

Nosocomial Urinary Tract Infections in Baghdad Teaching Hospital

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المستخلص

الهدف: الهدف من الدراسة الحالية هو تحديد التهابات المسالك البولية في الردهات الجراحية والباطنية في مستشفى بغداد التعليمي وتشخيص أنواع الأحياء المجهرية الشائعة المسببة لهذا النوع من الإصابات المكتسبة من المستشفيات. كما هدفت الدراسة إلى تحديد نمط مقاومة هذه العزلات للعديد من المضادات الحيوية من جهة، ودراسة تأثير بعض المعقمات مثل اليوفيدون إيودين والكلوروكسيدين والسيتيسين على نمو هذه العزلات. **المنهجية:** دراسة وصفية للمدة من ٢٠٠٩/٦/١ ولغاية ٢٠٠٩/١١/١ إذ اختير ٢٠٠ مريض ممن أدخلوا إلى مستشفى بغداد التعليمي. قسمت العينة بواقع ١٠٠ مريض من طابق الجراحية وال١٠٠ الأخرى من طابق الباطنية. جمعت بعض المعلومات المهمة من المرضى في استمارة استبيان خاصة. زرعت نماذج الإدراج مبدئياً على أوساط زرعيه مختلفة لغرض عزل أنواع مختلفة من البكتريا المرضية، أختبرت بعدها حساسية العزلات للمضادات الحيوية شائعة الاستعمال مثل الأمبيسلين، الأميكاسين، الأكمنتين، السيفكسيم، السيفاتكسيم، السيفالكسين، السيبروفلوكساسين، الجنتاميسين، حامض النالديكسك، نايتروفورانتونين، الميثيسيلين، الريفامبيسن، السلفا والفانكوميسين، كما اختبر تأثير بعض أنواع المطهرات المستعملة في المستشفيات ويتراكيز متسلسلة مثل كلوريدات البنز الكونيم (تجارياً-السيتيسين)، الكلوروكسيدين والبتادين (تجارياً-اليوفيدون إيودين) على نمو البكتريا المسببة لالتهاب المسالك البولية.

النتائج: بينت النتائج أنّ أعلى نسبة إصابات للجهاز البولي (كإصابات مكتسبة من المستشفيات) كانت عند الذكور وضمن الفئتين العمريتين (٤٦-٥٥) سنة و(٣٦-٤٥) سنة وظهرت أعلى نسبة لدى المرضى الذين كانوا يعالجون باستعمال قنطرة الإدراج في الردهات الباطنية والجراحية على التوالي. تمّ عزل وتشخيص العديد من أنواع البكتريا المرضية السالبة لملون غرام؛ كان أكثرها شيوعاً بكتريا الزوائف الزنجارية وايشريشيا قولون وفي كلا الطابقين، تلتها بكتريا المكورات العنقودية المقاومة للميثيسيلين. بينت النتائج ظهور صفة المقاومة المتعددة للمضادات الحيوية المستعملة، كان عقار النايتروفورانتونين هو الأفضل للسيطرة على نمو كافة العزلات البكتيرية. أظهر محلول اليوفيدون إيودين وبتراكيز ١٠-١٥ % أفضل فعالية ضد مايكروبية تجاه أغلب العزلات البكتيرية قيد الدراسة قيدا. أظهرت نتائج التحليل الإحصائي فروقا معنوية بمستوى (p < 0.01) بين تأثير كل من محاليل السيتيسين والكلوروكسيدين على فعالية الأنواع البكتيرية المعزولة.

التوصيات: توصي هذه الدراسة على ضرورة استبدال قنطرة الإدراج كل يومين أو مباشرة بعد ظهور أعراض الإصابة بالتهاب المسالك البولية والاستعمال المدروس للتقنيات الحالية من التلوث وخفض مستوى الاستعمال العشوائي للمضادات الحيوية واستعمال الأفضل من أنواع المطهرات وبالتركيبة المحددة من الشركات المجهزة والكشف عن الجينات المقاومة للمضادات الحيوية باستعمال تقنيات PCR.

