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Research article

Study of bacteria isolated post operative wound infection and their antibiogram in Hafr Albatin hospitals

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ABSTRACT

Background: Surgical site infection (SSI) is among the most common problem for patients who undergo operative procedures. It remains a common and widespread problem contributing to morbidity and mortality; partly attributed to increase in infections due to antimicrobial resistant bacterial pathogens. **Objective**: To determine the spectrum of bacteria isolates from postoperative wound infections and their antimicrobial susceptibility patterns at King Khalid (KKH) and Maternity & Children Hospitals (MCH), Hafr Al-Batin. **Methodology:** Culturing for colony characteristics followed by Gram stain was used for provisional identity of pathogenic bacteria. Further identification was done by a set of biochemical tests and MicroScan. Antimicrobial susceptibility pattern of isolated bacterial pathogens was determined by MicroScan. **Results:** *Pseudomonas aeruginosa Staphylococcus aureus* was the most frequently isolated pathogenic organism from post operative wound infections. Most of the Gram negative bacteria isolated were multiply resistant to antimicrobial agents tested; but all were sensitive to carbapenems. The findings in this study suggest that patients and health workers should adhere strictly to guidelines and policies on nosocomial infection preventions and control.

INTRODUCTION

Postoperative surgical site infection (SSI) is among the most common problems for patients who undergo operative procedures and the third most frequently reported nosocomial infection in the hospital population (Mangram et al., 1999). Postoperative surgical site infections are associated with increased morbidity, mortality, prolonged hospital stay and increased economic costs for patient care (Weigelt et al., 2010). SSIs can be reduced by appropriate use of surgical antimicrobial prophylaxis. In hospital practice 30- 50% of antibiotics are prescribed for surgical prophylaxis and 30-90% of this prophylaxis is inappropriate (Munckhof, 2005). This inappropriate use increases selection pressure favoring emergence of pathogenic drug resistant bacteria (Al-Momany et al., 2009).

The most commonly isolated bacterial pathogens are *S. aureus*, Enterobacteriaceae, Coagulase Negative Staphylococci (CoNS), Enterococci and *Pseudomonas aeruginosa* (Mahmood, 2000 and Cantlon et al., 2006). Although the pathogens isolated depend on the surgical procedure involved, recent reports have documented an increasing proportion of Gram positive organisms and decrease in number of Gram negative organisms associated with SSIs (Mangram et al., 1999). Furthermore, there is an increase in incidence of SSIs attributed to antimicrobial resistant pathogenic bacteria like methillin resistant *Staphylococcus aureus* (MRSA) (Weigelt et al., 2010 and Anderson et al, 2007) and Vancomycin resistant *Staphylococcus aureus*.

Following contamination the risk of development of SSIs will depend on several factors, the most important ones being the dose and virulence of the pathogens, and host defense mechanisms (Mangram et al., 1999). The risk of SSIs increases if the surgical site is contaminated with more than 10^5 organism per gram of tissue (Krizek and Robson, 1975). Many studies have reported a number of procedure related factors as contributory risk factors for the development of SSIs. Kaya et al in one year surveillance program in a tertiary care centre in Turkey reported abdominal incision, whole blood transfusion, early preoperative hair removal, inappropriate antimicrobial prophylaxis, famotidine treatment and repair with mesh as independent risk factors for SSI (Kaya et al., 2006). The sensitivity pattern of SSI isolates is changing due to increasing emergence of antimicrobial resistant pathogenic bacteria strains like MRSA (Anderson et al, 2007), making the choice of empirical treatment more difficult and expensive. Objectives of this study were designed to determine the bacteriological aetiology of post operative SSI among post operative patient at from King Khalid (KKH) and Maternity & Children Hospitals (MCH). Also, to determine the antimicrobial susceptibility pattern of the isolates from SSI at KKH and MCH.

MATERIALS AND METHODS

Ethical consideration

Approval for this study was obtained from the Chief Medical Director of each hospital. Confidentiality was maintained in accordance with standard Medical practice.

Sample collection

Specimens were aseptically collected using sterile cotton wool and swabs from post- operative wounds of patients who had developed pus or discharge following surgical operations. Samples were collected over a period of 3 months from King Khalid (KKH) and Maternity & Children Hospitals (MCH), Hafr Al-Batin (Octoper 2013-December 2013), 127 from patients who had undergone surgical operations in surgical, paediatric, orthopaedic, obstetrics and gynaecology wards of these hospitals. Sites of collection were Mastectomy, Leparatomy, Appendicetomy, Colostomy, Prostatectomy, Thyroidectomy, Gastrectomy, Caeserean section (C/S), Herniotomy, Ampution, Cystostomy and Osteotomy wounds.

