

Uropathogens and Empiric Antibiotics for the Treatment of Urinary Tract Infections in Spinal Cord Injured Patients at Rehabilitation Center, Thai Red Cross Society during 2001 to 2005

Natthiya Tantisiriwat MD*,
Wasuwat Kittisomprayoonkul MD**, Kwanyupa Sukonthamarn MD*,
Chudaachhara Unhasuta ***, Chusana Suankratay MD, PhD****,
Woraphot Tantisiriwat MD, MPH*****, Sek Aksaranugraha MD*

* Rehabilitation Center, Thai Red Cross Society, Bangkok

** Division of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, Bangkok

*** Department of Microbiology, Faculty of Medicine, Chulalongkorn University, Bangkok

**** Division of Infectious Disease, Department of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok

***** Department of Preventive Medicine, Faculty of Medicine, Srinakharinwirot University, Bangkok

Background: Urinary tract infection (UTI) is common in spinal cord injured patients. The authors investigated the epidemiology of bacteria associated with UTI to select an appropriate antibiotic for empirical treatment of UTI before obtaining a bacterial culture.

Objective: To determine the prevalence, as well as the causative bacteria and their susceptibility pattern of urinary tract infection in spinal cord injured patients hospitalized to the Rehabilitation Center, Thai Red Cross Society, Samutprakarn, Thailand from January 2001 to December 2005.

Material and Method: A retrospective chart review of 76 spinal cord injured patients.

Results: Of all spinal cord injured patients, there were 50 males and 26 females, with the average age of 44.70 years. The average length of hospitalization was 104.5 days. 71.2% of the patients needed intermittent catheterization for bladder drainage, and only 2.7% had suprapubic cystostomy. None of patient had indwelling catheterization. Forty-six patients had 68 episodes of UTI (60.52%). Eighteen patients had recurrent UTI (14 patients had two episodes and four patients had three episodes). *E. coli* was the most common isolated pathogen (74.36%) followed by *K.pneumoniae* (12.82%), *E. faecalis* (5%) and *P. mirabilis* (5%). Most gram-negative pathogens were susceptible to amikacin and third generation cephalosporins. The susceptibility of these organisms to cotrimoxazole, amoxicillin/clavulanate, and ciprofloxacin were in the range of 34.6-60.0%, 44.0-50.0% and 25.9-50.0%, respectively.

Conclusion: Urinary tract infections were commonly observed among spinal cord injured patients in the presented institution. *E. coli* was the most common isolated pathogen. Surprisingly, most gram-negative pathogens were resistant to cotrimoxazole, amoxicillin/clavulanate, and ciprofloxacin. An antibiotic of choice for UTI in our patients should be aminoglycoside or third generation cephalosporins.

Keywords: Spinal cord injury, Urinary tract infection, Intermittent catheterization

J Med Assoc Thai 2007; 90 (II): 2482-6

Full text. e-Journal: <http://www.medassocthai.org/journal>

Spinal cord injured patients who have neurogenic bladder cannot have normal physiologic voiding and require catheterization for bladder drainage for prevention of urologic complications. Although renal

Correspondence to : Aksaranugraha S, Rehabilitation Center, Thai Red Cross Society, Bangkok 10330, Thailand.

failure is not the major problem at present⁽¹⁾, urinary tract infection (UTI) still remains troublesome^(2,3). UTI is the frequent problem found among spinal cord injured patients. Urinalysis of average 15 patients per year with spinal cord injury showed evidence of pyuria and bacteriuria during their hospitalization in

Rehabilitation Center, Thai Red Cross Society during 2001 and 2005. Urinary tract infection (UTI) was frequently reported during the past five years. Initial oral antimicrobial agent sometimes could not sterilize the urine and switch to the appropriate antimicrobial agent was done after obtaining the microbiologic results. Prolongation of antimicrobial affected patient's quality of life and rehabilitation outcome⁽²⁾. The authors aimed to identify and elucidate the causative bacteria associated with UTI to select an appropriate antimicrobial agent for empirical treatment of UTI before obtaining the results of urine culture

Objective

The authors aimed to determine the prevalence as well as the causative bacteria and their antimicrobial susceptibility patterns of both symptomatic and asymptomatic UTI in spinal cord injured patients hospitalized in the Rehabilitation Center, Thai Red Cross Society, Samutprakarn, Thailand from January 2001 to December 2005.

