.1 ± 3.5		.2 (NS)
Gestational age (weeks)							
Mean ± SD	38.9 ± 1.1		38.2 ± 1.6		38.3 ± 1.4		.5 (NS)
Indications for CS							
Previous CS	39	53.4%	48	59.3%	36	53.8%	.6 (NS)
CPD	19	26.2%	16	19.7%	13	19.4%	
Mal-presentation	8	10.9%	9	11.1%	9	13.4%	
Maternal request	7	9.5%	8	9.9%	9	13.4%	
Duration of operation (min)							
Mean ± SD	45.36 ± 15.3		43.91 ± 13.9		48.48 ± 12.4		.8 (NS)

NS: no statistically significant difference; BMI: body mass index; CS: cesarean section; CPD: cephalo-pelvic disproportion.

Table 2. Main outcome measures of the study groups.

	Group A (n = 73)		Group B (n = 81)		Group C (n = 67)		p-Value
Urine retention and recatheterization	12	13.6% ^b	2	2.5%	0	0%	.001 ^a
Symptomatic UTI	1	1.4%	3	3.7%	9 ^b	13.4%	.005 ^a
Postoperative urine culture							
Negative	72	98.6%	78	96.3%	59 ^b	88.1%	.001 ^a
Positive	1	1.4%	3	3.7%	8	11.9%	
First ambulation (h)							
Mean ± SD	4.1 ± 1.8		6.8 ± 1.7 ^b		10.3 ± 2.5 ^b		.001 ^a
Hospital stay (days)							
Mean ± SD	1.9 ± 1.4		2.4 ± 1.3		3.9 ± 1.1 ^b		.01 ^a

^aStatistically significant difference among three groups.

^bStatistically significant difference versus other two groups.

Table 3. Urinary symptoms and urine culture 1 week after CS.

	Group A (n = 73)		Group B (n = 81)		Group C (n = 67)		p-Value
Symptoms							
Fever	0	0%	0	0%	2	2.9%	.09 (NS)
Dysuria	0	0%	1	1.2%	12	17.9% ^b	.001 ^a
Frequency	1	1.4%	1	1.2%	16	23.8% ^b	.002 ^a
Urgency	1	1.4%	1	1.2%	13	19.4% ^b	.001 ^a
Loin pain	0	0%	0	0%	2	2.9%	.09 (NS)
Postoperative urine culture							
Negative	73	100%	81	100%	55	82.1% ^b	.001 ^a
Positive	0	0%	0	0%	12	17.9%	

NS: No statistically significant difference.

^aStatistically significant difference among three groups.

^bStatistically significant difference versus other two groups.

1.2%, respectively) showed symptoms suggestive of lower urinary tract infection. Regarding the culture results, about 18% of patients in group C had positive cultures versus none of patients either in group A or B (Table 3).

Discussion

To the best of our knowledge, this study is the first trial to assess timing of urinary catheter removal after elective CS by comparing three different regimens either immediate (0 h), intermediate (6 h), or delayed (24 h) removal of an indwelling catheter regarding the

rate of recatheterization due to urinary retention, rate of symptomatic urinary tract infections, time of ambulation, and the length of hospital stay. Most, if not all previous trials compared immediate versus delayed urinary catheter removal after CS [7–9].

Our study shows that removal of the urinary catheter 6 h after CS is associated with low rates of urinary retention (2.5%). However, there was a high rate of recatheterization due to temporary urinary retention observed in the group with early catheter removal (13.6%), a finding not observed in the delayed removal group. In agreement with our results; Alessandri and his group found higher rates of

recatheterization in cases of immediate removal of catheter while none of the delayed cases was recatheterized [14]. Also, Chai and Pun confirmed that finding, however, was not significantly different, as the sample size in their study was small [15]. However, El-Mazny et al. did not find any significant differences between immediate or delayed urinary catheter removals regarding the rate of urinary retention necessitating recatheterization [7].

A lower incidence of urinary tract infections was observed in cases that underwent immediate (1.4%) or intermediate (3.7%) removal of the catheter in comparison to the delayed removal group (12%). One week later, the delayed removal group had significantly higher rates of lower UTI symptoms with 18% of positive urinary cultures; hence—concurrent with our results—many studies demonstrated that prolonged postoperative catheterization was considered the main triggering factor for UTI [1,9,15]. El-Mazny et al. in their study comparing immediate and 12-h postoperative removal of urinary catheter after elective cesarean section found that lower significant incidence of postoperative bacteruria, dysuria, urinary frequency, and urgency in the immediate group when compared with delayed removal group [7]. However, Onile and his group found a nonsignificant lower incidence of positive urine culture postoperatively for women in the immediate removal group compared with those delayed removal after 24 h [8]. A Foley catheter in the bladder acts as a foreign body in a moist environment which enhances colonization of biofilm microorganisms that have the great ability to resist antimicrobial agents. This means that urinary catheter cannot usually be cleared of a pathogenic biofilm without removing the catheter [16].

Interestingly, ambulation time and hospital stay were found to be correlated to the timing of urinary catheter removal, as the delayed catheter removal group had a prolonged time of ambulation and hospital stay in comparison to the other groups. The prolonged hospital stay could be explained by the presence of symptomatic UTI and positive urinary culture cases which necessitated lengthy in patients with antibiotic treatment. In agreement with our results, some studies demonstrated that finding [1,7].

In conclusion, early removal of the catheter had an increased risk of temporary urinary retention and recatheterization; but a lower incidence of urinary tract infection, earlier ambulation, and shorter hospital stay. On the other hand, delayed urinary catheter removal was associated with higher incidence of urinary tract infection, delayed ambulation and longer hospital stay

but without urinary retention. Interestingly, intermediate urinary catheter removal just 6 h after surgery appears to be more advantageous than early or late catheter removal in all study outcomes. So, removal of urinary catheter 6 h after elective CS is highly recommended as it is associated with lower risk of urinary tract infection and patients' morbidities.

The relatively small sample size in this study population is the main study limitation. Hence, larger scale multicenter studies addressing that limitation are recommended.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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