Abstract:

Objectives: The objectives of the present study are to identify both, the rate of urinary tract infections (UTI) in medical and surgical wards in Baghdad Teaching Hospital and the common types of microorganisms that cause this type of NIs, study the resistance of isolated microorganisms to several types of antibiotic and the effect of some disinfection material like Iodine, chlorhexidine and septicin on the growth of these isolates.

Methodology: This is descriptive study carried out from 1\6\2009 to 1\11\2009. A total of 200 patients were admitted to medical and surgical wards in Baghdad teaching hospital, patients were divided into two group 100 patients, in surgical ward and 100 patients in medical ward. Some of important information was recorded. Urine samples were cultured on different culture media in order to isolate different pathogenic bacteria. Then, the sensitivity of these isolates were tested against different antimicrobials, antibiotics (amikacin, ampicillin, cefixime, cefotaxime, cephalexin, gentamycin, nalidixic acid, nitrofurantion, rifampicin and vancomycin) and the effects of different disinfectant solutions with different concentrations; including benzalkonium chloride (septicin, commercial), chlorhexidine and povidoniodine (betadine, commercial), were tested as well on the growth of isolated bacteria.

Results: The results show that a high incidence of (UTI) as nosocomial infections appeared in medical and surgical wards in Baghdad Teaching Hospital and most of patients were male at age groups ranged from 46-55 years and 36-45 years in medical and surgical ward respectively. The highest rate of UTIs increased in patients who had needed catheterization procedures in both wards. Gram negative bacteria were commonly p. aeruginosa and E. coli, less commonly gram positive bacteria like methicillin-resistant *Satph aureus* were isolated as etiologic agents of UTIs infections in both wards. Moreover, multi-drug resistance for common use antibiotics was observed in most virulent species like *Pseudomonas aeruginos* and Methicillin resistant *Staphylococcus aureus* (MRSA). Nitrofurantion was the best drug for all bacterial isolates. It was obvious that 10-15% of povidone-iodine solution has more effect on the growth controlling of pathogenic bacteria, especially *Pseudomonas aeruginos* isolates. The results indicated significant differences (p<0.01) between the effect of Septicin and Chlorhexidine on the activity of isolated bacteria.

Recommendations: The study recommends that the catheter should be changed every 2 days, especially if signs of urinary tract infections appear and using antimicrobial catheters and intelligent use of aseptic techniques, and limiting the use of antibiotics and the use of most effective disinfectant in the exact concentration specified by the manufacture, and the detection antibiotic resistance gene using Polymerase Chain Reaction (PCR) technique.

Keywords: Nosocomial infections, urinary tract infections, pathogenic bacteria, antibiotic resistance, disinfectant

Introduction:

Hospital acquired infections (HAI_s) are a common, costly, and potentially lethal patient safety problem⁽¹⁻²⁾. It also called nosocomial infections; they are the infections which developed during hospitalization between 2-4 days after admitted patient to hospital and were not incubating or present at the time of admission to the hospital⁽³⁾. The common types of (HAI_s) include: urinary tract infections (UTI_s), pneumonia, surgical site infections (SSI_s), and blood stream infections (BSI_s).

Urinary tract infections account for almost 60% of all nosocomial infections^(3,4). Most HAI_s of urinary tract are associated with urethral catheterizations. Up to 25% of with hospital patients placed urinary catheter during their hospitalization⁽⁵⁾. Any pathogen present in the hospital environment can cause infection, because of the compromised immune status of some of the patients. However, organisms which can survive for long periods in hospital environment and in disinfections are specially equipped to cause hospital infections. *Escherichia coli* and *pseudomonas aeruginosa* (G-ve bacteria) are the most frequently causative agents of urinary tract infections. From the other hand, the gram positive cocci *Staphylococcus aureus* is one of the most important organisms in nosocomial infections⁽⁶⁾. Nosocomial infections are often caused by antibiotic resistant microorganism, which became a major clinical and public health problem during the lifetime of most people⁽⁷⁾. The transmission of the microorganism in the health care is occurring specific control measures are necessary. Some strains of Methicillin resistant *Staphylococcus aureus* MRSA strains are often resistant to several antibiotics in addition to the B. Lactams antibiotic, and occasionally are sensitive only to Vancomycin⁽⁸⁾.

