AMJ
ISSN: 0005-2523

ISSN: 0005-2523
Volume 63, Issue 05, May, 2023

EVALUATION OF URINE CULTURE BEFORE AND AFTER CATHETER INSERTION IN ELECTIVE AND EMERGENCY CAESAREAN SECTION

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Keywords:
Catheter-Associated Urinary Tract Infection (CAUTI), Urine Culture, Catheter Insertion, Elective Cesarean Section, and Emergency.

ABSTRACT

Indwelling urinary catheterization is a routine procedure before a cesarean section. The catheterization can cause bacterial colonization of the urine and cause urinary tract infections. Catheter-Associated Urinary Tract Infection (CAUTI) is the cause of 40% of all nosocomial infections worldwide. This study is an analytic study with a cross-sectional design at *Khadijah* Hospital and *Fatimah* Hospital in Makassar City. Urine culture examination was performed on 99 patients who were going to undergo elective and emergency cesarean sections before and after catheter insertion in cesarean section procedures. Data were analyzed using the Chi-square test, Mc Nemar, Mann-Whitney test, and t-independent test. The study showed that urinary bacterial colonies before catheterization were found in 18.60% of elective cesarean section patients compared to only 10.71% after catheter insertion. The urinary bacterial colonies before catheterization in 2.33% of emergency cesarean section patients were 14.29% compared to after the catheterization. There was a significant difference in the results of urinary bacterial colonies before and after catheterization in patients with elective cesarean section with a p-value was < 0.05. However, there was no significant difference in the results of bacterial colonies in the urine between pre and post-catheterization in patients with an emergency cesarean section and a value of $p > 0.05$. There was a change in urine culture before and after catheterization, more colony growth was found in an elective cesarean section than in an emergency cesarean section, and bacterial colony growth was also more common preoperatively than postoperatively.

1. Introduction

The installation of an indwelling urinary catheter before carrying out a cesarean section (SC) operation is one of the routine preparations before the surgery is carried out. This is done to reduce the risk of intraoperative injury to the bladder during an SC operation. It is also expected to be an assessment of urine output and can prevent postoperative urinary retention [1].

Catheterization has been associated specifically with the occurrence of urinary tract infections (UTIs). The use of a urinary catheter for more than 48 hours will increase the occurrence of bacterial colonization which will cause bacteriuria up to 85%. Catheterization before and during a CS operation has symptomatic symptoms of bacteriuria that can occur in 15 to 25% of pregnant women [2].

Catheter use related to urinary tract infection or Catheter-Associated Urinary Tract Infection (CAUTI) is one of the most common nosocomial infections worldwide. Approximately 80% of the infection is caused by patient catheterization which causes increased morbidity and affects the length of patient care in the hospital [3].

Furthermore, antibiotics can be given to patients who use a catheter with symptoms of postoperative fever and have signs and symptoms of urinary tract infections. In routine urine examination and urine culture in patients, infections from Escherichia Coli, Acinetobacter anitratus, Enterobacter sps, Pseudomonas aeruginosa, Staphylococcus aureus, and Citrobacter sps are often found [4].

Thus far, studies related to the relationship between the urine culture of SC patients and rational antibiotic administration have not been available. Therefore, researchers are interested in investigating the comparisons of urine culture before and after catheter insertion or catheterization in elective and emergency SC patients.

2. Methods

This study is an analytical cross-sectional study that aims to compare the results of urine culture in patients undergoing elective and emergency CS. The research was conducted at *Khadijah* Hospital and *Fatimah* Hospital, Makassar City for 6 months, i.e.: from January to June 2022. The number of samples was obtained using the consecutive sampling method. The population of this study was all pregnant women who met the inclusion and exclusion criteria. Besides, they underwent SC surgery and had signed an informed consent to participate in the study. The inclusion criteria are (1) willingness to participate in research activities by signing a consent form; (2) pregnant women who will undergo SC operations; (3) The patients' consciousness and living fetuses. While the exclusion criteria are (1) consuming antibiotics, prebiotics, and/or synbiotics within the last thirty days; (2) having a history of urinary tract infection in the last thirty days; (3) having kidney disorders or other disorders of the urinary tract; (4) Patients who participated in the study but experienced atonia or postpartum hemorrhage; (5) patients who participated in the study but were under postoperative supervision, the general condition of the patient was unstable or was declared dead.

