Nosocomial Infection Monitoring Using Urine Catheter

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NOSOCOMIAL INFECTION MONITORING USING URINE CATHETER

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ABSTRACT

The objective of this research was to study the onset of urinary tract infection in patients using an indwelling catheter and the pattern of bacteria causing nosocomial infection. In-patients using urinary catheter in the neurology, surgery and internal medicine wards of Dr Soetomo Teaching Hospital were studied. Urine catheter samples were obtained by aspiration. Patients with UTI before catheterization and positive cultures at the first catheterization were excluded. Urine cultures were examined on day 3, day 5 and day 7 after catheterization using the BBL Urotube. Of 32 urine catheter samples with negative cultures at the first catheterization, 30 urine catheter samples have been examined. The incidence of hospitalized positive urine culture was 11 of 30 (36.6%) while the true UTI was 5 of 30 (16.7%). Gram positive cocci were 2 of 11 (18.2%), Gram negative bacilli were 7 of 11 (63.6%) and Candida sp were 2 of 11 (18.2%). Microorganism grew initially on day 3, four of 30 (13.3%) and increased on day 5, five of 15 (33..3%) as well on day 7, two of 6 (33.3%). This study concluded that urinary tract infection in patients using urinary catheter initially occurred on day 3. Gram negative bacilli were the most prevalent uropathogens in CAUTI.

Keywords**:** *Catheter-associated Urinary Tract Infection (CAUTI), Nosocomial Infection, Urotube*

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INTRODUCTION

Nosocomial infections (IN) was acquired infections patients when hospitalized. Nosocomial infection is an important issue because of its effect on the unemployment morbidity, mortality and the impact on duration of treatment and increased treatment costs. Based on WHO data 1980, in America, the incidence of nosocomial infections was 6%, a loss of U.S. $ 1,800 and is one of the 10 leading causes of death in America (Roeshadi, 1994). Nosocomial infections in 1995 resulted in 8000 deaths each year or one death every six minutes with a loss of $ 4.5 billion (Weinstein, 1998). According to the latest source, the death rate of nosocomial infection for 1-3% of all cases treated in hospitals in the USA 1.5 million per year and 15,000 people died. (Guntur 2007). The incidence of nosocomial infection varies greatly between hospitals and between countries. The actual incidence of infection has not been widely reported by developing countries. In 1987, the Health Department reported the incidence of nosocomial infections in Indonesia amounted to 9.1%. WHO reported incidence of this infection in the world amounted to 8.7% (Gucell 2002). The incidence of nosocomial infections in countries that have advanced are still ranged between 50-10% (Wenzel 1985). According to sources, the rate of nosocomial infection rates ranging from 2-12% (Guntur 2007).

Urinary tract is frequently affected body parts of nosocomial infections. Patients with acute illness in hospital suffering from a urinary tract nosocomial infections by 40%. Sixty to eighty-six percent of patients with nosocomial infection after using a bladder catheter. The risk of nosocomial urinary infection increases with longer use of catheters (Wong 1981). Nosocomial infections increased from 10% on the first day to 50% on day 8 (Stamm 1986). According to the SMF Lab Medicine (1997), duration of catheter use in Dr. Descriptive can be more than seven days. Medical Infection Control Committee had reported that the duration of catheter use in Dr Soetomo can until 10-14 days (Panmed Dalin 1985). Disposal of urine through a catheter often can not be avoided in order to help sufferers, an estimated 10-20% of patients who were treated in hospitals require bladder catheterization (Wenzel 1985). Aseptic principles in performing catheterization is absolutely essential to prevent infection. Insiden infection in the catheterization of 30-10% per day, although with the principles of aseptic and using a closed flow system, (Danchaivijitr 2005)

Based on the criteria by WHO and nosocomial UTI is still little research on nosocomial UTI in Dr Soetomo as well as considering the impact of nosocomial infections caused so great, this research is conducted to determine the pattern of nosocomial urinary tract infection on the use of catheters, and to know the long usage of safe catheter in order to reduce the incidence of nosocomial urinary tract infection.