Some chemical agents are used to control the growth of microbes on both of living tissue and inanimate objects, few chemical agents are a achieve sterility. For example, phenol and phenolics, Bisphenol, (hexachlorophene), Biguanides (Chlorhexidine), which are frequently used

for microbial control on skin and mucous membranes, it is much used for surgical an hand scrubs and preoperative skin preparation in patients. Halogens particularly iodine and chlorin are effective antimicrobial agent, both alone and as constitutes of inorganic compounds. Iodine (I₂) is one of the oldest and most effective antiseptics. The most common commercial preparation is Betadine (povidone iodine) which is a surface-active iodophor used for skin disinfection and wound treatment⁽⁷⁾.

Benzalkonium chloride (Septicin) is popular Quaternary ammonium compounds (Qauts). It is strong antimicrobial stable, tasteless, easily diluted and nontoxic, expect at high concentration, effect on G+ve bacteria but less on G-ve bacteria⁽⁹⁻¹⁰⁾. Several practices have been evaluated to prevent hospital acquired UTI, such practices include using indwelling catheters only when necessary, using antimicrobial catheters only in patients at highest risk of infection, using external or (condom-style) catheter, maintaining proper insertion technique, hand washing, intelligent use of instrumentation and limiting the use of antibiotics⁽¹¹⁻¹²⁾.

The study aims to determine the rate of UTIs at medical and surgical wards in Baghdad Teaching Hospital, find out the best way to control this type of infections, identify the most common types of microorganisms that cause this type of NIs and determination the susceptibility of isolated microorganisms to several mostly used of antibiotic, and study the effect of some disinfection materials like Iodine, Chlorhexidine and Septicin on the growth of these isolates.

Methodology:

Samples:

A total of 200 patients admitted to Baghdad Teaching Hospital from 1/6/2009 to 1/11/2009 are selected from both medical and surgical wards (100 patients of each). Urine samples are collects from all the patients at least after one week of their admission, using sterilized plastic containers. Some of the important information was recorded from each patient.

Results:**Table 1.** Distribution of patients according to their ages

Medical ward (n) %			Surgical ward (n) %		
Age group	Frequency	Percent	Age group	Frequency	Percent
5-15	2	2%	5-15	6	6%
16-25	6	6%	16-25	8	8%
26-35	20	20%	26-35	22	22%
36-45	28	28%	36-45	42	42%
46-55	30	30%	46-55	14	14%
56-65	10	10%	56-65	5	5%
66-75	4	4%	66-75	3	3%
Total	100	100%	Total	100	100%

This table shows that patients within age group (36-45) years in surgical ward and (46-55) years in medical ward, who admitted to the Baghdad teaching hospital during this study, they are more frequency infected with UTI (30%),

(42%) in medical and surgical wards respectively, while the infection rate decreased in other age groups in both wards.

Table 2. Distribution of patients according to their gender

Gender	Surgical Ward (n) %		Medical Ward (n) %	
Male	(74)	74%	(58)	58%
Female	(36)	36%	(42)	42%
Total	(100)	100%	(100)	100%

This table shows that the highest rate of infection was found in males, 74%, and 58% in surgical and medical ward respectively.

Table 3. Common Isolated Microorganisms

Types of isolated microorganisms	Medical ward n	Surgical ward n	Total
<i>Pseudomonas aeruginosa</i>	42	56	98
<i>Escherichia coli</i>	23	11	34
<i>Klebsiella pneumonia</i>	14	5	19
<i>Staphylococcus aureus</i>	13	5	18
<i>Coagulase negative Staphylococcus</i>	5	9	14
<i>Enterococcus faecalis</i>	5	1	6
<i>B hemolytic Streptococci</i>	1	4	5
<i>Serratia marcescens</i>	1	3	4
<i>Candida albicans</i>	7	2	9
Total of isolated microorganisms	115	98	213
Negative culture	8	11	29

This table illustrated the most common pathogen isolated from UTIs patient in both

wards. The Gram negative bacteria were more commonly reported as etiologic agents of UTI, as

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NCIs in medical surgical wards. The most common bacterial isolates were *Pseudomonas aeruginosa* (42, 56) isolated from UTI patients in medical and surgical ward respectively. On the other hand the most common isolates of gram positive bacteria were *Staphylococcus aureus* (13, 5) isolates in medical and surgical ward

respectively. *Candida albicans* (fungi) was isolated from 9 patient (7, 2) isolates from medical and surgical wards respectively.

