Bacteriological study of hospital-acquired urinary tract infections in Erbil city

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Abstract

Background and objectives: Urinary tract infections are amongst the most common infections, Hospital-acquired urinary tract infection increases not only morbidity and mortality but also hospital costs. The objectives of this study were to determine bacteria responsible for hospital-acquired urinary tract infection, their antibiotic sensitivities and to describe the risk factors of the infection.

Methods: All urine samples fulfilling the criteria for significant bacteriuria were included in the study. Isolation and identification of bacteria was performed by standard method and susceptibility testing was determined by disk diffusion method.

Results: Out of 290 patients, 133 (45.86%) have acquired hospital-acquired urinary tract infection. Older age, hospitalization and catheterization were risk factors of the infection. *Escherichia coli* (51.70%) and *Klebsiella pneumoniae* (16.33%) represented the most common isolates. The most bacteria isolates were sensitive to ciprofloxacin, rifampin and trimethoprim + sulphamethoxazole.

Conclusion: To prevent hospital-acquired urinary tract infections, important factors must be taken into consideration, for example: avoid unnecessary urethral catheterization, choose narrow spectrum antibiotics according to antibiotic sensitivities, and investigate regularly the causative bacteria and their susceptibility patterns

Key words: Urinary tract infections; Hospital-acquired; Bacteria; Susceptibility

Introduction

Hospital-acquired infections are defined as infections which are not present or not incubating when the patient is hospitalized and are acquired during hospitalization [1, 2]. A direct correlation has been suggested between length of stay in a hospital and the incidence of hospital-acquired infections [3]. The rate of hospital-acquired urinary tract infection (HA-UTI) is determined by duration of hospitalization [4].HA-UTIs have been shown to increase the hospital stay by 2-4 days [5]. Female sex was found to be significantly associated with the acquisition of the infection. The increased risk of infection among women is probably due to their anatomic make-up, causing an easier access of the perineal flora to the bladder along the catheter as it traverses the shorter female urethra [6]. Older age is a significant factor for HA-UTIs than the younger age [7].Catheterization and instrumentation of the urinary tract are implicated as precipitating factors in approximately 80% of the cases [8]. In addition, the risk of urinary tract infection (UTI) increases by 5-8% a day of catheterization [9]. The microorganisms can gain entry to the urinary bladder during the catheterization procedure or by migration between the external catheter surface and the urethral epithelium [10]. The normal urethra is colonized with bacteria, insertion of

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a catheter through the urethra may carry some of these organisms into the bladder [9, 11].HA-UTIs can be caused by exogenous microorganisms such as *Pseudomonas aeruginosa* or by endogenous faecal or urethral microorganisms. The endogenous microorganisms responsible for UTIs include *Escherichia coli*, *Proteus* spp. and *Klebsiella* spp. [9]. *Escherichia coli* being the most common followed by *Klebsiella* spp. [6]. Antibiotic resistance increases illness, death and healthcare cost. There has been a steady increase in the level of resistance to commonly used antibiotics [4].

Methods

The study included 290 patients (131 males and 159 females). Urine samples were obtained from hospitalized patients who were in the hospitals for more than 48 hours and haven't any evidence of UTI at the time of admission at Hawler, Maternity (pregnant were excluded) and Rizgary teaching hospitals in Erbil city from January 2006 to February 2007. Data such as age, gender, presence of urinary catheter, and duration of hospitalization and symptoms of UTI were obtained. Patients instructed to collect only early morning midstream sample of urine into sterile tube [12]. All patients with an indwelling urinary catheter, the urine was collected through the draining portal of the urinary catheter using aseptic precautions [10]. All patients had given their acceptance to share in this study. The samples were processed using cultural and direct examination techniques [13]. All isolates of significant bacteriuria were identified by standard methods and confirmed by using API 20E system (bioMerieux France Co.). The antibiotic susceptibility of bacteria was determined by disk diffusion method using antibiotic containing disks on Mueller-Hinton agar (HiMedia, India) according to guidelines of National Committee for Clinical Laboratory Standards [14].