MATERIALS AND METHODS

This study is a prospective observational study. Population patients from several wards (neurosurgery, internal and surgical) in Dr Soetomo. Total sample of 30 obtained by consecutive sampling from patients hospitalized at Dr permanent catheter placed Soetomo (Indwelling catheter). Patients already known to suffer from UTI and culture on the first day (day 0), which already shows the growth of bacteria not included. The experiment was conducted from October 2006 until March 2007.

Catheter Urine Samples

Urine sampling on the first day (0) is carried out just when the new catheter fitted with urine accommodate the exit of the catheter in a sterile container. Urine sampling at days 3, 5 and 7 through the pipe connecting the catheter was removed aseptically with 70% alcohol. Approximately 10 cm distal from the branching catheter was inhibited with clamps for 50-10 minutes so that the bladder filled with urine and then smoked (aspirated) in the branching catheter with a stabbing that section using a sterile syringe size of 10 ml and then collected into a sterile pot or urotube which had been prepared.

Catheter Urine Culture

Catheter urine culture media ready urotube wear. Urotube is the tube containing the three types of plates as a medium for bacteria and bacterial colony count. Urotube also functions as a secure transport medium. Media urotube consists of three types of media; media for the growth of bacteria ferment CLED Gram positive and negative, Mac Conkey media for selective growth of Gram negative bacteria and the media for the growth of Pseudomonas sp Cetrimid. If the colony grows only in CLED plate, the colonies taken from plates CLED. If the colony grows on the slide CLED and Mac Conkey, the colonies were taken from Mac Conkey plates. If the colonies growing on plates CLED, Mac Conkey and Cetrimid, then the colonies taken from plates Cetrimid. Urotube quality control using controls with known bacteria. *Staphylococcus aureus* / ATCC 25 923 to the media CLED, *Escherichia coli* / ATCC 25 922 for Mac Conkey media, and *Pseudomonas aeruginosa* / Cetrimid ATCC 37 853 to the media.

Gram Staining

Gram staining is one good step is very important and most widely used to identify bacteria. Gram staining, bacteria were classified into two groups: Gram positive and Gram negative. Gram-positive bacteria can withstand iodine complex crystal violet dye pratama until the end of the procedure step, so that the bacteria appear dark blue / purple. Gram-negative bacteria will lose the crystal violet color complex at the time of flushing with alcohol, but with the addition of dye fuchsin appeared pink (Chessbrough 1994; Isenberg 1998). Quality control of Gram staining using *Staphylococcus aureus* / ATCC 25 923 and *Enterococcus faecalis* / ATCC 29 212 for Gram-Positive, and *Pseudomonas aeruginosa* / ATCC 27 853 for Gram-negative.

Biochemical Test with the Analytical Profile Index (API).

API is a biochemical test with the dual function media. Some of the API test available for example for identification of Staphylococcus and Micrococcus (API Staph), Streptococcus (API 20 Strep), Gram-negative rods (API 20e), rods Gram-negative non-enteric (API 20NE), yeast (API 20CAUX), anaerobes (API 20A), etc. The selection of API test based on bacterial morphology and Gram staining results. Hoop API consisting of micro tubes containing dry media. Micro tube is then poured bacterial suspension (obtained from the culture specimen), your metabolism will produce a color change either spontaneously or with the addition of reagents during incubation. The reaction is read according to the guidelines of API, was identified by the referring tables (numerical profile in the profiles list or using the Analytical Profile Index identification software (computer). Quality control testing of API using four bacterial control. *Pseudomonas aeruginosa* and *Escherichia coli* for the control of the API 20e. *Enterococcus faecalis* to Strep API controls, whereas *Staphylococcus aureus* for the control of the API Staph

Reporting and Data Analysis

Data reported in the form of assessment problems with percentages, figures and tables

RESULTS

A total of 32 patients studied consisted of 22 male patients and 10 female patients. Age range from 10

years to 84 years. Today there are two to three samples of culture that can not be done because the catheter was removed and another one had died (dropped out), so only 30 samples could be continued culture with the result that there are four samples of bacterial growth. Samples with negative culture results on day 3 (26 samples), transmitted on day 5 of culture. There are 11 samples dropped out on day 5 so that the remaining 15 samples with results forwarded culture there are five samples of bacterial growth.

