POSITIVE BACTERIAL CULTURE RATE FROM URINE SPECIMEN AND CATHETER SWAB IN INDWELLING CATHETER PATIENTS IS NOT DIFFERENT

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ABSTRACT

Objective: *To study the difference between urinary culture before and after indwelling catheter insertion and also the difference in positive bacterial culture rate between urine and catheter swab at the 7th and 14th days.* ***Material & method:*** *The subject of this study were patients who used indwelling catheters in urology outpatient department. The sample was allocated into two groups of 10 patients each, the 7 and 14 days group. Sterile urine is good initial check before catheter insertion. After 7 and 14 days of catheterisation respectively, urine and intraluminal catheter swab were performed at removal. All samples were examined in the Microbiology Department using McConkey and Nutrient agar (Mayo technique T/T33). After 24 hours incubation, bacterial colonies were identified.* ***Results:*** *All urinary cultures obtained before the study were sterile, after 7 days catheter insertion two cultures (20%) remained negative and the remainder (80%) became positive. McNemar test result was 0,008 (p<0,05). In 14 days group after catheter insertion only one (10%) remained negative while 9 others were positive for bacteria. Mcnemar test shows 0,004 (p<0,05). The urinary and catheter swab culture is not significantly different in 7 days of indwelling catheterization patients (0,500; p>0,05) nor in the 14 days patients (1,000, p>0,005). While the catheter swab culture is significantly positive after administering the urinary catheter in 7 and 14 days of catheterization (0,002; p<0,05).* ***Conclusion:*** *There was significant difference in urinary culture positive rate before and after catheter insertion in 7th and 14th day. Bacteriuria rose sharply after urinary catheter insertion despite aseptic procedure. There was no difference in culture positive rate between urine and catheter swab at 7th day as well as 14th day.*

Keywords: *Bacterial positive rate, indwelling catheter, urine culture, swab catheter.*

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INTRODUCTION

Urinary tract infection (UTI) is a common occurence in daily practice and is the most prevalent nosocomial infection comprising 40% of all hospital acquired infections in more than 1 million persons per year.[1,2] Several studies reported 80% of nosocomial UTI occurred after urinary tract instrumentation, chiefly catheterisation.[3] Since more than 25% of inpatients had urethral catheters, UTI prevention is the main factor in reducing nosocomial infections.[1,4,5] Data from Surabaya found nosocomial infections in 27,5% of 80 patients with indwelling catheters.[6]

Urinary diversion is a common indication for catheterisation. Aseptic technique is an absolute prerequisite for infection prevention. Neither aseptic technique nor chemoprophylaxis eliminates probability of infection.[7] Although closed system drainage and aseptic technique reduces incidence of catheter-related UTI, 48% of inpatients with catheters are at risk for infection.[8] Bacteriuria due to indwelling catheters are frequent with an incidence of 3-10% per day.[9] Most UTIs associated with catheterisation are asymptomatic. Only 10-30% of patients with temporary catheter infection show signs of acute infection.[10,11] Fever was only found in

less than 10% of UTI cases due to indwelling catheter, and only 2% had temperature higher than 38ºC.[12]

Latex or siliconized latex foley catheter should be replaced every 2 weeks.[13] Latex catheters are appropriate for short term catheterisation of 10-14 days because potential allergic reaction, irritation of urinary tract mucosa, encrustation, water absorbtion and potential luminal narrowing.[14-16]

Data from Department of Clinical Microbiology of Dr. Soetomo Hospital Surabaya showed that bacteria most often found in urinary isolates were *Escherichia coli, Klebsiella spp, Pseudomonas, Acinetobacter, Proteus, Enterobacter.*[17] Bacteria may adhere to luminal catheter surface together with production of mucoid biofilm which are predisposing factors for UTI.[18]

Bacteria can colonize intraluminal catheter surface despite previous sterile urine and increase urinary density. This shows that with time bacteria may cause UTI.[19] Studies reported that bacteria isolated in urine samples were different from ureteric stent surfaces. Despite absence of stent surface bacteria in urine, fever may occur upon removal of stent.[20]

