Bacterial uro-pathogens of urinary tract association with urinary catheterization

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Abstract

Urinary tract infection (UTI) is a very common problem in clinical care. It is diagnosed by the finding of significant bacteria. This study was carried out in the urology department at Al-Hussein Teaching Hospital, Thi-Qar province, south of Iraq. The bacteriological investigations were performed in the bacteriological laboratory of the hospital. Urine samples were aseptically collected from catheterised patients. Each sample was followed by the health information for patients including heath history, gender, and age. A total 104 patients with urinary catheters were studied; 86 (82.6%) patients were males, while 18 (17.3%) patients were females. The most common cause for using urinary catheter was benign prostatic hypertrophy (61.5%), postoperative (21.1%) and cardio-vascular diseases (17.3%). The common pathogens were isolated were *Escherichia coli* (27.2%) and *Klebsiella* spp. (23.6%). A high antibiotic resistance against bacterial isolates such as Ampicillin (100%) and Cephalexin (100%) was shown. Medical staff should use aseptic techniques with preparation to improve the urinary catheter care of patients. Treatment of catheter-associated UTI should be guided by the results of susceptibility test of isolated pathogens.

Key words*: UTI, urinary catheter, antibiogram

I. INTRODUCTION

Urinary tract infection (UTI) is a very common problem in clinical care. It is diagnosed by the finding of significant bacteria, a pure growth of midstream urine from two repeated specimens [1], [2]. UTI is the most common type of nosocomial infections accounting for more than forty percent of the total percentage reported by acute care hospitals [3], [4]. There are two types of UTI, first one is called uncomplicated UTI usually occurs in the healthy adult non-pregnant women, while the second one is called complicated UTI may occur in both sexes and all age groups and are commonly related to either functional and/or structural urinary tract defects (John et al. 2015).

Approximately, sixty-six to eighty-six percent of these infections usually follow equipment of urinary tract, a mainly urinary catheter [5]. Up to half of the patients requiring an indwelling urethral catheter for five days or longer will develop bacteriuria. Silent catheter-associated bacteriuria comprises a huge reservoir of antibiotic resistance in the hospital. The risk of acquiring a UTI depends on method and duration of the urinary catheter and the quality of catheter care and host susceptibility [6]. Catheter-associated UTI in healthy people is often asymptomatic and is probable to resolve spontaneously with the elimination of the catheter. Occasionally, the infection persists and leads to complications such as prostatitis, epididymitis, cystitis, pyelonephritis and Gram-negative bacteraemia particularly in high risk patients [7].

Over twenty percent of patients catheterized and maintained on hospital wards may be expected to become infected. Host factors which appear to increase the risk of acquiring catheter-associated UTI include advanced age, debilitation and the postpartum state [4], [8]. The aim of the current study is to provide scientific information about UTI association with urinary catheter and to know the essential health challenge to improve the care of catheterized patients.

11. PATIENTS AND METHODS

This study was carried out in the urology department at Al-Hussein Teaching Hospital, Thi-Qar province, south of Iraq. The bacteriological investigations were done in the bacteriological laboratory of the hospital. Urine samples were aseptically collected from catheterised patients. Each sample was followed by the health information for patients including heath history, gender, and age. Microscopic examinations of the catheter urine samples were performed to detect the presence of pus, red blood and other cells. A sterile loop was used to inoculate of catheterised urine onto appropriated media and incubated aerobically at 37 °C overnight. The isolation of bacteria was performed on common bacteriological culture media, such as blood agar, MacConkey agar, mannitol salt agar and bile esculin azide agar. Bacteria were identified according to biochemical reactions and Gram stain [9], [10]. In addition, catalase, coagulase and oxidase tests were used for the identification of the isolated bacteria, while the commercial biochemical test kits (BioMerieux API 20) were used to confirm Gram-negative and Gram positive bacteria [9]. The antibiotic susceptibility was performed by using disk diffusion method on Mueller Hinton agar. The resistance profile of the bacteria was recognized through the inhibition zone of their antibiotic items [11], [12]. The results were statistically analyzed using the SigmaPlot programme version 11. Analysis of variance (ANOVA) one way test was used. A p value of 0.05 or less was considered significant.