Results

Out of 290 patients were investigated, 133 (45.86%) acquired HA-UTIs by noticing significant bacteriuria. Among 131 males and 159 females included in the clinical trial, the percentage of HA-UTIs among females (49.06%) was higher than in males (41.98%), but statistically non significant (Table 1). Table (2) illustrate a higher distribution of HA-UTIs in patients of $\geq$65 years (68.42%), than that was noted in patients of age 20-34 years (24.44%), statistically the different between ages was significant ($P< 0.01$) (Table 2). The patients who were admitted to hospital for $\geq$ 8 days acquired 55.71% of HA-UTIs, statistically ($P< 0.05$) the hospitalization a risk factor (Table 3).
About 86% of HA-UTIs associated with catheter insertion from 3 to 4 days, and 48.31% have acquired the infection from 1 to 2 days of the hospitalization. However, 39.66% of the infections were not associated with urinary catheter, statistical analysis revealed that the catheterization was a risk factor (Table 4). Out of 133 HA-UTIs, 147 bacteriae were isolated, including 119 (89.47%) pure growth (monomicrobial) the remaining 9 (10.53%) of the samples had polymicrobial growth. The most frequently isolated bacteria were *Escherichia coli* (51.70%) followed by *Klebsiella pneumoniae* (16.33%) and *Pseudomonas aeruginosa* (10.20%) (Table 5).The susceptibility patterns of all isolated bacteria are shown in Table 6, *Escherichia coli* were highly sensitive to ciprofloxacin (94.74%), trimethoprim + sulphamethoxazole (92.11%) and rifampin (85.53%). *Klebsiella pneumoniae* were sensitive to rifampin (70.83%), Ciprofloxacin (66.67%), and trimethoprim + sulphamethoxazole (62.5%). Eleven isolates (73.33%) of *Pseudomonas aeruginosa* were sensitive to trimethoprim + sulphamethoxazole and nalidxic acid. All *Staphylococcus aureus* were sensitive to rifampin.

Table 1: Number and percentage of HA-UTI among male and female patients

Patients	Male		Female		Male and Female	
	No.	%	No.	%	No.	%
HA-UTI (significant bacteriuria)	55	41.98	78	49.06	133	45.86
Non-significant bacteriuria	76	58.02	81	50.94	157	54.14
Total	131		159		290	

No significant difference between males and females, $X^2 = 1.45$.

Table 2: Age distribution among patients with HA-UTI.

Patients	Age groups (years)									
	20 –34		35 – 49		50 – 64		≥ 65		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
HA-UTI (significant bacteriuria)	22	24.44	41	47.67	57	60	13	68.42	133	45.86
Non-significant bacteriuria	68	75.56	45	52.33	38	40	6	31.58	157	54.14
Total	90		86		95		19		290	

Table 3: Relation between hospitalization and HA-UTI

Patients	Hospitalization groups (days)							
	2 - 4		5 - 7		≥ 8		Total	
	No.	%	No.	%	No.	%	No.	%
HA-UTI (significant bacteriuria)	36	35.64	58	48.74	39	55.71	133	45.86
Non-significant bacteriuria	65	64.36	61	51.26	31	44.29	157	54.14
Total	101		119		70		290	

Significant difference between hospitalization ($P< 0.05$), $X^2= 7.38$

Table 4: Relation between catheterization and HA-UTI

Patients	Catheterization (days)							
	Catheterization (1-2 days)		Catheterization (3-4 days)		Total		No catheterization	
	No.	%	No.	%	No.	%	No.	%
HA-UTI (significant bacteriuria)	43	48.31	19	86.36	62	55.86	71	39.66
Non-significant bacteriuria	46	51.69	3	13.64	49	44.14	108	60.34
Total	89		22		111		179	

Highly significant difference (P< 0.01) between catheterization and no catheterization, X^2 = 7.23

Table 5: Numbers and percentages of the bacteria cause HA-UTI

Etiology of HA-UTI	No.	%
Escherichia coli	76	51.70
Klebsiella pneumoniae	24	16.33
Pseudomonas aeruginosa	15	10.20
Staphylococcus aureus	14	9.52
Enterobacter cloacae	9	6.12
Proteus mirabilis	6	4.08
Citrobacter freundii	3	2.04
Total	**147**	**100**

