Postoperative Wound Infections and the Antimicrobial Susceptibility in Baghdad Hospitals[#]

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Abstract

Nosocomial infections are one of the most important causes of mortality and morbidity in hospitals. These are major public health problems worldwide, but particularly in developing countries. The purpose of this research was to analyze the frequency of the microorganisms in the specimens taken from the surgical wounds, and to examine antimicrobial susceptibility for some isolates . Wound swabs were examined from June 2010 to January 2011. The isolates were identified by conventional methods, antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method as per NCCLS guidelines.A total of 102 wound swabs were examined 22(21.56%) swabs were sterile and 80(78.43%) were positive for microorganisms. The results showed 27.2% positive for *Pseudomonas aeruginosa*, 25.0% positive for Coagulase positive Staphylococci, 20.0% positive for Enterococcus spp., 17.5% positive for *Escherichia coli*,15.0% positive for *Klebsiella pneumonia*,13.7% for *Proteus mirabilis,*and10.0% for *Acinetobacter baumannii*. Antimicrobial susceptibility testing showed that the rate of isolates of Imipenem Resistance *Pseudomonas aeruginosa*(IRPA) were 3.7% , 11.2% positive for Vancomycin Resistance Enterococci(VRE) ,13.7% positive for both Methicillin Resistance *Staphylococcus aureus*(MRSA)and Vancomycin Resistance *Staphylococcus aureus*(VRSA) ,and 11.2% positive for Vancomycin Intermediate *Staphylococcus aureus*(VISA). We found that postoperative wound infections increase with pre and post operative hospitalization that's mean the infections can be decrease by shortening the hospitalization time.Our results appear to be maintained with strategies for preventing nosocomial infection,permanent education, strong application of protocols and urging the implementation of strict infection control policy.

Key words: nosocomial infection, surgical wound, antimicrobial susceptibility.

الخلاصة

الأصابات المتعلقة بالمستشفيات واحدة من الأسباب المهمة للموت والأمراضية في المستشفيات , وهي من المشاكل الصحية في كل انحاء العالم وبالأخص في البلدان النامية . الغرض من هذا البحث هو معرفة الأحياء المجهرية في المسحات المأخوذة من جروح العمليات , وفحص القابلية الضد مايكروبية لعدد من العزلات. تم جمع وفحص المسحات للفترة من حزيران 2010 الى كانون الثاني 2011 بالطرق التقليدية , أما فحص القابلية الضد مايكروبية فكان بطريقة كيربي- باور (طريقة الأنتشار باسنعمال الأقراص). وجد من مجموع 102 مسحة ,22(21,56%) مسحة معقمة (غير ملوثة) و 80(78,43%) مسحة موجبة (ملوثة) , كما أظهرت النتائج 27,2% مسحة موجبة لبكتريا *Pseudomonas aeruginosa* , 25,0% لبكتريا coagulase positive Staph. ,20,0% لبكتريا Enterococcus spp. ,17,5% لبكتريا *Escherichia coli* ,15.0% لبكتريا *Klebsiella pneumonia* ,13.7% لبكتريا *Proteus mirabilis* و10.0% لبكتريا *Acinetobacter baumannii*. القابلية الضد مايكروبية أظهرت نسب من العزلات المقاومة للمضاد Imipenem من بكتريا *Pseudomonas aeruginosa* (IRPA) وكانت نسبتها3,7% , و 11,2% من العزلات المقاومة للمضاد Vancomycin من بكتريا Enterococcus (VRE) و 13,7% موجبة لكل من بكتريا MRSA(Methicillin Resistance *Staphylococcus aureus*) وبكتريا VRSA (Vancomycin Resistance *Staphylococcus aureus*) و 11,2% لبكتريا VISA ((Vancomycin Intermediate *Staphylococcus aureus*. استنتجنا من بحثنا أن التلوث لجروح مابعد العمليات يزداد بزيادة مدة البقاء في المستشفيات (قبل وبعد اجراء العمليات) ,وهذا يعني أنه ممكن تقليل نسبة الأصابات بتقليل هذه المدة , لذا فأنه للحماية من أصابات المستشفيات يستوجب التثقيف الدائم والتطبيق الصارم لسياسات السيطرة على اصابات المستشفيات.

Introduction

Despite recent advances in the operative techniques and better understanding of the pathogenesis of the wound infections, postoperative wound infections continues to be a major source of morbidity and mortality for patients undergoing operative procedures. Surgical site infections (SSIs), as they are called today, accounted for 16% of all hospital-acquired infections, making them the third most frequent type of nosocomial infections in developed countries. The rates were higher in developing countries, and vary from 7% to 40% [(1,2)].