UTI due to catheter insertion is a common nosocomial infection often resistent to antibiotic therapy. Resistance may be caused by biofilms produced by bacteria on urinary catheter surfaces. Biofilm bacteria is strongly resistent to antibiotics and subsequently difficult to eradicate.[19] Administration of systemic antibiotics may decrease incidence of bacteriuria in short term catheterisation, after 3-4 days incidence of bacteriuria becomes similar regardless of antibiotic administration.[21]

Current diagnosis of UTI is only based on urinary culture, although catheter swab cultures may identify different bacteria and colony counts which may contribute to incidence of UTI. Significance of catheter colonizing bacteria has not yet been studied. Studies comparing positive culture rate of urine and catheter are not reported, therefore this study may provide data on importance of catheter culture in predicting UTI in patients with indwelling catheters.

OBJECTIVE

To demonstrate difference in bacterial isolate and positive rate of urine culture and catheter swab culture in patients with indwelling catheter after 7 and 14 days.

MATERIAL & METHOD

This was a prospective observational analytical study. Study sample were all patients with indwelling catheters and appropriate indications visiting Urology Outpatient Clinic of Dr. Soetomo Hospital. The study enrolled 20 patients allocated in 2 groups, 7 and 14 days catheterisation, respectively.

Urine sample were collected by clamping between catheter and drainage bag, catheter was disinfected with 70% alcohol 5 cm proximal to catheter junction, 5 cc of urine was aspirated from the tube with 20 cc sterile syringe in an aseptic manner. Urine was immediately sent to laboratorium, in case of delayed delivery urine was stored at 4°C for not more than 24 hours. Urine was put in a vertex and calibrated by loop (1 loop eyelet = 0.01 ml sample), cultured on McConkey and nutrient media with Mayo technique (T/T^{33} pattern). After 24 hours incubation, identification and colony counts were performed as standard procedure.

Catheter samples were taken from intraluminal catheter tip, which was constantly exposed to urine. Outer surface of catheter was not selected as detection location because of possibility of urethral bacterial contamination upon catheter removal. Catheter culture was performed on removal on 7^{th} and 14^{th} day after catheterisation. Sample was taken from intraluminal catheter tip using, a sterile swab was applied three times in a circular manner clockwise and counterclockwise. Swab tip was immediately inserted in 5 cc BHI Broth liquid culture medium, homogenised in vertex and calibrated with loop (1 loop eyelet = 0.01 ml sample) cultured on McConkey and nutrient media with Mayo technique (T/T^{33} pattern). After 24 hours incubation, identification and colony counts were performed as standard procedure.

Figure 1. Kultur swab dan collection transport anaerob.

Descriptive and inferential analysis was performed. Descriptive analysis was performed on bacteria species identified. Inferential analysis was

performed with t test and McNemar to evaluate difference in urine culture before and after catheterisation, using Chi Square. Significance level utilised at 0,05.

RESULTS

In patients inserted catheter for 7 days, youngest subject age was 52 years, eldest was 70 years. Mean age was 64,8 years ± 6,16. In patients with 14 days catheter, youngest subject age was 50 years and eldest was 78 years. Mean age was 66,7 ± 8,64. Chi square test showed no significant difference between the groups ($p>0.05$), therefore age between both groups was homogeneous.

Diagnosis in patients inserted catheter for 7 days mostly were BPH (8 subjects, 80%) and prostate cancer (2 subjects, 20%). All patients in the 14 days group had BPH.

Table 1 showed *E. coli* was more frequent in catheter compared to urine culture, while *Enterobacter aeruginosa* was only isolated in urine. Similar organisms found in urine and catheter was *E. coli* and *Klebsiella pneumonia.*

E coli was found in similar amount on catheter and urine culture results. *Klebsiella pneumoniae* was more prevalent in catheter cultures compared to urine culture. Organism found in similar numbers on catheter and urine cultures were *E. coli* and *Klebsiella pneumonia* (Table 2).

Table 1. Organism type cultured in urine and catheter at 7 days.

