Catheter-Associated Urinary Tract Infection

Somwang Danchaivijitr MD*,
Chertsak Dhiraputra MD **, Rachada Cherdrungsi MSc***,
Duangporn Jintanothaitavorn MSc***, Nitaya Srihapol RN***

**Department of Medicine, **Department of Microbiology, ***Center for Nosocomial Infection Control, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok*

Objectives : *To study the incidence, risk factors, clinical outcomes and antibiotic costs of catheter-associated urinary tract infections (CAUTI) in patients with indwelling urinary catheter for one week and longer.*
Material and Method : *Patients in neurology and neurosurgery wards in a teaching hospital were studied. Patients with UTI before catheterization and in whom the catheter was removed before one week were excluded. Urine cultures were done immediately after catheterization and 3 times a week there after. Patients were followed for symptoms of UTI for 1 week after catheter removal, for 4 weeks without evidence of UTI or until discharge.*
Results : *One hundred and one patients met the inclusion criteria. The incidence of CAUTI was 73.3%. High incidence of CAUTI was found in the first 2 weeks after catheterization. About one-half of the patients with CAUTI had a single episode and were symptomatic. None of the 132 episodes of CAUTI were associated with secondary bacteremia. Risk factors for CAUTI identified were prolonged catheterization and change of the catheter. Nosocomial pathogens were found in urine and yeast was the commonest. Eleven patients (14.9%) with CAUTI died and only in 2, CAUTI was considered a contributory factor for mortality. The cost of antimicrobials for treating one episode of CAUTI was 8,180 baht and this rose to 49,983 baht for CAUTI associated with concurrent infections at other sites.*
Conclusion : *Catheter-associated urinary tract infection was common. uropathogens were nosocomial microorganisms with high incidence of resistance to antimicrobials. Impacts on morbidity, mortality and costs were substantial. Better management of urinary catheter is to be explored and implemented.*

Keywords : *Catheter-associated, Urinary tract infection*

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Urinary tract is the commonest site of nosocomial infections[1-6]. It is associated with an indwelling urethral catheter in the majority of cases. Catheter-associated urinary tract infection (CAUTI) has been a leading cause of morbidity and mortality in hospitalized patients[6-7]. The accepted means to prevent CAUTI are the maintenance of closed urinary drainage system and early removal of the catheter[6-7]. With currently best practices, CAUTI still occurs at an incidence of 3-10% per day of catheterization[2-3]. The infection is followed by bacteremia in 2-4%[6], and in a few patients by septic shock and death. Prolonged catheterization has been known to be complicated by urinary stones, periurethral infections, chronic kidney infection and bladder cancer[2]. The incidence, risk factors and impacts of CAUTI in Thailand have yet to be studied and better preventive measures to be implemented.

Correspondence to : Danchaivijitr S, Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand. E-mail : sisdc@mahidol.ac.th

Material and Method

Patients admitted to the neurology and neurosurgery wards in a university hospital during July 2002 and September 2003 with retained urethral catheter of over 1 week were enrolled. Urine cultures were done immediately after catheterization and 3 times a week thereafter. Patients with positive first urine cultures were excluded. They were followed for symptoms of UTI for 1 week after the catheters had been

removed. The study was terminated when the patients were discharged from hospital, and 4 weeks after catheterization without evidence of CAUTI. Patients with CAUTI had blood culture done whenever it was deemed appropriate. Urinary tract infections were classified into symptomatic and asymptomatic groups. In patients who died, the causes of death were determined by attending doctors whether they were related to CAUTI. Costs of antimicrobials for the treatment were also collected by the researchers. Categorical variables were expressed as number and percentage respectively.

Results

One hundred and one patients fulfilled the inclusion criteria. Their demography is shown in Table 1. Male and female patients were almost equal in number and their mean age was 48±20.1 years. The incidence of CAUTI in this group of patients was 73.3% (Table 2). The incidence was higher in females patients than male, but the difference was not statistically significant.

Table 1. Demography of patients (N=101)

Patients	No.	%
Sex		
- Male	47	46.5
- Female	54	53.5
Age (yr)		
- Range	6-89	
- Mean ± S.D.	48 ± 20.1	

Table 2. Incidence of CAUTI (N=101)

Patients	No.	%
Male	30	29.7
Female	44	43.6
Total	74	73.3

Table 3. Interval between catheterization and the first bacteriuria (N=101)

Interval (days)	No.	%
1-7	38	37.6
8-14	28	27.7
15-21	4	4.0
22-28	4	4.0

As shown in Table 3, the incidence of CAUTI was higher in the first week (37.6%), followed by the second week (27.7%). In 35 patients, more than one episode of CAUTI was recorded (Table 4).