Primary data are in the form of questionnaire results, results of physical examination, and laboratory examination in the form of urine culture. Before this research was conducted, the researchers requested ethical clearance from the biomedical research ethics committee at the Faculty of Medicine, University of Hasanuddin Makassar. The researchers began this research by explaining the research procedure, identity, history, and physical examination to all the pregnant women who will undergo CS. If a patient meets the inclusion and exclusion criteria and is willing to participate in the study, the patient/guardian is asked to sign a consent form. Before the catheter was placed as part of the preoperative preparation procedure, 5 cc

ISSN: 0005-2523
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of midstream urine was collected. The pre-action urine sample was sent to the laboratory for urine culture examination. The catheterization procedures used standard operating procedures. The catheter was removed within 24 hours after surgery. When the catheter is released, 5 cc of midstream urine was taken again. It was also sent to the laboratory for urine culture examination.

The results of post-action urine culture were recorded and analyzed using the Chi-Square test, which is a statistical method used to see the significance and relationship between unpaired categorical variables in the 2 x 2 table. If the Chi-Square test conditions are not met, the alternative test is Fisher's test. The p-values between elective and emergency CS surgeries were recorded; p-value ≤ 0.05 means there is a significant difference, and p-value > 0.05 means there is no significant difference between the two treatment groups. In this study, the independent T-test was also used to compare the means of the two independent sample groups. The Mann-Whitney test was also used where this test is a non-parametric test to compare two samples that are the same and ordinal. McNemar's test was used to test the difference in the proportion of two populations that are related and only have two categories.

Data on the types of bacteria on positive urine culture results after SC surgery are descriptively grouped in tables. The number of bacterial colonies was also recorded and grouped into 2 groups, namely significant bacteriuria if the bacterial colonies were $\geq$ 105 CFU/ml, and insignificant bacteriuria if the bacterial colonies were $<$ 105 CFU/ml. Types of antibiotics that are sensitive and resistant according to the type of bacteria were found. Then an appropriate statistical test was carried out to see the significance between the two operating groups.

3. Results

Characteristics of the Research Sample

In this study, 99 pregnant women who underwent elective and emergency CS were observed by comparing the results of their mid-portion urine culture before and after urinary catheterization. Table 1 shows the characteristics of the sample of this study. Based on the type of SC performed, 43 people belonged to elective SC, while 56 belonged to emergency SC. The majority of the sample did not work, namely 88 people (88.9%). There were 3 people (3.0%) who are twins as an indication of SC. Most of the patients, 60 people (60.6%), had abdominal pain and backache as signs of their labor. Furthermore, 66 people (66.7%) of the patients had no history of previous SC surgery. Regarding UTIs, 93 people (93.9%) of the patients had never experienced it. Also, there was no history of catheterization in 72 people (72.7%). The history of previous catheterization in both the elective and emergency SC groups was 28 people (65.1%) in elective SC and 44 people (78.6%) in emergency CS. It means there was no significant difference between the two groups ($p > 0.05$). Gram-Positive Bacteria 8 (18.6) was the most common type of bacteria found in elective surgery before surgery. The number of colonies found in the sample before elective SC was 35 people with a colony count of $<$ 100 CFU/ml, and in the emergency SC, there were 8 people with $>$ 100 CFU/ml. Whereas for the sample after elective SC surgery, there were 50 people with $<$ 100 CFU/ml, and 6 people with $>$100 CFU/ml. It means there was no significant difference ($p > 0.05$).

Table 1. The Sample Characteristics

Variables	N (%) Mean ± SD	Types of Sectio *Caesarea*		p
		Elective	Emergency	
Marriage age (years)	22.68 ± 4.38	22.95 ± 4.90	22.46 ± 3.96	[a]0.584
SC Duration (minutes)	61.41 ± 7.56	61.86 ± 9.58	61.07 ± 5.62	[b]0.788
Length of Marriage (years)	6.47 ± 5.79	7.21 ± 6.34	5.91 ± 5.32	[b]0.312
Occupations				