Material and Method

A retrospective chart review of 76 spinal cord injured patients was available for the presented analysis. All patients had routine urinalysis every two weeks. Pyuria was defined if white blood cells in the urine sample was more than 10 cells/high-power field (HPF), and was categorized into two groups including low-level pyuria (white blood cell range from 10 cells/HPF to 50 cells/HPF) and high level pyuria (white blood cells were more than 50 cells/HPF)⁽⁴⁾. In the present study, UTI was defined if the patient had signs and symptoms of UTI including fever, discomfort or pain over kidney or bladder, onset of urinary incontinence and increase in spasticity of skeletal muscles especially in the lower extremities, sweating or autonomic dys-

reflexia, in association with significant bacteriuria. Urine culture revealing a bacterial colony count of 10^5 colony-forming units (CFUs) or higher was considered a significant bacteriuria⁽⁵⁾.

Results

Patient characteristics

Of 76 spinal cord injured patients, there were 50 males and 26 females, with the mean age \pm SD was 44.70 ± 18.31 years. A mean length of hospitalization \pm SD was 104.5 ± 64.63 days. 71.2% of these patients needed clean intermittent catheterization for bladder drainage, 26.1% were able to void, 3.9% were able to void with a history of clean catheterization in the initial period of hospitalization, and 2.7% had suprapubic cystostomy. None of the patients had indwelling urinary catheterization. Clean intermittent catheterization was initially performed by a nurse. Patients were trained to perform self-catheterization if their hand function was available. Patient characteristics are summarized in Table 1.

Degree of spinal cord injury was classified based on American Spinal Injury Association Impairment Scale (ASIA). Post void residual urine was measured, as it is a risk factor for UTI, in all 76 spinal cord injured patients, to determine if the urodynamic study or manual cystometry was needed. The urodynamic study was performed in 48 patients. Of these 48 patients, the type of neurogenic bladder could be classified into two groups including detrusor muscle overactivity (39 patients, 51.3%) and detrusor muscle underactivity (9 patients, 11.8%).

Prevalence of UTI

Of 76 spinal injured patients, there were 46 patients (60.52%) with 68 episodes of UTI. Eighteen patients had recurrent UTI (14 and four patients had

Table 1. Patient characteristics of all 76 spinal injured patients

Patient characteristics	Male	Female	Total (%)
Number of case	50	26	76 (100%)
Type of neurogenic bladder based on urodynamic study report			
Detrusor overactivity	26	13	39 (51.3%)
Detrusor underactivity	5	4	9 (11.8%)
Type of bladder drainage			
Clean intermittent catheterization (vary frequency from 2-6 times/day)	32	20	52 (68.4%)
Ability to void without catheterization	14	5	19 (25.0%)
Ability to void with history of clean intermittent catheterization during initial hospitalization	2	1	3 (3.9%)
Suprapubic cystostomy	2	0	2 (2.7%)

two and three episodes respectively) as shown in Table 2. Thirty-nine patients (97.14%) who had neurogenic detrusor overactivity had UTI, whereas six of nine patients (66.67%) with neurogenic detrusor underactivity had UTI.

Causative bacteria and susceptibility pattern

Of 68 episodes of UTI, urine culture was performed in 41 episodes. There were 39 episodes of significant bacteriuria and two episodes were negative. *Escherichia coli* was the most commonly isolated bacteria (74.36%) followed by *Klebsiella pneumoniae* (12.82%), *Enterococcus faecalis* (5%), and *Proteus mirabilis* (5%) (Table 3). Most gram-negative bacteria were susceptible to amikacin and third-generation cephalosporins (Table 4). The susceptibility of *E. coli* and *K. pneumoniae* to cotrimoxazole, amoxicillin/clavulanate, and ciprofloxacin were in the range of 34.6-60.0%, 44.0-50.0%, and 25.9-50.0%, respectively.