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The organisms causing most nosocomial infections usually come from the patient's own body (endogenous flora). They also can come from contact with staff (cross-contamination), contaminated instruments and needles, and the environment (exogenous flora). Because patients are highly mobile and hospitalizations are becoming shorter, patients often are discharged before the infection becomes apparent. In fact, a large portion of nosocomial infections in hospitalized patients—and all from ambulatory care facilities—become apparent only after the patients are discharged. As a consequence, it is often difficult to determine whether the source of the organism causing the infection is endogenous or exogenous [3],it is very useful to explore the causes of these infections in order to timely detect and remove the causative agents [4,5], with plentiful using of invasive technologies, severe and fatal nosocomial infections cause many damages every day [6].These infections also contribute greatly to the economic costs of surgical procedures and the estimated range is 1.47-19.1 billion euro. This is a great problem, especially in resource of poor countries [7], therefore ,knowledge about the frequency and distribution of nosocomial infections is important to improve infection control measures as well as to develop curative strategies which, in turn, will help us in decreasing incidence associated treatment cost[8].In order to minimize the postoperative wound infections, it is important to create a safe environment by controlling four main sources of infection i.e. personnel, equipment , the environment and patient's risk factors [9].There are some indicators of the effects of infection control, most MRSA are hospital acquired and so this organism is a useful indicator. MRSA do not generally appear to be more virulent than sensitive strains but, because of their resistance patterns, they are more difficult to treat if infection occurs [10,11].The rapid increase in enterococcal strains resistant to vancomycin (VRE) and other antibiotics and their ability to pass this trait on to other pathogens, i.e. *Staphylococcus aureus*, indicates an urgent and expanding clinical problem, VISA stands for *S.aureus* with intermediate resistance to vancomycin. VRSA stands for *S. aureus* with complete resistance to vancomycin. It is probable that *S.aureus* bacteria with intermediate or complete resistance to vancomycin would be resistant to most antibiotics commonly used for staphylococcal infections [12]. *Pseudomonas aeruginosa* is an important nosocomial pathogen with its ability to propagate on medical devices, hospital environment and even in disinfectants. It causes high morbidity and mortality in the services of oncology, hematology, surgery, burn and intensive care units [13,14].

The purpose of this research was to :

- Know the incidence rate of nosocomial infection in surgical wards.
- Study some factors influencing nosocomial infections in surgical wards.
- Know the commonest organisms causing nosocomial infections.
- Develop an effective antibiotic policy to deal with the common nosocomial infection.

Materials and Methods

Sampling

The study was carried out on 102 patients admitted in the surgical wards of 4 hospitals in Baghdad city between June 2010 and January 2011.The age of patients was ranging from 12-79 years . Gender structure of patients was 54.90 % males and 45.09 % females. Surgical site infection was classified according to preoperative and post-operative hospitalization, type of the ward ,and types of bacterial organisms in each ward with examine the sensitivity of three isolated organisms .All laboratory testings were performed in the Kadhimyia Teaching Hospital .

Media

The media used for cultures were: Blood agar plates (containing blood agar base and 5% of human blood) were used to facilitate the growth of fastidious microorganisms, particularly Gram positive bacteria . Mac Conkey agar was used for selective isolation of Enterobacteriacae. The plates were incubated for20-24 hrs. at 37°c in bacteriological incubators. All isolates were identified by conventional biochemical testing according to the Medical Laboratory Manual 2004. Antimicrobial susceptibility testing was prepared by Kirby-Bauer disc diffusion method [15]on Muller-Hinton agar (Difco), the following antibiotics were tested : Methicillin , Vancomycin, Imipenem, Gentamicin, Trimethoprim, Oxacillin, Penicillin, Piperacillin.

Results and Discussion

Nosocomial infections are a significant problem throughout the world and are increasing [16]. For example, nosocomial infection rates range from as low as 1% in a few countries in Europe and the Americas to more than 40% in parts of Asia, Latin America and sub-Saharan Africa[17].The incidence of postoperative infections with bacterial growth was 78.43% from the 102 patients admitted and examined in our study, samples of wound swabs were examined: 80(78.43%) were positive and 22(21.56%) were negative (Figure 1) , it was similar to the result of Maida Sisirak et al which was 83.7% in Bosnia[1] , and it was higher than incidence rates reported from developed countries in Western Europe, such as the United Kingdom (3.1%) and the Netherlands (4.3%) [18]. In Pakistan infection rate was 22.7% [19], while in Nigeria 38.8% had Surgical Site Infections[20],