employed	11 (11.1)	8 (18.6)	3 (5.4)	[c]0.053
unemployed	88 (88.9)	35 (81.4)	53 (94.6)	
Education				
< Senior High School level	20 (20.2)	7 (16.3)	13 (23.2)	[c]0.549
≥ Senior High School level	79 (79.8)	36 (83.7)	43 (76.8)	
Twins				
Yes	3 (3.0)	0 (0)	3 (5.4)	[c]0.255
No	96 (97.0)	43 (100)	53 (94.6)	
Labor Complaint				
Yes	60 (60.6)	20 (46.5)	40 (71.4)	**[c]0.021**
No	39 (39.4)	23 (53.5)	16 (28.6)	
Diseases				
Yes	8 (8.1)	2 (4.7)	6 (10.7)	[c]0.460
No	91 (91.9)	41 (95.3)	50 (89.3)	
Medical Surgery Records				
Yes	33 (33.3)	21 (48.8)	12 (21.4)	**[c]0.008**
No	66 (66.7)	22 (51.2)	44 (78.6)	
Familial Diseases				
Yes	5 (5.1)	3 (7.0)	2 (3.6)	[c]0.650
No	94 (94.9)	40 (93.0)	54 (96.4)	
Urinary Tract Infection Records				
Yes	6 (6.1)	1 (2.3)	5 (8.9)	[c]0.229
No	93 (93.9)	42 (97.7)	51 (91.1)	
Catheterization Records				
Yes	27 (27.3)	15 (34.9)	12 (21.4)	[c]0.207
No	72 (72.7)	28 (65.1)	44 (78.6)	
Waters Breaking				
Yes	15 (15.2)	1 (2.3)	14 (25.0)	**[c]0.005**
No	84 (84.8)	42 (97.7)	42 (75.0)	
Frequency of Marriage				
Once	93 (93.9)	40 (93.0)	53 (94.6)	[c]1.000
> Once	6 (6.1)	3 (7.0)	3 (5.4)	
Parity of Pregnancy				
Primigravida	32 (32.3)	12 (27.9)	20 (35.7)	[c]0.544
Multigravida	67 (67.7)	31 (72.1)	36 (64.3)	
Preoperative Bacteria				
Gram-Positive Bacteria	12 (12.1)	8 (18.6)	4 (7.1)	
Gram-Negative Bacteria	2 (2.0)	0 (0.0)	2 (3.6)	[c]0.114
TAP	85 (85.9)	35 (81.4)	50 (89.3)	
Postoperative Bacteria				
Gram-Positive Bacteria	7 (7.1)	0 (0.0)	7 (12.5)	
Gram-Negative Bacteria	2 (2.0)	1(2.3)	1 (2.3)	**[c]0.055**
TAP	90 (90.9)	42 (97.7)	48 (85.7)	
Preoperative Colony				
<100 CFU/ml	85 (85.9)	35 (81.4)	50 (85.9)	
>100 CFU/ml	14 (14.1)	8 (18.6)	6 (10.7)	[c]0.409
Postoperative Colony				
<100 CFU/ml	90 (90.9)	42 (97.7)	48 (85.7)	
>100 CFU/ml	9 (9.1)	1 (2.3)	8 (14.3)	[c]0.073
Total	**99 (100)**	**43 (100)**	**56 (100)**	

[a]T-independet test; [b]Mann Whitney test; [a]Chi-Square test; p < 0,05

Factor Analysis Associated with the Type of SC Performed

Table 2 shows an analysis of risk factors in the form of average age at marriage, duration of CS, and length of marriage related to the type of CS performed. At the age of marriage, the mean of patients who underwent elective SC was 22.95 ± 4.90 years, while at the emergency CS was 22.46 ± 3.96 years. The results showed that there was no significant difference between the two groups (p > 0.05). Regarding the duration of SC, the average number of patients who underwent elective SC was 61.86 ± 9.58 minutes starting from 60 to 120 minutes, while the emergency CS was 61.07 ± 5.62 minutes starting from 60 to 90 minutes. The results showed that there was no significant difference between the two groups (p > 0.05). In addition, in the analysis of the length of the marriage, the mean of patients who underwent elective CS was 7.21 ± 6.34 years starting from 0 to 26 years, while emergency CS was 5.91 ± 5.32 years from 0 to 23 years. The results showed that there was no significant difference between the two groups (p > 0.05).

Table 2. Analysis of the Mean Factors Associated with the Type of SC performed.

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Variables	Types of Sectio *Caesarea* Mean ± SD (Min-Max)		p
	Elective	Emergency	
Marriage Age	22.95 ± 4.90 (15 – 41)	22.46 ± 3.96 (14 – 32)	[a]0.584
SC Duration	61.86 ± 9.58 (60 – 120)	61.07 ± 5.62 (60 – 90)	[b]0.788
Length of Marriage	7.21 ± 6.34 (0 – 26)	5.91 ± 5.32 (0 – 23)	[b]0.312

[a]T-independet test; [b]Mann Whitney test, p<0,05

Comparative Analysis of Bacterial Growth in Urine Culture Before and After Catheterization between Elective and Emergency SC Groups