Discussion

More than 50% of spinal cord injured patients had at least one episode of UTI during hospitalization at the present study Rehabilitation center from 2001 to 2005. 39.1% of these 46 patients with UTI reported more than one episode of UTI. None had indwelling urinary catheter, and only two patients (0.02%) had suprapubic cystostomy, whereas most patients used intermittent catheterization (IC) for bladder drainage. Self intermittent catheterization is considered as the authors' choice of the bladder drainage method for spinal cord injured patients because it induced less morbidity than indwelling catheterization⁽⁶⁾. However, recent studies

revealed that UTI did not correlate with type of bladder management. Patients who use this method still had a chance to develop UTI. Liguori reported the spinal cord patients using the IC method had a higher incidence of UTI than those using normal voiding⁽⁷⁾. Waites also reported persons using IC method had bacteriuria that occurred when diverse gram-negative bacteria from the bowel, perineum, and urethra gained access to the bladder, aided by contaminated instruments⁽⁸⁾.

The present findings revealed that UTI was observed although patients used intermittent

Table 2. Group of Spinal Cord Injured Patient who had UTI classified based on episode of infection

Episode of UTI	Number of patient
1 episode	28
2 episodes	14
3 episodes	4

Table 3. Uropathogen was obtained from urine culture 39 samples

Uropathogen	Urine culture	
	# Samples	%
<i>E. coli</i>	29	74.36
<i>K. pneumoniae</i>	5	12.82
<i>E. faecalis</i>	2	5.13
<i>P. mirabilis</i>	2	5.13
<i>Citrobacter spp.</i>	1	2.56

Table 4. Susceptibility pattern of uropathogen

Organism	Case/ Total case	Sensitivity				
		Cotrimoxazole	Amoxicillin/ Clavulanic acid	Ciprofloxacin	Amikacin	Ceftazidime, Cetriaxone
1. <i>Escherichia coli</i>	29/39 (74.36%)	9/26 (34.61%)	11/25 (44%)	7/27 (25.92%)	25/26 (96.1%)	24/27, 21/28 (88.89%), (75%)
2. <i>Klebsiella pneumoniae</i>	5/39 (12.82%)	3/5 (60%)	2/4 (50%)	1/2 (50%)	3/5 (60%)	4/5, 4/5 (80%), (80%)
3. <i>Enterococcus faecalis</i>	2/39 (5%)	2/2 (100%)	2/4 (50%)	-	2/2 (100%)	2/2, 1/1 (100%), (100%)
4. <i>Proteus mirabilis</i>	2/39 (5%)	-	2/2 (100%)	-	2/2 (100%)	2/2, 1/1 (100%), (100%)
5. <i>Citrobacter spp.</i>	1/39 (3%)	1/1 (100%)	1/1 (100%)	1/1 (100%)	1/1 (100%)	1/1 (100%)

catheterization. This could be explained by an average prolonged length of hospital stay in Rehabilitation Center, which is about 104.5 days, and it could expose patients to causative bacteria of UTI with nosocomial strains. These patients would be routinely trained to perform self-catheterization before discharge. The risk of UTI could be higher during training program due to unfamiliarity to aseptic technique of IC.

In addition, the present study showed that 97.14% of UTI was found in patients with detrusor overactivity. Neurogenic bladder, which had changed the physiology of urine emptying, is one of the risks for development of UTI^(1,2). Detrusor overactivity causes high detrusor pressure during the storing phase and results in upper urinary tract infection. Decreased detrusor pressure by medication or other interventions could reduce this risk⁽²⁾. *E. coli* was the most commonly isolated bacteria in our study, similar to Waites' study⁽⁸⁾. But the present finding is in contrast to other studies which reported that *Klebsiella spp.*, *Proteus spp.*, and *Enterococci spp.* were the common uropathogen in patients with catheter-associated UTI^(9,10). Bennett et al reported that *E. coli* and *Enterococcus spp.* caused UTI in more than two-thirds of female patients with undergoing clean intermittent catheterization⁽¹¹⁾.