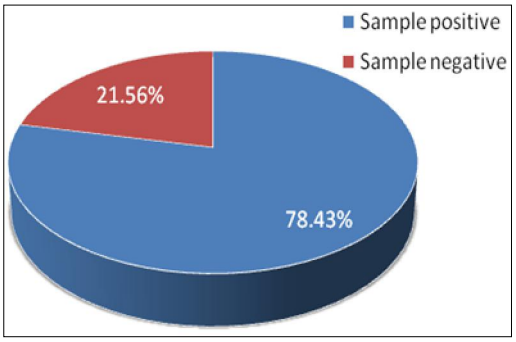


Figure 1: Review of examination samples

and it was relatively higher in patients aged 12-29 years(88.2%), and in males 48(47.05%) than females 32(31.37%) (Table 1), it might be that most male patients had lower health care behaviors than female patients ,and this evidence supported the findings of previous studies[21,22]. These factors were not significant by multivariate analysis, the results supported the findings of previous studies, especially the studied variable as age.[23,24]

Table 1: demographic data of patients with nosocomial infection (n=102)

Age(Yrs)	Examined samples No. %	Incidence of infection No. %	No. %	Incidence of infection No. %
12-29	34 33.3%	30 88.2%	(Male) 56 (54.90%)	48 (47.05%)
30- 39	23 22.5%	16 69.5%		
40- 49	19 18.6%	16 84.2%		
50- 59	10 9.8%	6 60.0%	(Female) 46 (45.09%)	32 (31.37%)
60- 69	8 7.8%	6 75.0%		
70- 79	8 7.8%	6 75.0%		
Total No.	102	80		

We found 39.2% positive for abdominal wards which showed the highest positive (Table 2), this may be due to the types of operations in these wards, this finding is compatible to a previous study [25].

Table 2: Percentage of various nosocomial infections according to the type of surgical ward.

Type of surgical ward	No. of samples	No. of positive samples	%positive of Total No.
Abdominal	48	40	39.21
Gynecology	16	10	9.80
Orthopedics	20	16	15.68
Urology	18	14	13.72
Total	102	80	78.43

The tables (3and 4) showed that postoperative wound infections increase with the hospitalization (pre and post operative) that's mean the infections can be decreased by shortening the hospitalization, and this findings are in agreement with a number of studies [1,25,26]. Antibiotic-susceptible microorganisms in body flora of the hospitalized patients can be replaced with antibiotic resistant strains which are present in hospital environment any time. Due to flora changes, prolonged hospitalization is a risk factor in all units and all types of nosocomial infections [19].

Table 3 : Surgical site infection according to pre-operative hospitalization

Pre-op hospitalization	Total	Infected	Percentage%
0-1 DAYS	46	31	67.39
2-3 DAYS	19	15	78.94
4-7 DAYS	18	15	83.33
>7 DAYS	19	19	100.0

Table 4:Surgical site infection according to post operative hospitalization

Post-op hospitalization	Total	Infected	Percentage%
1-4 DAYS	48	33	68.75
5-10 DAYS	19	15	78.94
11-15 DAYS	16	13	81.25
>15 DAYS	19	19	100.0

In the present study, *Pseudomonas aeruginosa* was the most frequent in the abdominal wards (23.3%) as in Table5 .

Table 5: Showing organisms in Abdominal wards

Culture	No. of patients	Percentage%
Coag-pos.Staph.	4	18.1
Escherichia coli	2	9.0
Pseudomonas aeroginosa	4	18.1
Klebsiella pneumoniae	–	0.0
Proteus mirabilis	–	0.0
Acinetobacter baumannii	6	27.2
Enterococcus spp.	2	9.0
Negative	4	18.1

While in Gynecology wards we found that Coag-pos.Staph. (25.0%) was the most frequent (Table6).

Table 6 : Showing organisms in Gynecology wards

Culture	No. of patients	Percentage%
Coag-pos.Staph.	5	25.0
Escherichia coli	2	10.0
Pseudomonas aeroginosa	1	5.0
Klebsiella pneumoniae	2	10.0
Proteus mirabilis	–	0.0
Acinetobacter baumannii	–	0.0
Enterococcus spp.	4	20.0
Negative	6	30.0

In Table 7 the most frequent reported microorganism in Orthopedics wards was *Acinetobacter baumannii* (27.2%) .

Table 7: Showing organisms in Orthopedics wards

Culture	No. of patients	Percentage%
Coag-pos.Staph.	6	10.0
Escherichia coli	4	6.6
Pseudomonas aeroginosa	14	23.3
Klebsiella pneumoniae	10	16.6
Proteus mirabilis	8	13.3
Acinetobacter baumannii	2	3.3
Enterococcus spp.	8	13.3
Negative	8	13.3

In Urology wards(Table 8) ,the *Escherichia coli* was most common species(27.2%).