Table 3 shows a comparison of urine culture before and after catheterization between the elective and emergency SC groups. Of the 8 samples in the elective SC group, growth of pre-catheter bacterial colonies was found, while there was only 1 sample found in post-catheterization. Furthermore, pre-catheter bacterial colonial growth was not found in 35 samples. Besides, post-catheter growth was not found in all of the samples, where there was a significant difference between the two groups ($p < 0.05$). Growth of pre-catheter bacterial colonies was found in 6 samples in the emergency SC, while the growth of post-catheter bacterial colonies was found only in 2 samples. Next, growth of pre-catheter bacterial colonies was not found in 50 samples, while no post-catheter growth was found in 44 samples where there was no significant difference between the two groups ($p > 0.05$). From a total of 3 samples, growth of bacterial colonies on the post-catheter was found in 2 samples of emergency SC and 1 sample was in elective SC. There were no post-catheter bacterial colonies found in 79 samples which consisted of 44 emergency SC samples and 35 elective SC samples. No growth of bacterial colonies was found in each of the pre-catheter where there was no significant difference between the two groups ($p > 0.05$).

Table 3. Comparison of Bacterial Growth in Urine Culture before and after Catheterization between the Elective and Emergency SC Groups.

Types of Sectio *Caesarea*	Pre-Catheterization	Post- Catheterization		Total	p
		Yes	No		
Elective	**Yes**	1	7	8	**[a]0.016**
	No	0	35	35	
Emergency	**Yes**	2	4	6	[a]0.754
	No	6	44	50	
Total	**Yes**	3	11	14	[a]0.332
	No	6	79	85	

[a] Mc Nemar Test, p<0,05

Comparative Analysis of Bacterial Growth in Urine Culture before and after Catheterization Based on Risk Factors

Table 4 shows a comparison of urine culture in which there was growth before and after catheterization on marital status, complaints, surgical records, and water breaking. Bacterial growth was found in 10 samples

with complaints and 8 samples in post-catheterization. However, in the samples with no complaints, there were 4 samples of colony growth before catheterization and 1 sample after catheterization where there was no significant difference ($p > 0.05$). Whereas for samples with surgery records, 7 samples of colony growth were found before catheterization and 2 samples after the catheter was released. In samples without surgery records, 7 samples of colony growth were obtained before catheterization and 7 after catheter removal. The results showed that all of the aforementioned samples were not significantly different ($p > 0.05$). In samples with water breaking, 3 colony growths were obtained before catheterization and 1 sample was found after catheter removal. In samples with no records of water breaking, 11 samples of colony growth were obtained before catheterization and 8 samples after the catheter removal. All of them have no significant difference ($p > 0.05$).

Table 4. Comparison of Bacterial Growth in Urine Culture before and after Catheterization based on Risk Factors.

		Bacterial Growth		p-value
		Pre-Catheterization	Post-Catheterization	
Complaint	Yes	10	8	0,774
	No	4	1	0,375
Surgical Records	Yes	7	2	0,125
	No	7	7	1,000
Water Breaking	Yes	3	1	0,500
	No	11	8	0,607

*Mc Nemar Test, $p < 0,05$

4. Discussion

In this study, 99 samples met the inclusion and exclusion criteria for elective and emergency SC surgery (43 elective SC samples and 56 emergency SC samples) and would be assessed for mid-portion urine culture both before and after catheterization. The use of an empirical urinary catheter is generally carried out during SC deliveries because it is believed to increase the exposure of the lower uterine segment during surgery, prevent bladder injury, and avoid postoperative urinary retention. Unfortunately, the use of indwelling urinary catheters has been implicated as a major cause of urinary tract contamination which occurs in 1.7 per 1000 CS patients and accounts for more than 80% of UTIs and greater postoperative pain [5].

The birth rate conducted by CS was reported to be over 1 million in 2014 in the United States [6]. Catheteter-Associated Urinary Tract Infection (CAUTI) remains a significant problem contributing to approximately 20% of hospital-acquired bacteremia [7] There is currently no consensus regarding the specific time to remove the urinary catheter after CS operations. The longer the duration of the catheter, the higher the significant bacteriuria rate and the lower the incidence of urinary retention after CS operations. So it is necessary to find a balance in the duration of urethral catheterization which will give a reduced rate of bacteriuria and reduce the incidence of urinary retention [8], [9].

This study showed that the incidence of post-catheter urinary tract infections was very low, namely 8 samples. Furthermore, 3 of them had a UTI detected before inserting a preoperative catheter, while 5 new samples (6%) were found after inserting a postoperative catheter. In this study, there was a decrease in the incidence after surgery due to the administration of antibiotics after the procedure. Besides, the examination of samples was carried out 24 hours after the catheter was released (after the patient received antibiotics 2 times) [10].

