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Nosocomial Uropathogens and Their Antibiotic Susceptibilities In a Turkish Military Hospital: A Prospective and Microbiological Study

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Abstract: In this prospective study, we found that 21.80% (29/133) of nosocomial urinary tract infections (NUTIs) were caused by *Escherichia coli*, 12.78% (17/133) by *Pseudomonas aeruginosa* and 10.53% (14/133) by *Klebsiella pneumoniae* whereas 16.54% (22/133) were caused by coagulase negative staphylococci. The highest susceptibility rate was determined with imipenem among gram negatives (21/28 for non-fermentatives and 65/66 for others); and with vancomycin (30/30) and pristinamycin (29/30) among gram positives. On the other hand, the lowest susceptibilities were to amoxicilin (7/66), amoxicilin clavulonat (18/66) and cotrimoxazole (27/66) among gram negatives other than non-fermentatives. All of the non-fermentative gram negative isolates were resistant to gentamicin (30/30). Most of the *P. aeruginosa* strains (15/17) were isolated from samples of catheterized patients. Because of their poor susceptibility rates, cotrimoxazole, penicilins and gentamicin shouldn't be administered empirically, especially to catheterized patients with NUTIs

Key Words: Nosocomial urinary tract infection, antibiotic susceptibility, microorganisms.

Introduction

Nosocomial infections (NIs) are defined as infections which are not present or not incubating when the patient is hospitalized and are acquired during hospitalization. Sign and symptoms of the infection may be evident during hospitalization or after discharge related to the length of the incubation period (1).

Nosocomial urinary tract infections (NUTIs) are the most commonly identified cause of NIs, accounting for about 40% of all cases. Catheterization of the urethra is recognized as the major risk factor for NUTI (2).

In this prospective study, we investigated both the epidemiology of NUTIs in our hospital and the antibiotic susceptibilities of causative uropathogens in order to provide a database.

Materials and Methods

All urine samples submitted to the clinical microbiology laboratories of Gülhane Military Medical Academy were inoculated on sheep blood agar and McConkey agar plates, and incubated at 37°C for 24-48 hours aerobically. Both the identification and the antibiotic susceptibility tests of the isolated bacteria were performed using API ID and ATB (ID 32 GN, ATB G-, ATB PSE, ATB Staph, Biomerieux/ France) strips. Only the identification of the gram positive cocci was carried out using conventional methods. Evaluation of positive cultures was done according to the CDC criteria for (NUTIs) (1).

Results

Over a period of nine months (between November 1994 and July 1995), a total of 100 patients (65 male, 35 female) with 133 episodes of NUTIs (91 male, 42 female) were identified in 9805 newly hospitalized patients. The highest NUTI rates were observed among the following divisions in descending order: geriatrics (14.29%), nephrology (2.89%), pediatrics (2.68%) and rehabilitation departments (1.96%). Prior urethral catheterization or instrumentation history was available for 47.01% of patients.

In this study, 70.68% (94/133) of NUTIs were caused by gram negative bacteria, 22.56% (30/133) by gram positives and only 6.76% (9/133) by yeasts. 21.80% (29/133) of NUTIs were caused by *Eschericha coli*, 12.78% (17/133) by *Pseudomonas aeruginosa* and 10.53% (14/133) by *Klebsiella pneumoniae* whereas

16.54% (n=22) of NUTIs were caused by coagulase negative staphylococci. *E. coli* was the most commonly isolated uropathogen followed by *Pseudomonas sp.* among gram negative bacteria. The percentage of non-fermentative gram negative rods was 29.79 (28/94) among all gram negatives. Fifteen (88.24 %) out of the seventeen *P. aeruginosa* strains were isolated in patients subjected to catheterization. Other microorganisms which have not been mentioned so far, isolated in this study are listed in table 1.

Susceptibility rates of gram negative rods other than non-fermentatives are summarized in table 2, imipenem, cephotaxime and amikacin were the most active agents against gram negative rods with their high susceptibility rates of 98.5%, 76.1% and 73.1%, respectively. Only 10 of 29 (34.48%) *E. coli* strains and 27 of 66 (40.91%) gram negative rods other than nonfermentatives were susceptible to trimethoprim-sulfamethoxazole which is usually recommended for empirical therapy of urinary tract infections.

Imipenem was also the most active agent against non-fermentative gram negative rods (75% susceptible), whreas all of them were resistant to gentamicin. In addition, most of these strains were resistant to netilmicin (96.4%) and aztreonam (92.9%).