In the present study, most gram-negative pathogens were resistant to cotrimoxazole, amoxicillin/clavulanate, and ciprofloxacin. These medications, especially fluoroquinolones, were mostly used as the empirical treatment of UTI before obtaining the culture results in the Rehabilitation center. A widespread use of fluoroquinolones was associated with the development of emergence resistance among causative uropathogens^(8,12). The authors' observation is consistent with a recent study that reported an increasing development of fluoroquinolones-resistant gram-negative bacilli in spinal cord injured patients with UTI⁽⁸⁾.

In the present study, most causative uropathogens were susceptible to amikacin and third-generation cephalosporins. An antibiotic of choice for empirical treatment of UTI in the Rehabilitation Center should be an aminoglycoside or a third-generation cephalosporins.

Conclusion

UTIs were commonly observed among spinal cord injured patients in the authors' institution *E. coli* was the most commonly isolated pathogen. Surprisingly, most gram-negative pathogens were resistant to cotrimoxazole, amoxicillin/clavulanate, and ciprofloxacin. An antibiotic of choice for UTI in the presented patients

should be an aminoglycoside or a third generation cephalosporins.

References

1. DeVivo MJ, Black KJ, Stover SL. Causes of death during the first 12 years after spinal cord injury. *Arch Phys Med Rehabil* 1993; 74: 248-54.
2. Garcia Leoni ME, Esclarin DR. Management of urinary tract infection in patients with spinal cord injuries. *Clin Microbiol Infect* 2003; 9: 780-5.
3. Cardenas DD, Hoffman JM, Kirshblum S, McKinley W. Etiology and incidence of rehospitalization after traumatic spinal cord injury: a multicenter analysis. *Arch Phys Med Rehabil* 2004; 85: 1757-63.
4. Roghmann MC, Wallin MT, Gorman PH, Johnson JA. Prevalence and natural history of colonization with fluoroquinolone-resistant gram-negative bacilli in community-dwelling people with spinal cord dysfunction. *Arch Phys Med Rehabil* 2006; 87: 1305-9.
5. The prevention and management of urinary tract infections among people with spinal cord injuries. National Institute on Disability and Rehabilitation Research Consensus Statement. January 27-29, 1992 *J Am Paraplegia Soc* 1992; 15: 194-204.
6. Jamil F. Towards a catheter free status in neurogenic bladder dysfunction: a review of bladder management options in spinal cord injury (SCI). *Spinal Cord* 2001; 39: 355-61.
7. Liguori PA, Cardenas DD, Ullrich P. Social and functional variables associated with urinary tract infections in persons with spinal cord injury. *Arch Phys Med Rehabil* 1997; 78: 156-60.
8. Waites KB, Chen Y, DeVivo MJ, Canupp KC, Moser SA. Antimicrobial resistance in gram-negative bacteria isolated from the urinary tract in community-residing persons with spinal cord injury. *Arch Phys Med Rehabil* 2000; 81: 764-9.
9. Montgomerie JZ, Chan E, Gilmore DS, Canawati HN, Sapico FL. Low mortality among patients with spinal cord injury and bacteremia. *Rev Infect Dis* 1991; 13: 867-71.
10. Stamm WE, Hooton TM. Management of urinary tract infections in adults. *N Engl J Med* 1993; 329: 1328-34.
11. Bennett CJ, Young MN, Darrington H. Differences in urinary tract infections in male and female spinal cord injury patients on intermittent catheterization. *Paraplegia* 1995; 33: 69-72.
12. Hooper DC, Wolfson JS. Fluoroquinolone antimicrobial agents. *N Engl J Med* 1991; 324: 384-94.