ISSN: 0005-2523
Volume 63, Issue 05, May, 2023

Of the 6 samples taken by emergency SC, urine culture results showed various pathogens ranging from *Staphylococcus haemolyticus* in 3 samples, *Enterococcus faecalis* in 2 samples, and *Staphylococcus warneri* in 1 sample. This is consistent with the previous studies which showed that the most common organisms causing nosocomial UTIs were *Escherichia coli* and *Enterococcus faecalis* [11]. *Enterococcus faecalis* causes strong infections of the bladder through the catheter, kidney, and the catheter itself, where these bacteria form biofilms that facilitate persistent infection to overcome the effects of inflammation. In one study, the rate of catheter-induced UTI after CS operations was low, while further prospective or randomized trials are needed to assess the usefulness of the practice of catheterization after CS operations where delayed catheterization would be beneficial in patients at high risk of UTI [12].

The length of hospital stay was also shorter in the non-catheter group. The catheterized group had a longer hospital stay due to postoperative urinary tract infection and fever. Similar results were seen in several studies in which the reason for prolonging hospitalization was postoperative morbidity due to catheter use [13- 15]. In this study, all samples that underwent elective and emergency SC procedures used catheters because in Indonesia, especially in South Sulawesi, they still believe that the use of intraoperative catheters is more specific to patient ambulation and the patient's comfort. Besides, it is also used to measure incoming fluid and how much fluid is flowing out, both intraoperatively and postoperatively.

In this study, 9 cases of colony growth were found in samples with one time-marriage before and after catheterization. This is quite the opposite because patients with a history of getting married more than once or with a sexual history with more than one partner are more likely to have an increased risk factor for UTI. Therefore, colony growth was possibly found in samples with one-time time marriage which could be due to a history of frequent sexual intercourse. [16] study showed various risk factors for recurrent UTI and pyelonephritis in the sample. One of which was the frequency of sexual intercourse that can increase the risk of UTI where the OR (odd ratio) ranged from 1.5 to 6. Colony growth was found in 427 (99.8%) samples who had sexual intercourse compared to controls with a risk of 27 times having a recurrent UTI ($p < 0.001$, OR = 27.8).

Several studies showed that the effect of vaginal toucher can cause UTIs that occurred up to 6 to 7 weeks later. From the pelvic examination, microtrauma and bacterial inoculation occurred during sexual intercourse. Sexually active patients usually have repeated sexual intercourse. However, this study did not compare the frequency of sexual intercourse with the occurrence of UTIs. Recent studies have shown that infection with ascending *Escherichia coli* causes initial superficial colonization of the epithelium and bacteriuria which is often cured by the immune system. However, persistent colonization of the bladder epithelium may persist for weeks without detectable bacteriuria and may precipitate UTIs later in life. Although the number of vaginal toucher and pelvic bimanual examinations such as inspection can lead to increased exposure to pathogens, it was not included as a sample characteristic for UTI occurrence.

The wound healing process is one of the most complex human physiological processes. Healing of old surgical wounds, commonly called surgical wound infections, are infections that often occur in postoperative patients. Meanwhile, in the research sample, we always provide education to carry out early mobilization as soon as possible in stages, and for the nutrition itself, we educate patients to consume soft foods first, have sufficient nutrition, consume fibrous foods, and maintain hygiene.

More colony growth was found in samples with a history of water breaking than in samples without a history of water breaking. This was because they received previous antibiotic therapy. Therefore, the use of a catheter increased the risk of CAUTI which prolonged morbidity and mortality in postoperative SC

samples. Many studies have shown that the routine use of an indwelling urinary catheter for CS delivery in hemodynamically stable patients is unnecessary. The CAUTI rates showed that there was no significant difference between elective and emergency SC. However, better and larger randomized trial studies are needed to confirm these findings.

There are some limitations of this study such as a comparison of urine culture before and after catheterization in patients with cesarean section. As a result, much bacterial growth was not found. Thus, it can be concluded that giving antibiotics after surgery should be minimized because not all catheterizations lead to the growth of bacteria which can lead to urinary tract infections. This is also an advantage of research. Another drawback of this study is that it did not compare catheter removal between 4 hours, 6 hours, and 8 hours postoperatively. Consequently, it cannot be compared to the growth of any colonies found with differences in the time of catheter removal.

5. Conclusion

Based on the results of this study, it can be concluded that there was a change in urine culture before and after catheterization. Meanwhile, more colony growth was found in elective cesarean section than in emergencies. Postoperative SC antibiotics also need to be reconsidered. Catheterization had better follow the available SOP (Standard Operating Procedures) because it is a major concern in disease prevention. Before inserting the catheter, patients are recommended to clean their vaginas first.

6. Acknowledgment

All authors contributed to the processes of this research, including preparation, data collection, analysis, drafting, and approval for publication of this manuscript.

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