Table8: Showing organisms in Urology wards

Culture	No. of patients	Percentage%
Coag-pos.Staph.	5	22.7
Escherichia coli	6	27.2
Pseudomonas aeroginosa	2	9.0
Klebsiella pneumoniae	–	0.0
Proteus mirabilis	3	13.6
Acinetobacter baumannii	–	0.0
Enterococcus spp.	2	9.0
Negative	4	18.1

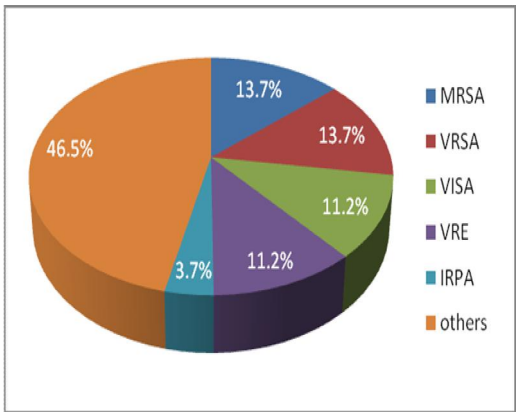
The results showed 27.2% positive for *Pseudomonas aeruginosa*, 25.0% positive for Coagulase positive Staph., 20.0% positive for *Enterococcus spp.*, 17.5% positive for *Escherichia coli* which were predominant to others as shown in (Table 9).

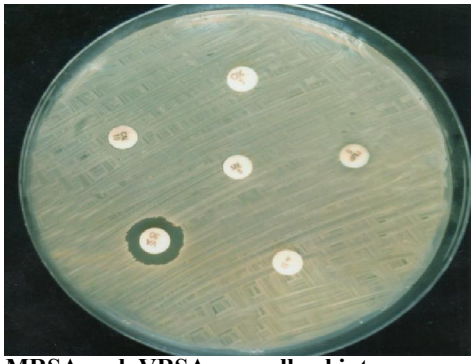
Table 9 : Shows the most common isolates from wound swabs

Isolated microorganisms	No.	Percentage%
Coag-pos.Staph.	20	25.0
Escherichia coli	14	17.5
Pseudomonas aeroginosa	21	27.2
Klebsiella pneumoniae	12	15.0
Proteus mirabilis	11	13.7
Acinetobacter baumannii	8	10.0
Enterococcus spp.	16	20.0

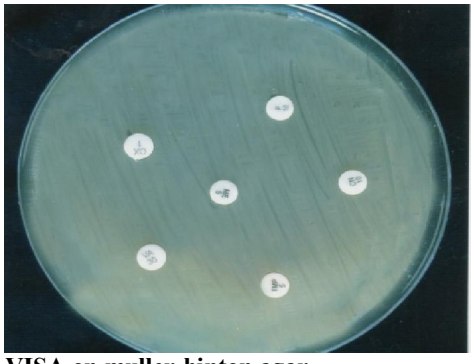
The most frequently isolated microorganisms in the postoperative wound infections was *Pseudomonas aeruginosa* (27.2%) ,among these isolates, resistance rate for Imipenem were 3.7% . Because of increase of imipenem resistance, studies were done to determine the risk factors for IRPA infections, the isolates of IRPA were often multidrug resistant causing a difficulty in the treatment and control of these infections[13].The genetic material that makes Vancomycin Resistant Enterococci(VRE) resistant to vancomycin, the vanA gene, can be transferred from the enterococci to other kinds of bacteria. If this vanA gene was to be transferred to MRSA bacteria, the end result would be *S. aureus* bacteria that are resistant to virtually all of our currently available antibiotics[12,27].The results showed 11.2% positive for VRE and13.7% positive for MRSA and VRSA and 11.2% positive for VISA (Figure 2). VISA/VRSA may spread from person-to-person in the same way as any *S. aureus* infection. *S. aureus* infections most often spread from person-to-person by direct contact. For example, in medical settings staphylococcal infections are often spread from patient to patient in unwashed health care workers' hands[1].

Figure 2: Percentage of MRSA , VRSA , VISA , VRE , IRPA in the Samples





MRSA and VRSA on muller-hinton agar



VISA on muller-hinton agar

Conclusions and Recommendations

From this study, the following points emerged as priorities to be followed in the near future: definition of the antibiotic prophylaxis policy; reduction of preoperative length of hospitalization; increased follow up surveillance and setting up systematic surveillance; and reduction of the length of procedures through adequate training of the staff on proper surgical techniques and intra-operative infection control measures.Most of the postoperative infections can be prevented with readily available, relatively inexpensive strategies by:

- adhering to recommended infection prevention practices, especially hand hygiene and wearing gloves.
- paying attention to well-established processes for decontamination and cleaning of soiled instruments and other items, followed by either sterilization or high-level disinfection.
- improving safety in operating rooms and other high-risk areas where the most serious and frequent injuries and exposures to infectious agents occur.

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