Table 4. Number and percentages of resistance to antimicrobials against isolated bacteria from urine samples

Number of isolated bacteria	Antibiotics at final concentrations ($\mu\text{g/ml}$)																									
	AN* (30) Rn (%) Sn (%)		AMP (50) Rn (%) Sn (%)		AC (30) Rn (%) Sn (%)		CFM (5) Rn (%) Sn (%)		CTX (30) Rn (%) Sn (%)		KF (30) Rn (%) Sn (%)		CIP (5) Rn (%) Sn (%)		GM (10) Rn (%) Sn (%)		NA (30) Rn (%) Sn (%)		FT (30) Rn (%) Sn (%)		RF (10) Rn (%) Sn (%)		SXT (20) Rn (%) Sn (%)		VN (10) Rn (%) Sn (%)	
<i>Pseudomonas aeruginosa</i> (98)	98 0	(100) 0	98 0	100 0	42 56	41 57	87 21	89 11	33 65	34 66	98 0	100 0	79 19	81 19	98 0	100 0	98 0	100 0	11 87	11 89	98 0	100 0	98 0	100 0	83 15	85 15
<i>Escherichia coli</i> (34)	34 0	100 0	34 0	100 0	13 21	38 62	7 27	21 79	11 23	32 68	33 1	97 3	9 25	26 74	34 0	100 0	34 0	100 0	0 34	0 100	34 0	100 0	34 0	100 0	25 9	74 26
<i>Klebsiella pneumonia</i> (19)	19 0	100 00	19 0	100 0	2 17	11 89	0 19	0 100	0 19	0 100	19 0	100 0	2 17	11 8	19 0	100 0	19 0	100 0	0 19	0 100	19 0	100 0	19 0	100 0	2 17	11 89
<i>Proteus mirabilis</i> (6)	6 0	100 0	6 0	100 0	6 0	100 0	1 5	17 83	2 4	33 67	6 0	100 0	4 2	67 33	6 0	100 0	6 0	100 0	0 6	0 100	5 1	84 16	6 0	100 0	2 4	23 67
Coagulase negative <i>Staphylococcus</i> (14)	14 0	100 0	14 0	100 0	6 8	43 57	9 5	64 36	6 8	43 57	14 0	100 0	9 5	64 36	11 3	76 24	12 2	86 14	0 14	0 100	10 4	71 29	13 1	93 7	9 5	64 36
<i>Enterococcus faecalis</i> (6)	6 0	100 0	6 0	100 0	1 5	16 84	5 1	84 16	3 3	50 50	5 1	84 16	2 4	33 67	5 1	84 16	5 1	84 16	0 6	0 100	4 2	67 33	5 1	84 16	2 4	33 67
B hemolytic <i>Streptococci</i> (5)	5 0	100 0	5 0	100 0	3 2	60 40	5 0	100 0	3 2	60 40	5 1	84 16	4 1	80 20	5 0	100 0	5 0	100 0	1 4	20 80	5 0	100 0	5 0	100 0	5 0	100 0
<i>Serratia marcescens</i> (4)	4 0	100 0	3 1	75 25	0 4	0 100	2 2	50 50	0 4	0 100	0 4	0 100	0 4	0 100	1 3	25 75	1 3	25 75	0 4	0 100	3 1	75 25	3 1	75 25	0 4	0 100
<i>Staph. aureus</i> (18)	18 0	100 0	18 0	100 0	4 14	22 78	4 14	22 78	15 3	83 17	18 0	100 0	15 3	83 17	18 0	100 0	18 0	100 0	0 18	0 100	18 0	100 0	18 0	100 0	4 14	22 78

*AN: Amikacin, AMP: Ampicillin, AC: Augmentin . CFM:Cefixime, CTX: Cefetaxime , KF: Cephalexin, CIP: Ciprofloxacin, GM: Gentamycin, NA: Nalidixic acid, FA: Nitrofurantoin, RE: Rifampicin, SXT: Trimethoprim-Sulfamethoxazol, VN: Vancomycin. Rn: Resistant number. Sn: Sensitive number.