Table 6: Antibiotics susceptibility of the 141 isolates

Isolated bacteria		Numbers and percentages of antibiotics sensitivity								
		P	**AMP**	**AX**	**CL**	**CN**	**RF**	**SXT**	**CIP**	**NA**
Escherichia coli (No. = 76)	*No.*	6	19	23	41	55	65	70	72	47
	%	7.89	25.00	30.26	53.95	72.37	85.53	92.11	94.74	61.84
Klebsiella pneumoniae (No. = 24)	*No.*	3	2	9	14	13	17	15	16	12
	%	12.50	8.33	37.50	58.33	54.17	70.83	62.50	66.67	50.00
Pseudomonas aeruginosa (No. = 15)	*No.*	0	1	5	9	7	8	11	9	11
	%	0.00	6.67	33.33	60.00	46.67	53.33	73.33	60.00	73.33
Staphylococcus aureus (No. = 14)	*No.*	2	4	8	8	9	14	9	11	8
	%	14.29	28.57	57.14	57.14	64.29	100.00	64.29	78.57	57.14
Enterobacter cloacae (No. = 9)	*No.*	1	1	5	7	7	8	6	6	7
	%	11.11	11.11	55.56	77.78	77.78	88.89	66.67	66.67	77.78
Proteus mirabilis (No. = 6)	*No.*	0	0	1	2	3	3	4	3	4
	%	0.00	0.00	16.67	33.33	50.00	50.00	66.67	50.00	66.67
Citrobacter freundii (No. = 3)	*No.*	0	0	1	1	2	3	2	3	2
	%	0.00	0.00	33.33	33.33	66.67	100.00	66.67	100.00	66.67
Total (No. = 147)	*No.*	12	27	56	82	96	118	117	120	91
	%	8.16	18.37	38.10	55.78	65.31	80.27	79.59	81.63	61.90

P = Penicillin G, AMP = Ampicillin, AX = Amoxicillin, CL = Cephalexin, CN = Gentamicin, RF = Rifampin, SXT = Trimethoprim + Sulphamethoxazole, CIP = Ciprofloxacin, NA = Nalidxic acid.

Discussion

Urinary tract infections are the most common nosocomial infections [1, 4]. In southern Nigeria, 49.5% of patients had HA-UTIs [15]. On the other hand, the percentage of infection was higher than the study done in Turkey (28.8%) [4]. The percentage of HA-UTIs among females was higher than males, as noted from Table (1) female gender is a significant risk factors [6]. This study clarified that HA-UTIs frequency increase in elderly patients and this result is in accordance with those reported by other studies [4, 7, 16].

Regarding hospitalization, the present study delineated that it was a risk factor for occurrence of HA-UTIs and this result is in harmony with other studies [4, 17].

The results showed that catheterization was the most important risk factor of HA-UTIs in the present study. Catheterization of the urethra is recognized as the major risk factor for HA-UTI [19].The urinary catheter was a significant factor in acquiring catheter related infection [9]. A high proportion of HA-UTIs are associated with indwelling catheters [18]. About 65% of urinary tract infections were associated with

urinary catheters in Turkey [19]. It is reported that the risk of acquiring a UTI depends on the method and duration of catheterization, the quality of catheter care, and host susceptibility [4]. *Escherichia coli* was the most frequently isolated bacteria in this study followed by *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. The frequency of bacteria isolation by study done in Turkey were *Escherichia coli* (32.4%) followed by *Klebsiella* spp. (17.0%) [19]. Culture of 5477 urine samples from patients admitted to the India Institute of Medical Sciences showed that 46.15% of microorganisms identified as *Escherichia coli*, (14.58%) as *Klebsiella* species, (14.23%) as *Pseudomonas* species [(2]. It was noted from this study that *Escherichia coli* is the most common causative bacteria. This result is in agreement with the conclusion of a study by [9] that microbial flora found in the gut is always the potential source of infection. Most of the isolates in this study were resistant to oral antibiotics that are commonly used in general practice. Ciprofloxacin, rifampin and trimethoprim + sulphamethoxazole were the most effective amongst the antibiotic tested.

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