Urine organism isolate	7 Days group		Total (%)
	Urine culture (%)	Catheter culture (%)	
E. Coli	5 (38,5)	8 (61,5)	13 (72,2)
Enterobacter aeruginosa	1 (100)	0 (0)	1 (5,6)
Klebsiella pneumoniae	2 (50)	2 (50)	4 (22,2)
Total	8 (80,0)	10 (100,0)	18 (100,0)

Table 2. Organism type cultured in urine and catheter at 14 days.

Urine organism isolate	14 Days group		Total (%)
	Urine culture (%)	Catheter culture (%)	
E. Coli	5 (50,0)	5 (50,0)	10 (53,0)
Enterobacter aeruginosa	0 (0)	0 (0)	0 (0)
Klebsiella pneumoniae	4 (44,4)	5 (55,6)	9 (47,0)
Total	9 (47,0)	10 (53)	19 (100,0)

Table 3. Urine culture at 7 days.

Duration of catheterisation	Initial urine culture	Urine culture results		p
		Negative (%)	Positive (%)	
7 days	Negative	2 (20)	8 (80)	0,008
	Positive	0	0	
	Total	2 (20)	8 (80)	

Table 4. Urine culture at 14 days.

Duration of catheterisation	Initial urine culture	Urine culture results		p
		Negative (%)	Positive (%)	
14 days	Negative	1 (10)	9 (90)	0,004
	Positive	0	0	
	Total	1 (10)	9 (80)	

Urine culture results at 7 days post catheterisation showed all samples were sterile at catheter insertion, and after 7 days catheterisation only 2 patients remained negative (20%), while 8 patients (80%) converted to positive. McNemar test was significant at 0.008 ($p<0,05$), meaning there is significant difference in urine culture before and after catheter insertion (Table 3).

Urine culture results at 14 days catheterisation showed all samples had negative initial urine cultures, and after 14 days catheterisation only 1 subject (10%) remained negative on culture and 9 (90%) patients were positive on urine culture. McNemar test showed significance value of 0,004 ($p<0,05$), showing difference in urine culture before and after catheterisation (Table 4).

Table 5. Results of urine and catheter culture at 7 days.

Urine culture at 7 days	Catheter culture at 7 days		p
	Negative	Positive	
Negative	0	2 (20 %)	
Positive	0	8 (80%)	0,500
Total	0	100 (100%)	

Table 6. Results of urine and catheter culture at 14 days.

Urine culture at 7 days	Catheter culture at 14 days		p
	Negative	Positive	
Negative	0	1 (10 %)	
Positive	0	9 (90%)	1,000
Total	0	100 (100%)	

Cross tabulation (table 5) showed 2 (20%) negative and 8 (80%) bacteria positive cultures in urine culture group, while all results from catheter culture group was positive (100%). McNemar test yielded 0,500 ($p>0,05$) showing no significant difference in urine and catheter culture at 7 days after insertion.

Crosstabulation (Table 6) showed 1 (10%) negative and 9 (90%) bacteria positive urine culture, while all results from catheter culture was positive. McNemar test showed significance of 1,000 ($p>0,05$) showing no difference in urine and catheter culture at 14 days insertion.

At 7 days and 14 days after catheter insertion (Table 7), crosstabulation showed that all samples were negative for bacteria prior to catheter insertion, converted to bacteria positive on all catheter culture results. McNemar test yielded significance of 0,002 ($p>0,05$) showing significant difference on catheter culture before and after 7 days insertion.

DISCUSSION

Diagnoses of patients in this study were benign prostatic hyperplasia (BPH) and prostate cancer with indications for catheterisation. In the 7 days catheterisation groups most patients had BPH (8 subjects) and others had prostate cancer (2 patients), while 14 days catheterisation group were all BPH patients. Prostate disorders in elderly male consists of 80% BPH, 18% prostate cancer, and 2% prostatitis resulting in symptoms of bladder outlet obstruction.[22]

Bacteria found in urine culture results were gram negative rods, *Escherichia coli*, *Enterobacter aeruginosa*, and *Klebsiella pneumonia,* while catheter culture results showed *Escherichia coli* and *Klebsiella pneumonia*. This is consistent with UTI causative organisms, the most prevalent being the gram negative bacteria *Escherichia coli* 85% in the community and 50% in nosocomial population. Other gram negative organisms causing UTI are *Klebsiella pneumonia* and *Proteus sp.*[1]

Table 7. Catheter culture at 7 and 14 days.