This table shows the number and percentage of antimicrobial resistance among pathogenic bacteria isolated from patients acquired UTI_s as nosocomial infections in medical and surgical wards. There was variation in the resistance to antibiotics among different bacterial isolates. *Ps. aeruginosa* isolated from urine samples were resistant to several types of antibiotics. Multidrug -resistance (Amikacin, Ampicillin, Cephalexin, Gentamycin, Nalidixic acid, Methicillin, Rifampicin and Trimethoprim) was observed in Methicillin-resistant *S. aureus* (MRSA). Nitrofurantion was the most effective drug on all bacterial isolates.

Table 5. Number and percentages of resistance to some disinfectants against isolated bacteria from urine samples

Types and Number of isolated bacteria	Disinfectant names at final concentration															
	BC1 R n (%) S n (%)	BC2 R n (%) S n (%)	BC3 R n (%) S n (%)	BC4 R n (%) S n (%)	BC5 R n (%) S n (%) (p<0.01)	BC6 R (%) S n (%)	CH1 R n (%) S n (%)	CH2 R n (%) S n (%)	CH3 R n (%) S n (%) (p<0.01)	CH4 R n (%) S n (%) (p<0.0)	CH5 R n (%) S n (%)	CH6 R n (%) S n (%)	Pi1 R n (%) S n (%)	Pi2 R n (%) S n (%) (p<0.0)	Pi3 R n (%) S n (%) (p<0.0)	Pi4 R n (%) S n (%)
<i>P.aeruginosa</i> (98)	98 100 0 0	98 100 0 0	96 98 2 2	81 83 17 17	60 61 38 39	0 0 98 100	98 100 0 0	82 83 16 16	42 43 56 57	0 0 98 100			71 72 27 28	22 23 76 78	3 3 95 97	0 0 98 100
<i>E.coli</i> (34)	32 94 2 6	26 76 8 24	13 38 21 62	6 18 28 82	0 0 34 100		33 97 1 3	30 88 4 12	23 68 11 32	8 24 26 76	2 6 32 94	0 0 34 100	16 47 18 53	5 15 25 85	0 0 34 100	
<i>K.Peumoniae</i> (19)	19 100 0 0	17 89 2 11	11 58 8 32	7 37 12 63	0 0 19 100		18 95 1 5	15 79 4 21	9 47 10 53	2 11 17 89	1 5 18 95	0 0 19 100	9 64 5 36	3 21 11 79	0 0 14 100	
<i>Proteus mirabilis</i> (6)	4 67 2 33	2 33 4 67	0 0 6 100				6 100 0 0	4 67 2 33	0 0 6 100				4 67 2 33	1 16 5 84	0 0 6 100	
<i>Staph. aureus</i> (18)	15 83 3 17	0 0 18 100					17 94 1 6	10 56 8 44	0 0 18 100				7 39 11 61	1 6 17 94	0 0 18 100	
Coagulase negative Staph (14)	9 64 5 36	0 0 14 100					10 71 4 29	2 14 12 86	0 0 14 100				3 21 11 79	0 0 14 100		
<i>Enterococcus faecalis</i> (6)	4 67 2 33	0 0 6 100					3 50 3 50	1 16 5 84	0 0 6 100				2 33 4 67	0 0 6 100		
B hemolytic Streptococci (5)	4 80 1 20	0 0 5 100					4 80 1 20	2 4 3 60	0 0 5 100				3 60 2 40			
<i>Serratia marcesens</i> (4)	4 100 0 0	0 0 4 100					2 50 2 50	2 50 2 50	0 0 4 100				3 75 1 25	0 0 4 100		

BC: Benzalkonium chloride: BC1:10µg/ml, BC2: 50µg/ml, BC3:100µg/ml, BC4:150µg/ml, BC5: 200µg/ml, BC6:300µg/ml. Ch: Chlorhexidin: ch1:10µg/ml, ch2: 50µg/ml, ch3:100µg/ml, ch4:150µg/ml, ch5:200µg/ml, ch6:300µg/ml. Pi: Povidon-iodin, Pi 1:5%, Pi 2:10%, Pi 3:15%, Pi4: 20%. Rn: Resistant number. Sn: Sensitive number.