Table 1. Bacteria Growth Time

	Day 3 (n=30)	Day 5 (n=15)	Day 7 (n=6)
There is growth	4 (13,3%)	5 (33,3%)	2 (33,3%)
There is no growth	26 (85,7%)	10 (66,7%)	4 (66,7%)

Samples with negative culture results on day 5 there are 10 samples), transmitted on day 7 of culture. There are four to seven days of sample drop-out, so stay six samples that can be passed on culture with the result that there are two samples of bacteria growth. The total number of positive culture samples is 11 samples, with the spread of growth; 5 CLED samples grown in media alone, three samples grown in CLED and Mac Conkey, while the three samples can grow in all three media (CLED, Mac Conkey and Cetrimid).

Type of bacteria that grows in CLED course is Gram-positive coccus-shaped bacteria pathogenic and non pathogenic, gram-positive rod-shaped bacteria and candida non-pathogenic. Moderate bacteria that can grow in media Conkey MAC are all negative salt rod-shaped bacteria pathogens. Three are grown in media Cetrimid pathogenic gram negative bacteria. Non-pathogenic bacteria that grew from the culture is *Macrococcus* (Gram-positive coccus) and *Bacillus subtilis* (Gram-positive rods), the rest is a bacterial pathogen that can be seen in Table 2. Incidence of nosocomial UTI are actually five patients (16.7%), 6 patients with colonization alone (to 20%).

Table 2. Pathogenic Bacteria which Grow

Gram (+/ -)	N	%	Bacteria	N	%
Gram positive	2	18.2	*Staphylococcus xylosus*	1	9
			Enterococcus faecalis	1	9
Gram negative	7	63.6	*Escherichia coli*	1	9
			Enterobacter aerogenes	1	9
			Pseudomonas aeroginosa	1	9
			Pseudomonas fluorescens	2	18.2
			Enterobacter cloacae	1	9
			Proteus mirabilis	1	9
Others	2	18.2	*Candida parapsilosis*	1	9
			Candida guillermondi	1	9

DISCUSSION

Characteristics of the Study Sample

In this study, there were 30 urine samples from 32 samples on the first negative culture, consisting of 21 patients male and nine female patients. Eleven urine samples gave positive results (there is bacterial growth). Gender proportion in the culture positive patients were 7 female and four male patients, so it looks like women more than men. These results are in accordance with the research and literature, women are more susceptible to urinary tract infections because women have a shorter urethra. (Winn 2006). Patients age range 10 to 84 years.

Age range of patients with positive cultures between 49-84 years, with the proportion as follows: 8 patients (72.7%) aged ≥ 60 years, and only three patients (27.3%) aged under 60 years old. Faria research also gives similar results, that more elderly patients suffering from UTI (patients> 60 years amounted to 20.6%, patients 41-60 years amounted to 15.3%). (Faria 2007). Immune response in older people is generally declining. IgG response against a specific antigen declines, the lower the number of T lymphocytes, reduced delayed hypersensitivity response and a reduction in regulatory T cells play a role in immune response decrease. (Levinson, 2003)

Patients included in this study have mostly been getting antibiotics at the time of admission to hospital. Use of antibiotics intended as a prophylactic or as therapeutic. In this study, 16 patients have ceftriaxon (53.3%), four patients get cefotaxim (13.3%) and three patients each get ceftazidim, cyprofloxacin and Amoxicillin (each 3.3%). Seven patients in the study did not receive antibiotics (23.5%). The use of antibiotics can inhibit bacterial growth, but the other is the use of antibiotics could increase bacterial resistance to antibiotics given. At this center researchers can not eliminate the influence of antibiotics on the growth of microorganisms.