III. Results

A total 104 patients with urinary catheters were studied; 86 (82.6 %) patients were males, while 18 (17.3%) patients were females. The age range is 15 - 91 years. The age group 61-70 years constitutes the largest group with 34.6 % followed by the age group 71-80 (20.1 %) and age group 51-60 (16.3%). More than 82 % of patients are above 50 years of age (Table 1).

Table 1: The distribution of catheterised patients based on gender and age

Age group	Male	Female	Total n (%)
11-20	1	0	1 (0.9)
21-30	2	1	3 (2.8)
31-40	2	4	6 (5.7)
41-50	6	2	8 (7.6)
51-60	14	3	17 (16.3)
61-70	33	3	36 (34.6)
71-80	19	2	21 (20.1)
81-90	8	2	10 (9.6)
> 90	1	1	2 (1.9)
Total	86(82.6)	18(17.3)	104 (100)

$p < 0.05$

Table 2 illustrates the patients had urethral catheter placed for a duration ranged from two days to over 26 days before change or removal. In addition, all patients were usually given some antibiotic after catheterization. The most common cause for using urinary catheter was benign prostatic hypertrophy (BPH) (61.5%), postoperative (21.1 %) and cardiovascular diseases (CVD) (17.3 %).

Table 2: The causes of indwelling urinary catheter in association with the duration among catheterised patients

Causes	Duration of urinary catheter (day)						
	2-5	6-10	11-15	16-20	21-25	>26	Total n (%)
Postoperative	16	6	0	0	0	0	22 (21.1)
BPH*	2	6	23	14	8	11	64 (61.5)
CVD	2	4	5	4	3	0	18 (17.3)
Total	20	16	28	18	11	11	104 (100)

*BPH: Benign Prostate Hypertrophy, CVD: Cardiovascular diseases, $p>0.05$

Table 3 shows the duration of the using urinary catheter and could lead to develop of bacteriuria and urinary tract infections. From 104 patients, 92 (88.4 %) had a bacteriuria with UTI and 12 (11.5 %) bacteriuia without UTI.

Table 3: Development of bacteriuria and UTI among catheterised patients in association with duration of catheterisation

Duration (day)	Bacteriuria		Total
	UTI	No UTI	N (%)
2-5	3	2	5 (4.8)
6-10	7	6	13 (12.5)
11-15	12	4	16 (15.3)
16-20	18	-	18 (17.3)
21-25	22	-	22 (21.1)
>26	30	-	30 (28.8)
Total n (%)	92 (88.4)	12 (11.5)	104 (100)

$P<0.05$

A total of 110 bacteria were isolated from the 104 patients with bacteriuria. Only one species of bacteria was recovered from 98 (89.0 %) patients while two species were recovered from 6 (5.4 %) patients. *Escherichia coli* and *Klebsiella* spp. were the common pathogens isolated with 30 (27.2 %) and 26 (23.6 %) respectively (Table 4).

Table 5 shows the *in vitro* antibiotic resistance against bacterial isolates commonly used for treatment the patients such as Ampicillin (100 %), Cephalexin (100 %), Cefixime (79.7 %), Ciprofloxacin (69.4 %), Gentamicin (68.4 %), Rifampicin (59.7%), Nitrofurantoin (38.2 %), Doxycycline (31.5%), Levofloxacin (22.85 %), and Amikacin (22.1 %).

Table 4: Bacterial isolated from catheterised patients

Bacteria	N (%)
Escherichia coli	30 (27.2)
Klebsiella spp.	26 (23.6)
Pseudomonas spp.	4 (3.6)
Proteus spp.	3 (2.7)
Staphylococcus aureus	11 (10.0)
Enterococci	20 (18.1)
Staphylococcus epidermidis	16 (14.5)
Total	110 (100)