The overall episodes of CAUTI were 132 in 74 patients. The infection was symptomatic in 47.0% of episodes. In 15.9% the symptoms could not be determined whether they were due to CAUTI because there were other co-morbid conditions that could cause the symptoms (Table 5).

The longer duration of catheterization was the only significant risk factor for a higher incidence of CAUTI. The mean duration of catheterization was 21.4 days in patients with CAUTI and 10.0 days in patients without. Other risk factors were not associated with an increased incidence of CAUTI statistically due to the small number of patients. These risk factors included :

Table 4. Episodes of CAUTI (N=101)

Episodes	No.	%
Single	39	38.6
Multiple	35	34.7
Total	74	73.3

Table 5. Manifestations of CAUTI (132 episodes)

Manifestations	No.	%
Symptomatic	62	47.0
Asymptomatic	49	37.1
Not evaluable	21	15.9

Table 6. Uropathogens isolated

Organisms	No.	%
Yeast	29	18.2
Escherichia coli	24	15.1
Non-fermative GNR*	21	13.2
Enterococcus spp	20	12.6
Pseudomas aeruginosa	18	11.3
Klebsiella pneumoniae	17	10.7
Other bacteria	30	18.9
Total	159	100.0

*GNR = gram-negative rods

gender, place of insertion of the catheter, perineal cleaning with clean water or antiseptics, use of antimicrobials before catheterization, change of urinary drainage bags. Sixteen of 74 patients with CAUTI and none of 27 patients without CAUTI had their catheter changed. The most prevalent uropathogen isolated was yeast (18.2%) followed by *Escherichia coli* (15.1%) and non-fermentative GNR (13.2%). Enterococci and *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* were also common isolates (Table 6).

The clinical outcomes of CAUTI are shown in Table 7. Hemocultures were done in 33 cases of CAUTI and were positive in 4 patients but the organisms in the blood were different from those from urine. Thirty-four patients (45.9%) were cured of the CAUTI and in 16 patients, without antimicrobials. In 29 patients (39.2%), the symptoms improved but their urine remained culture positive. Eleven patients (14.9%) died, 9 patients died of other causes and in 2 patients, CAUTI was considered to be a contributory factor.

The costs of antimicrobial treatment for one episode of CAUTI are illustrated in Table 8. The mean cost for treating CAUTI was 8,180 baht and for treating CAUTI in patients with other sites of infections, the mean cost was 49,983 baht.

Table 7. Clinical outcomes of 74 CAUTI patients

Outcomes	Total	Antimicrobial Treatment	
		Received	Not received
Cure	34	18	16
Improved	29	4	20
Death	11	5	6

Table 8. Costs of antimicrobials for one episode Of CAUTI (baht)*

Infection	No	Costs	
		Range	Mean ± SD
CAUTI	20	293-25,560	8,180±6,259
CAUTI+Other infection	12	10,000-115,469	49,983±32,927

*40 baht = 1 U.S. dollar

Discussion

The study was done only in 101 patients who fulfilled the inclusion criteria since urinary catheterization was done only when it was indicated. Those who had been catheterized had their catheter removed as early as possible. As a result, only a few patients had urinary catherization for one week or over. All patients had neurological conditions requiring urinary catheterization. Their mean age was 48.0 years. The incidence of CAUTI in the present study was 73.3%. The mean duration of catheterization was significantly longer in patients with CAUTI compared to that in patients without the infection. Higher incidence of CAUTI was found in the first week (37.6%) and in the second week (27.7%) than thereafter (Table 3). Almost one half of the patients with CAUTI had more than one episodes of the infection (Table 4). Only 47.0% of episodes of CAUTI were symptomatic, the results corresponded with previous studies[2,3,6,8] (Table 5). The significant risk factors for CAUTI identified in the present study were the duration of catheterization and changing the catheter. Due to the small sample size, other risk factors, such as gender, places of insertion of catheter, perineal care, change of urinary drainage bags could not be substantiated. The leading pathogen isolated was yeast (18.2%) (Table 6). Other prevalent organisms were nosocomial pathogens, for example, lactose non-fermenters, enterococci, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. These uropathogens are more resistant to antimicrobials compared with community acquired ones. The results were similar to previous reports.[2,6,9,10] Eradication of these micro-organisms in the presence of urethral catheter is difficult and is often impossible due to antimicrobial resistance and the presence of biofilm on the inner surface of the catheter[6]. None of 33 patients with CAUTI who had their blood cultures done were bacteremic secondary to bacteriuria. An incidence of 2-4% of secondary bacteremia was reported[6]. In the present study, the clinical outcomes were not different whether or not antimicrobials had been used. Eleven patients (14.9%) died, 9 of other causes and in 2, CAUTI was considered a co-factor for mortality (Table 7). The economic consequences of CAUTI were substantial. Treating one episode of CAUTI costed 8,180 baht for antimicrobials. In patients with concurrent other sites of infections, the cost of antimicrobials was as high as 49,983 baht (Table 9).