Duration of catheterisation	Initial urine culture	Catheter culture results		Total
		(-)	(+)	
7 days	Negative	0	10 (100%)	10 (100%)
	Positive	0	0	0
	Total	0	0	0
14 days	Negative	0	10 (100%)	10 (100%)
	Positive	0	0	0
	Total	0	0	0

Data from Department of Clinical Microbiology Dr. Soetomo Hospital Surabaya showed that the most frequent bacteria found in urine isolates are *Escherichia coli, Klebsiella spp, Pseudomonas, Acinetobacter, Proteus, Enterobacter.*[17] This study also showed that urine and catheter isolates are not always similar, with difference in urine and catheter culture results of 10%, where urine culture found *Enterobacter aeruginosa* and catheter culture showed *Escherichia coli*. A possible explanation is that bacteria colonises from different location, especially at the distal catheter, 5 cm from the distal catheter tip, may be a port of entry for intraluminal bacteria. Percentage of patients with similar organisms isolated from catheter and urine increases with duration of catheterisation.[19]

This study found a significant difference in urine culture results on days 7 and 14 compared to initial sterile culture, with significance of 0,008 and 0,004 ($p<0,005$). Compared to previous literature bacteriuria after indwelling catheterisation bacterial growth occurs within 24 hours and occurs frequently with an incidence of bacterial growth approximately 3-10% per day.[9] Several study reports 80% of nosocomial UTI occurs after prior instrumentation especially catheter insertion.[3] Despite aseptic technique and chemoprophylaxis does not eliminate possibility of infection.[7] Closed system catheter drainage and aseptic technique can decrease incidence of catheter-associated UTI, but 48% of inpatients with catheter is at risk for infection.[8] Urine and catheter culture showed a positive rate of catheter culture higher than urine culture. Meanwhile a negative culture rate (0) is larger in urine culture compared to catheter culture by 100% : 0%.

A study by Matsukawa et al (2005) in 26 patients with bacteria positive urine culture, (96,2%) had positive catheter culture. Bacteria may colonise catheter intraluminal surface despite not previously found in urine and subsequently increase in urine concentration. Despite negative urine culture, catheter may be colonised by bacteria. Bacterial colonisation within the catheter lumen may be a predisposing factor for bacteriuria. This shows that with time these bacteria may cause UTI.[18,19]

This study shows that absence of urinary bacteria does not indicate absence of bacterial colonisation in catheter and bacterial colonisation of catheter surface may be a predisposition for bacteriuria. This shows that planctonic microrganism is different from biofilm microorganism, still undetected from urine culture, causing failure of UTI treatment. If resistance is detected, catheter culture may be considered. Therefore a catheter change should be performed before antimicrobial therapy is administered.[19]

There is difference is catheter culture result before and after catheterisation after 7 and 14 days. After 7 days all samples with previous sterile urine converted to bacteria positive on all cultures, while after 14 days similar previous sterile urine also converted to bacteria positive on all urine cultures.

Latex catheters are appropriate for short term catheterisation of 10-14 days, because potential of allergic reaction, urinary tract mucosal irritation, encrustation, water absorbtion and diminished catheter luminal diameter.[14,15] Bacteria can enter in an ascending manner within the urinary tract and colonise the intraluminal catheter surface with biofilm formation. Bacteria within the biofilm may form within the catheter lumen and on the outer catheter surface, and a variety of organisms may grow.[9] Bacteria may adhere to luminal catheter surface along with mucoid biofilm formation becoming a predisposing factor for UTI.[18]

Colonisation of rectal and urethral meatus is often related to catheter associated bacteriuria. Bacteria may colonise catheter internal lumen despite initial absence of bacteria in urine, subsequently increasing in amount and indicating development of UTI.[1,23]

CONCLUSION

There is a significant difference in urine culture before and after catheterisation at 7 and 14 days. Bacteriuria rate increases sharply on use of indwelling catheter, despite aseptic insertion technique. There is no significant difference in bacteria positive rate between urine and catheter culture at 7 and 14 days.

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