Bacterial Growth Time

The observation that culture of 30 samples negative on the first day of culture (0), positive culture as much as four days to three samples of 30 samples were observed (13.3%), positive cultures of 5 days to 5 of 15 samples (33.3%) and on day 7 of culture there are two of the six positive samples were observed (33.3%). This shows that on day three catheterization already started to happen growth of bacteria in the urinary catheters with someone due to the installation of the incidence of 13.3%. On day five catheterization, bacteriuria greater incidence is equal to 33.3% while on day 7, the incidence of bacteriuria same day to five. The results of this study is similar to studies in Thailand, which showed the growth of microorganisms by 37.6% at 1-7 day intervals. (Danchaifijtr 2005).

Prevalence and Types of Bacteria Found

Of the 30 patients who placed the catheter, there were 11 patients with bacterial growth on culture (36.6%), while actually there are 5 UTI (16.7%). Of the 11 patients with bacteriuria due to the use of catheters, five patients (45.5%) really shows the urinary tract infection data based on clinical and laboratory. Six patients (54.5%) others showed no clinical symptoms of UTI but it could be the only colonization. Colonization is still potential for developing into symptomatic bacteriuria or urinary tract infection the next day. Of the 11 patients there were three samples positive culture is a mixture of two bacterial growth, so there are all 14 isolates of bacteria with the details of three non-pathogenic bacteria / contamination (21.4%) and 11 isolates of bacterial pathogens (78.6%). *Bacillus subtilis* is a Gram-positive rod bacterium that in certain circumstances non-patogen (mainly decreased host immune system) can develop into bacterial pathogens causing nosocomial urinary tract infections (Winn 2006)

Breakdown of pathogenic bacteria consists of two Gram-positive coccus isolates (18.2%), seven bacterial isolates were Gram negative rods (63.6%) and two isolates of Candida group (18.2%). Classification of pathogenic Gram-positive coccus bacteria consisting of *Staphylococcus xylosus* (1; 9%) and *Enterococcus faecalis* (1; 9%). Group of Gram-negative bacteria all types of stem; *Escherichia coli*, *Enterobacter aerogenes*, *Enterobacter cloacae, Proteus mirabilis* and *Pseudomonas aeruginosa* (each one; 9%) and fluorescent Pseudomonas (2; 18.2%). Group candida was found in *Candida parapsilosis* and *Candida guillermondi* (each a foreign one; 9%).

Growth of Pseudomonas sp of 27.2% consisting of *Pseudomonas aeruginosa* (9%) and *Pseudomona fluorescent* (18.2%). *Pseudomonas aeruginosa* is an opportunistic bacteria that are often found in nosocomial infections caused by catheterization. (Yetkin, 2006). Percentage of *Pseudomonas aeruginosa* as a cause of nosocomial infection between 2.9 to 11.3% (Chandrasekhar 2006; Danchaifijtr 2005; Savas 2006). Percentage growth of *Pseudomonas aeruginosa* in this study is similar to the surveillance of nosocomial infections reported by the National Nosocomial Infection Surveillance System in 1975 (9.3%). (Gaynes 2005).

Pseudomonas fluorescent rarely reported as a cause of nosocomial infections caused catheterization bladder. Carpenter reported that infections due to *Pseudomonas fluorescent* suprapubic catheterization. These bacteria are bacteria that require psychotropic temperature 40-30 º C for growth. Suprapubic catheter in patients with outpatient treatment causes the temperature is low and therefore supports the growth of these bacteria (Carpenter, 1985).

Escherichia coli is a major bacterial cause of nosocomial urinary tract infection. *E. coli* growth amounted to 48.4% in patients with bladder catheterization (Das 2006). Savas reported growth of E. coli as a cause of nosocomial urinary tract infection 31.4%. In this study the growth of *E. coli* only 9%. Low

percentage of *E. coli* growth may be due to the variant slow-growing *Escherichia coli* (slowly growing Fastidious *E coli*). These bacteria can not grow on ordinary media like to Mac Conkey, and so Methylen-Blue-Eosin, but can grow on 5% sheep blood agar. Incubation even longer time is 48-72 hours. Media used in this study were CLED, Mac Conkey and Cetrimid, so variant E. slow-growing coli can not grow. Incubation time was 18 hours on research so that still needs more time to grow (Isenberg 1988). Studio albums Slowly Growing certainty the existence of *E. coli* must be proven by further research.