$P < 0.05$

Table 5: Antibiotic resistance percentage among bacterial isolates

Bacteria \ Antibiotic	Amp*	Gm	Lev	Cip	Amk	Cfm	Rm	Cl	Dox	F
Escherichia coli N=30 (%)	30 (100)	12 (40.0)	5 (16.6)	10 (33.3)	5 (16.6)	26 (86.6)	25 (83.3)	30 (100)	4 (13.3)	8 (26.6)
Klebsiella spp. N=26 (%)	26 (100)	7 (26.9)	2 (7.6)	14 (53.8)	3 (11.5)	11 (42.3)	12 (46.1)	26 (100)	3 (11.5)	5 (19.2)
Pseudomonas spp. N=4 (%)	4 (100)	3 (75)	0 (0)	2 (50)	1 (25)	4 (100)	2 (50)	4 (100)	1 (25)	3 (75)
Proteus spp. N=3 (%)	3 (100)	3 (100)	1 (33.3)	3 (100)	1 (33.3)	3 (100)	3 (100)	3 (100)	2 (66.6)	2 (66.6)
Staph. aureus N=11 (%)	11 (100)	9 (81.8)	5 (45.4)	9 (81.8)	2 (18.1)	8 (72.7)	4 (36.3)	11 (100)	4 (36.3)	3 (27.2)
Enterococci N=20	20 (100)	15 (75.0)	4 (20.0)	16 (80.0)	6 (30.0)	14 (70.0)	8 (40.0)	20 (100)	6 (30.0)	7 (35.0)
Staph. epidermidis N=16	16 (100)	13 (81.2)	6 (37.5)	14 (87.5)	4 (25.0)	14 (87.5)	10 (62.5)	16 (100)	6 (37.5)	3 (18.7)

*Amp: Ampicillin, Gm: Gentamycin, Lev: Levofloxacine, Cip: Ciprofloxacine, Amk: Amikacin, Cfm: Cefixime, Rm: Rifampicin, Cl: Cephalexin, Dox: Doxycycline, F: Nitrofurantoin

VI. Discussion

The common and frequent reason that predisposes to catheter-associated UTI is elderly patients [13]. In the current study, the age group 61-70 years found the largest group (34.61 %), while over 82 % of the catheterized patients were above 50 years of age. This finding agrees with a previous study [4]. Males were common infected of urinary tract (82.69 %). Although this is unusual of what obtains in a simple UTI where females tend to be more commonly suffering from UTIs, it is known that males predispose to make a lesion in urinary tract especially from benign prostatic hypertrophy (BPH) and cancer of the prostate (61.53 %). This might be clarified by the weak immune system of this group of patients due to their age [14]. On the other hand, the prevalence of urinary tract

infections showing by the current study indicates the role of catheters in the contamination of the urinary system. Through the biofilms that are developed close to catheters, bacterial colonization can occur into the urinary tract and leads to UTIs [7]. The contamination role of the urinary tract by using the catheter is shown in the current study that establishes an increase in the percentage of UTI followed of the catheterization.

Bacteriuria with UTI among catheterized patients was a high percentage (88.4 %) while bacteriuria without UTI was less percentage (11.5 %). This suggests that positive culture may not essentially show a UTI, however, a negative culture commonly eliminates as UTI [4], [15].

The high frequent Gram-negative pathogens isolated in the current study were *Escherichia coli* (27.2 %) and *Klebsiella* spp. (23.6 %), while Gram-positive pathogens

were Enterococci spp. (18.1 %) and coagulase negative Staphylococci (14.5 %). Many of these pathogens are part of the gut flora of patient but some may have been acquired as nosocomial infections from other patients or hospital staff or by contact to non-sterile equipment [16]. The predominant infection was one pathogen (89.0 %) causes UTI in catheterized patients and two pathogens were isolated in about 5.4 %. This is in agreement with other studies who have been referred the one pathogen was frequently caused UTI in catheterized patients [4], [17], [18]. The antibiogram pattern indicates that most of the pathogens in the current study were resistant to the common antibiotics which were used in the treatment of UTI patients. This high resistant

may occurred from poorly guided antibiotic prophylaxis after using urinary catheter to treat of catheter-associated UTI. Many studies have pointed to the risk of abuse drugs with a development of resistance [4], [7], [17]–[19].

In conclusion, make a consideration to the problems of the urinary catheter by enhanced the education and additional skills for catheterization. Medical staff should use an aseptic technique with preparation to improve the urinary catheter care of patients. Treatment of catheter-associated UTI in should be guided by the result of susceptibility test of isolated pathogens.

V. References

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