เชื้อก่อโรคและการใช้ยาต้านจุลชีพแบบครอบคลุมสำหรับการรักษาการติดเชื้อทางระบบทางเดิน
ปัสสาวะของผู้ป่วยบาดเจ็บไขสันหลังที่ศูนย์เวชศาสตร์ฟื้นฟู สภากาชาดไทย ในระหว่างปี พ.ศ. 2543-
พ.ศ. 2548

ณัฐฐิยา ตันติศิริวัฒน์, วสุวัฒน์ กิตติสมประยูรกุล, ขวัญยูพา สุคนธมาน, จุฑาอัจฉร์ อุณหุต,
ชัชฌา สอนกระต่าย, วรพจน์ ตันติศิริวัฒน์, เสก อักษรานุเคราะห์

วัตถุประสงค์: เพื่อศึกษาหาความชุกของเชื้อก่อโรค ผลการเพาะเชื้อและความไวของเชื้อก่อโรคต่อยาต้านจุลชีพ
อันนำไปสู่การเลือกใช้ยาต้านจุลชีพในการรักษาเบื้องต้นที่เหมาะสมก่อนที่จะทราบผลเพาะเชื้อ

วิธีการศึกษา: เก็บข้อมูลย้อนหลังจากเวชระเบียนผู้ป่วยในเฉพาะผู้ป่วยบาดเจ็บไขสันหลังที่เข้ารับการรักษาที่
ศูนย์เวชศาสตร์ฟื้นฟู ตั้งแต่ พ.ศ.2543 – พ.ศ.2548

ผลการศึกษา: จากผู้ป่วยบาดเจ็บไขสันหลังทั้งหมด 76 รายเป็นชาย 50 รายและหญิง 26 รายมีอายุโดยเฉลี่ย 44.7 ปี
และมีระยะเวลาอนพักในศูนย์เวชศาสตร์ฟื้นฟูเฉลี่ยนาน 104.5 วัน มีวิธีการดูแลการขับถ่ายปัสสาวะดังนี้ ร้อยละ
71.2 ต้องอาศัยวิธีสวนปัสสาวะเป็นเวลา ร้อยละ 2.7 ได้รับการทำ suprapubic cystostomy ไม่มีผู้ป่วยที่ค้ำสายสวน
ปัสสาวะ ผู้ป่วยจำนวน 46 ราย (ร้อยละ 60.52) มีการติดเชื้อซึ่งคิดเป็นจำนวน 68 ครั้ง 18 รายมีการติดเชื้อมากกว่า
หนึ่งครั้ง โดย 14 รายมีการติดเชื้อสองครั้ง และ 4 รายมีการติดเชื้อ 3 ครั้ง พบเชื้อแบคทีเรียจากผลเพาะเชื้อ ปัสสาวะดังนี้
E. coli (ร้อยละ 74.36), *K. pneumoniae* (ร้อยละ 12.82), *E. faecalis* (ร้อยละ 5) และ *P. mirabilis* (ร้อยละ 5)
เชื้อกลุ่มกรัมลบส่วนใหญ่ยังคงตอบสนองต่อ amikacin และ third-generation cephalosporins ขณะที่อัตรา
การตอบสนองต่อ cotrimoxazole, amoxicillin/clavulanate และ ciprofloxacin มีค่าร้อยละ 34.6-60, ร้อยละ 44-50
และร้อยละ 25.9-50 ตามลำดับ

สรุป: ปัญหาการติดเชื้อทางระบบทางเดินปัสสาวะในผู้ป่วยบาดเจ็บไขสันหลังเป็นปัญหาที่พบบ่อยในศูนย์เวชศาสตร์
ฟื้นฟูโดยเชื้อก่อโรคที่พบบ่อยคือ เชื้อ *E. coli* นอกจากนี้ยังพบสายพันธุ์ที่ดื้อต่อยา cotrimoxazole, amoxicillin/
clavulanate และ ciprofloxacin ยาที่เหมาะสมในการรักษาเบื้องต้นจึงน่าจะเป็นยาในกลุ่ม aminoglycoside หรือ
third-generation cephalosporins