Conclusion

The incidence of CAUTI in the present study was 73.3% and the mortality of CAUTI was 14.9%. Risk factors for CAUTI identified were prolonged catheterization and change of urinary catheter. The cost of antimicrobials for treating CAUTI was substantial.

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การติดเชื้อทางเดินปัสสาวะที่สัมพันธ์กับการใส่สายสวนปัสสาวะ

สมหวัง ด่านชัยวิจิตร, เชิดศักดิ์ ธีระบุตร, รัชดา เจิดรังษี, ดวงพร จินตโนทัยถาวร

วัตถุประสงค์ : *ศึกษาอุบัติการณ์, ปัจจัยเสี่ยง, ผลของการติดเชื้อ และค่ายาต้านจุลชีพที่ใช้รักษาการติดเชื้อทางเดินปัสสาวะที่สัมพันธ์กับการใส่สายสวนปัสสาวะนานกว่า 1 สัปดาห์*

วัสดุและวิธีการ : *ศึกษาในผู้ป่วยในหอผู้ป่วยประสาทวิทยาและประสาทศัลยศาสตร์ในโรงเรียนแพทย์แห่งหนึ่ง. ผู้ป่วยที่ติดเชื้อก่อนใส่สายสวนปัสสาวะและที่ใส่สายสวนสั้นกว่า 1 สัปดาห์ถูกตัดออกจากการวิเคราะห์ เพาะเชื้อจากปัสสาวะหลังสวนทันทีและหลังจากนั้นสัปดาห์ละ 3 ครั้ง ติดตามอาการผู้ป่วยจนถึง 1 สัปดาห์หลังจากถอดสายสวนปัสสาวะออก, หรือ 4 สัปดาห์หลังใส่สายสวนโดยไม่มีอาการ หรือจำหน่ายออกจากโรงพยาบาล*

ผลการศึกษา : *ผู้ป่วย 101 รายมีคุณสมบัติครบสำหรับการศึกษา พบอุบัติการณ์ของการติดเชื้อทางเดินปัสสาวะที่สัมพันธ์กับการใส่สายสวนปัสสาวะ 73.3% การติดเชื้อพบมากใน 2 สัปดาห์แรกหลังใส่สายสวน ผู้ป่วยติดเชื้อประมาณครึ่งหนึ่งติดเชื้อครั้งเดียวและมีอาการของการติดเชื้อ ไม่พบเชื้อจากทางเดินปัสสาวะลามเข้าสู่เลือด ปัจจัยเสี่ยงต่อการติดเชื้อที่พบคือการใส่สายสวนปัสสาวะเป็นเวลานานและการเปลี่ยนสายสวนปัสสาวะ เชื้อที่เพาะได้เป็นเชื้อที่พบในโรงพยาบาลและพบ yeast มากที่สุด ผู้ป่วย 11 รายถึงแก่กรรม (14.9%) และการติดเชื้อทางเดินปัสสาวะเป็นสาเหตุร่วมของการตายใน 2 ราย ค่ายาต้านจุลชีพใช้รักษาการติดเชื้อทางเดินปัสสาวะที่สัมพันธ์กับการใส่สายสวนปัสสาวะเท่ากับ 8,180 บาท และเพิ่มเป็น 49,983 บาท ถ้ามีการติดเชื้อที่ตำแหน่งอื่นของร่างกายร่วมด้วย*

สรุป : *การติดเชื้อทางเดินปัสสาวะที่สัมพันธ์กับการใส่สายสวนปัสสาวะพบได้บ่อย เชื้อที่พบเป็นเชื้อในโรงพยาบาลที่มีอัตราการดื้อยาต้านจุลชีพสูง ผลกระทบของการติดเชื้อต่อการป่วย การตาย และค่าใช้จ่ายในการรักษาสูง การจัดการเกี่ยวกับการใส่สายสวนปัสสาวะควรจะได้รับการพัฒนาเพื่อนำสู่การปฏิบัติ*