As seen in table 3, no resistance was determined to vancomycin among gram positives. Fucidic acid and pristinamycin were the other most active agents with 96.7% (29/30) and 86.7% (26/30) susceptibility rates, respectively. However, low susceptibility rates to penicilin-G (6.7%), kanamycin (13.3%) and gentamicin (13.3%) were observed among gram positives.

Table 1. Microorganisms isolated from patients with NUTIs.

Microorganism	n	%
Escherichia coli	29	21.80
Coagulase negative staphylococci	22	16.54
Pseudomonas aeruginosa	17	12.78
Klebsiella pneumoniae	14	10.53
Yeasts	9	6.77
Acinetobacter baumannii	7	5.26
Klebsiella oxytoca	5	3.76
Pseudomonas cepacia	4	3.01
Staphylococcus-coagulase (+)	4	3.01
Serratia odorifera	4	3.01
Citrobacter freundii	3	2.26
Enterobacter cloacae	3	2.26
Morganella morganii	3	2.26
Streptococcus-non hemolytic	3	2.26
Proteus mirabilis	2	1.50
Enterobacter aerogenes	1	0.75
Enterobacter sp	1	0.75
Streptococcus-alpha hemolytic	1	0.75
Serratia marcescens	1	0.75

Discussion

As in this study, urethral catheterization or instrumentation is the most important risk factor for NUTIs and the reported prevalence varies between 48-92% (2, 3). *E. coli* was the most commonly isolated uropathogen followed by *Pseudomonas sp.* among gram negative bacteria as also reported by many authors (2, 4-7). Many authors have reported that gram negative bacteria have greater isolation rates than other microorganisms in NUTIs and their isolation percentages vary between 45 and 74 as seen in this study (8-10). Among investigators, reported isolation rates for gram positive bacteria vary between 3.3% and 19.0% (2, 6, 11). However, steadily increasing isolation rates of gram positives have been reported by some authors, also (8, 12-14). The higher percentage of isolation of gram

Table 2. Susceptibilities of gram negative rods other than non-fermentatives (n=66) to various antimicrobial agents.

Antibiotic	n	(%)	Antibiotic	n	(%)
Imipenem	65	98.5	Tobramycin	31	46.3
Nalidixic acid	51	76.1	Tetracycline	27	40.3
Amikacin	49	73.1	Trimethoprim sulfamethoxazole	27	4.03
Cefotaxime	49	73.1	Cephalothin	22	32.8
Peflacin	47	70.1	Mezlocilin	19	28.4
Netilmicin	40	59.7	Amoxicillinclavulonat	18	26.9
Ceftazidime	39	58.2	Amoxicillin	7	10.4
Gentamicin	34	50.7			

positve bacteria in this study (22.56%) may be explained by this increase.

In conclusion, although *E. coli* is the most commonly isolated bacteria in nosocomial urinary tract infections today, the isolation rate of *P. aeruginosa* is steadiy increasing particularly in catheterized patients. Trimethoprim-sulfamethoxazole and penicilins shouldn't be the drug of choice for empirical therapy because of poor susceptibilty rates. Empiric antibiotic selection should be avoided because of the changing pathogen spectrum and susceptibility patterns.

Table 3. Susceptibilities of gram positive cocci to various antimicrobial agents (*).

Antibiotic (n=30)	SCN (n=22)	SCP (n=4)	SNH (n=3)	SAH (n=1)	TOTAL (n=1)
Vancomycin	22	4	3	1	30
Fucidic Acid	21	4	3	1	29
Pristinamycin	20	4	2	0	26
Nitrofurantoin	17	3	2	0	26
Minocyclin	15	2	1	0	18
Fosfomycin	12	2	2	0	16
Trimethoprim-Sulfamethoxazole	9	3	2	1	15
Teicoplanin	8	4	3	0	15
Erythromycin	10	2	0	0	12
Oxacillin	6	1	0	0	7
Tobramycin	5	1	0	0	6
Tetracycline	4	1	1	0	6
Rifampicin	4	1	0	0	5
Peflacin	4	1	0	0	5
Lincomycin	3	2	0	0	5
Kanamycin	3	1	0	0	4
Gentamicin	3	1	0	0	4
Penicillin-G	2	0	0	0	2

SCN: *Staphylococcus*-coagulase negative; SCP; *Staphylococcus*-coagulase positive; SNH: *Streptococcus*-nonhemolytic; SAH: *Streptococcus*-alphahemolytic

* Number of susceptible strains are shown in columns.

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