This table Explains the effect of some disinfection material like Benzalkonium Chloride (Septicin,commercial), Chlorhexidine and Povidone-iodine (Betadine, commercial) on the growth of isolated bacteria form UTIs patients were studied on the limited concentration for controlling the growth of isolated bacteria. The results indicated that bacterial isolates showed varied response towards different concentration of disinfectant, povidone-iodine 15% (Pi3) was more effective against all bacterial isolates rather than other disinfectants. Septicin was more effective than Chlorhexidine on gram positive bacteria isolated from urine samples of UTI patients, this result showed high significant difference (p<0.01). The anti bacterial activity of septicin was higher against gram negative bacteria.

Discussion:

Hospital acquired infections are infections that are neither present nor incubating when a patient enters the hospital. About 9% of inpatients have a hospital ac within age group (36-45 years) in surgical ward and (46-55 years) in medical ward acquired infection at any one time, equivalent to at least 100,000 infections yearly⁽¹⁻²⁾.

The highest rate of UTIs found in patients within age group (36-45) years in surgical ward and (46-55 years) in medical ward table (1), most of patients were males in both wards table (2), whom usually infected with UTI_s during these age^(1, 2). So, we should be sure from hygiene and medical care by hand washing, using surgical gloves and intelligent use of instrumentation before using catheterization or preparing patients for surgical operations will be necessary⁽¹⁶⁾.

In this study, the Gram negative bacteria were more commonly reported as etiologic agents of UTI_s as NCIs in medical and surgical wards. The most common bacterial isolates were *Pseudomonas aeruginosa*, followed by *Escherichia coli* were isolated from UTI_s patients in medical and surgical wards table (3). The ability of these types of pathogenic bacteria to grow in moist conditions with simple nutrients, colonize sites catheter insertion (annular insertion) and its amazing high resistance to antibiotics, has established them to be the most pathogens and cause serious infections⁽⁶⁾. The most common isolates of gram positive bacteria were *Staphylococcus aureus*, this bacteria still one of the most important G+ve bacteria in UTI_s^(7, 17). Many different pathogens may cause nosocomial infections. The infecting organisms vary among different patient populations. Different health care settings, different facilities and different countries. Our results were consistent with⁽¹⁸⁾ they were found that urinary tract infections topped the list of nosocomial infections in ICUs medical centers and the top three pathogens of nosocomial infections for patients were *Ps. aeruginosa*, *E.coli* and *Staph. aureus*.

In the present study, there was variation in the resistance to antibiotics of the different bacterial isolates but the most important findings of significance in this study was the multi-drug-resistance (an, amp. kf, gm, na, sxt) observed in most isolated bacteria (Table 4). There are many

reasons for this problem, one of which is an over use of antibiotics by doctors as well as patients⁽¹⁹⁻²⁰⁾. The quantity of antibiotic prescribed is the major factor in increasing rates of bacterial resistance, single dose of antibiotics leads to a greater risk of resistant organisms to that antibiotic in the person for up to a year, while taking antibiotics dose less than those recommended by the doctor may increase rates of resistance. Poor hand hygiene by hospital staff has been associated with the spread of resistant organisms^(3, 7). In addition to the chromosomal change or exchange of the genetic material via plasmid and transposes. While, help in transmission and spread of drug resistance among bacteria⁽²¹⁾. Our results were consistent with recent reports⁽²¹⁻²²⁾ which had cited evidence from increased the resistance of common use antibiotic like ciprofloxacin, cefotaxime, in addition to the penicillins and other cephalosporins. *P. aeruginos* is a highly prevent opportunistic pathogen. One of worrisome characteristics of *P. aeruginos* consists in its low antibiotic susceptibility. This low susceptibility may attributable to a concerted action of multidrug efflux pump with chromosomally encoded antibiotic resistance genes and the low permeability of bacterial cellular envelopes⁽³⁾.