Antibiotics are given at 75% of patients in this study. Antibiotics will include ceftriaxon (53%), cefotaxim (12.5%), ceftazidim (3%), cyprofloxacin (3%) and Amoxicillin (3%). Researchers assume that the growth of *E. coli* is inhibited by the antibiotics given. Based on other studies of *E. coli* is still susceptible to ceftriaxon ceftazidim, and their respective sensitivity of 70.6% and 63.2% (Savas, 2006). While the percentage of antibiotic sensitivity cyprofloxacin and Amoxicillin in a row at 54.4% and 55.9% (Savas 2006).

Enterobacter groups that grew on this research is to *Enterobacter aerogenes* and *Enterobacter cloacae* with their respective percentage of 9%. *Enterobacter aerogenes* and *Enterobacter cloacae* is a species that often grows on clinical specimens. Habitats of the two is the water, soil and vegetables. Savas et al reported that growth of 2.3% Enterobacter sp. Percentage results of this study was higher than the study Savas et al. Enterobacter cloacae grew in patients who received antibiotic Amoxicillin, whereas Enterobacter aerogenes growing in patients who did not receive antibiotics. *Proteus mirabilis* is the species causing urinary tract infections. In this study the growth of *Proteus mirabilis* by 9%. This percentage is smaller than the study of Das (14.4%). Bacterial growth in patients who have not given antibiotics and other bacterial growth there is *Enterobacter aerogenes.*

The results of this study show that the growth of Gram positive Coccus comprised 18.2% of *Staphylococcus xylosus* and *Enterococcus faecalis* with their respective percentages of 9%. *Staphylococcus xylosus* is rarely reported as a cause of nosocomial urinary tract infection, but bacteria are reported as the cause of lower urinary tract infections (Winn 2006). *Enterococcus sp* was reported as a cause of nosocomial urinary tract infection rate of 6% and 12% (Savas 2006; Danchaivijtr 2005). Enterococcus infections are autogenous sources originating from intestinal flora of patients (Hall 1992).

Growth of *Candida sp* in this study amounted to 18.2%. Candida species are *Candida parapsylosis* (9%) and *Candida guillermondi* (9%). The study in Thailand also gave similar results for 18.2% (Danchaivijtr 2005), while research Savas gave a higher yield (21.3%). Paulista states candiduria increased in patients in the hospital (Passos 2005). Catheterization bladder, antibiotic therapy, duration of hospital stay and female gender is a factor causing the growth of candida in the urine. In this study, one patient who received antibiotics (50%). Both patients are infected with candida it was a female. Candida growth occurred on days 3 and 7. In this study, from 11 patients with a positive culture there are three patients (27.3%) with mixed growth of two microorganisms. Growth of these double covers *Macrococcus* & *Enterococcus faecalis*, *Candida guillermondi* & *Bacillus subtilis* and *Enterobacter aerogenes* and *Proteus mirabilis*. Polimikrobial infections have been reported by Orsi et al of 15.7%. Polimikrobial growth in this study only one sample of the two isolates of bacterial pathogens (8.3%) while in the other two samples, one of the isolates are not pathogenic bacteria (*Bacillus subtilis* and *Macrococcus*) (16.7%). Polimikrobial infection occurs can increase morbidity and mortality and prolong hospital stay time (Orsi 2006).

CONCLUSIONS

Based on data obtained from this study can conclude several things, namely: use of long catheters in patients with new problems which may cause the urethra nosocomial infection increases with longer catheterization. In this study the use of a catheter during the three days have shown the existence of bacterial growth at 13.3%, which increased by 33.3% on day 5 and 7. Prevalence of bacteriuria in patients with catheters placed in several inpatient bangasal Dr Soetomo was 36.6%, while that really amounted to 16.7% of nosocomial UTIs. Causing bacteria consist of bacteria form 18.2% Gram-positive coccus, Gram-negative rod bacteria 63.3% and 18.2% candidiasis. Further evaluation needs to be done periodically to determine duration of safe use of catheters and the pattern of bacteria causing nosocomial UTI.

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