The current study showed the antibacterial activity of three commonly used as hand wash product disinfectants listed in table (5). Iodine is a non-metallic essential nutrient with a potent broad range of microbicide action against almost all off important health-related microorganisms, including bacteria, fungi, viruses and protozoa. Although the high content of iodine species with free molecular form (I₂) and hypoiodous acid (HOI) in aqueous solution has powerful microbicidal effects but can causes volatility stinging and cytotoxicity⁽²⁴⁾. To overcome these problems, iodine was combined with neutral carrier polymers to increase its solubility. This will keep release iodine as a solubilizing agent, be siding act as iodine reservoir and decrease the cytotoxicity⁽²⁵⁾. The most popular carrier in current use is povidone which was no microbicidal activity, since povidone slowly and continuously releases free iodine into solution; these properties help to maintain antimicrobial

capacity for a long period and to decrease toxicity beside alternated fatty acids^(6,26).

A recent comparative investigation of the antiseptics, Povidone-iodine, Chlorhexidine and Octenidine, found that only Octenidine and povidone-iodine were the most effective agent against pathogenic bacteria like *Ps. aeruginosa*, *E. coli*, MRSA, *Enterococcus faecalis* and other pathogenic bacteria⁽²⁷⁾.

Speticin is popular quaternary ammonium compounds (Quits), it is cationic detergents, widely used as a surface-active agents for pre surgical antisepsis and antiseptic treatment of skin, wounds and mucous membranes. The cleansing ability is related to its positively charged, and is considering strong bactericidal against gram positive bacteria but less active against gram negative bacteria. Speticin change the cells permeability and causes the loss of essential cytoplasm constituent such as potassium⁽⁷⁾. Massager *et al* (2001) found that speticin was more effective than Chlorhexidine against the same pathogenic G+ve bacteria⁽²⁷⁾. *Ps.aeruginosa* isolates needs high concentration of speticin to be inhibited because *Pseudomonas* not only survive in Quits but grow actively in them, because the fibers tend to neutralize the Quits⁽⁷⁾. Recent study found that 200 µg /ml of aqueous Chlorhexidine solution inhibit most experimented G+ve pathogenic bacteria and some G-ve bacteria, except the isolates of *Pseudomonas aeruginosa* needs more than 250 µg/ml of Chlorhexidine. These results are consistent with our results⁽¹⁰⁾.

Recommendations:

The study recommends that the catheter should be changed every 2 days, especially if signs of urinary tract infections appear, using antimicrobial catheters and intelligent use of aseptic techniques, limiting use of antibiotics and the use of most effective disinfectant in the exact concentration specified by the manufacture, and detecting antibiotic resistance gene using Polymerase Chain Reaction (PCR) technique.

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Appendices

Appendix 1. Antibiotics and disinfectants

Antibiotic name	Symbol	Final (working) Concentration($\mu\text{g} / \text{ml}$)
Amikacin	AN	30
Ampicillin	AMP	50
A μg mentin (Amoxicillin+Glavulanic acid)	AC	30
Cefixime	CFM	5
Cefotaxime	CF	30
Cephalexine	KF	30
Ciprofloxacin	CIP	5
Gentamycin	GM	10
Nalidixic acid	NA	30
Nitrofurantoin	FT.	30
Methicillin	MT	30
Rifampicin	RF	10
Trimethoprim-sulfamethoxazole	SXT	20
Vancomycin	VN	10
Disinfectant name	Symbol	Final(working) Concentration($\mu\text{g} / \text{ml}$)
Benzalkonium Chloride (Septicin, commercial)	BC1	10 $\mu\text{g} / \text{ml}$
	BC2	50 $\mu\text{g} / \text{ml}$
	BC3	100 $\mu\text{g} / \text{ml}$
	BC4	150 $\mu\text{g} / \text{ml}$
	BC5	200 $\mu\text{g} / \text{ml}$
Chlorhexidine	Ch1	10 $\mu\text{g} / \text{ml}$
	Ch2	50 $\mu\text{g} / \text{ml}$
	Ch3	100 $\mu\text{g} / \text{ml}$
	Ch4	150 $\mu\text{g} / \text{ml}$
	Ch5	200 $\mu\text{g} / \text{ml}$
Povidon-iodine (Betadine, Commercial)	Pi1	5 %
	Pi2	10%
	Pi3	15%
	Pi4	20%