Laboratory procedures

Swab specimens were processed and tested in the Microbiology Laboratory, MNH. Specimens were immediately cultured upon arrival in the laboratory. Culturing for colony characteristics followed by Gram stain and biochemical tests were used to identify pathogenic bacteria. Culture media used were blood, Chocolate, MacConkey and nutrient agar. Isolated pure colonies were characterized culturally, microscopically and biochemically as described by Cheesbrough (2004). All isolates exhibiting ambiguous taxonomic classification were retested with MicroScan following the manufacturer’s instructions.

Samples processing and antibiogram

88 produced cultures were subjected to MicroScan for reidentification and antibiotic susceptibility. MicroScan® instrumentation (auto SCAN®-4 and WalkAway® System) (Siemens Healthcare Diagnostics Inc, USA) was used. Panels used were MicroScan Dried Gram Positive MIC/Combo, Dried Gram Positive Breakpoint Combo and Dried Gram Positive ID Type 2 or 3. Also, MicroScan Dried Gram Negative MIC/Combo panels and Dried Gram Negative Breakpoint Combo Panels were used. MicroScan panels were designed for use in determining agent susceptibility and/or identification to the species level of rapidly growing aerobic and facultative Gram positive cocci or aerobic and facultatively anaerobic Gram negative bacilli. The tests were performed as recommended by supplier guidelines (Snyder et al., 2008). Susceptible, intermediate and resistant isolates were arranged by location in the hospital according to antibiogram results.

RESULTS

Out of the 127 surgical sites infection samples examined, 106 (83.5%) showed bacterial growth. Table 1 shows Gram stain morphology in relation to culture results. Majority 107 of specimens (84.3%) of the Gram-stained smears revealed presence of pus cells. Among these, 86.0% had bacterial growth while 14.0% had no bacterial growth. Of the 20 smears with no pus cell, 70.0% showed bacterial growth suggesting that absence of pus cell on Gram stain does not exclude the possible presence of bacteria.

Table (1): **Gram stain morphology in relation to culture results**

Gram stain morphology	Culture results		Total
	Bacterial growth	No bacterial growth	
Pus cell present	92 (86.0%)	15 (14.0%)	107 (84.3%)
Pus cell Not present	14 (70.0%)	6 (30.0%)	20 (15.7%)
Total	106 (83.5%)	21 (16.5%)	127

The 107 cultures that were positive yielded a total of 152 bacterial isolates. Gram negative organisms were more prevalent than gram positive bacteria accounting for 77.5% and 22.5% of isolates respectively. The bacteria isolated were *Staphylococcus aureus* 68(44.7%), *Pseudomonas aeruginosa* 32(21.1%), *Escherichia coli* 25 (16.4%), *Klebsiella pneumoniae* 14(9.2%), *Streptococcus* spp. 8(5.3%), *Proteus* spp. 3(2.0%) and *Enterobacter* spp. 2(1.3%) (Figure 1).

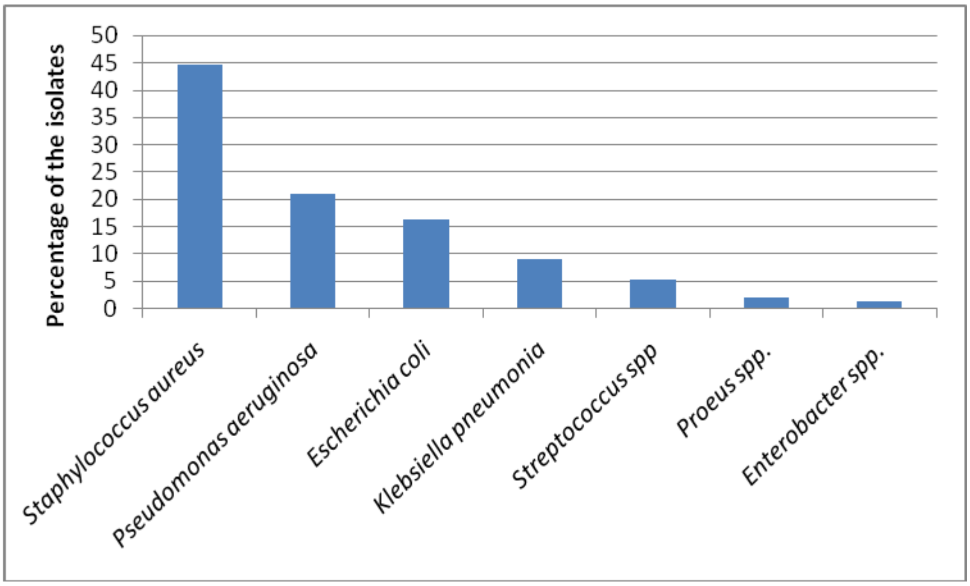

Figure 1: Bacterial isolates from post operative wound infections

The antibiotic susceptibility data for Methicillin Resistant *Staphylococcus aureus* (MRSA) and Methicillin Susceptible *Staphylococcus aureus* (MSSA) in vitro are summarized in table 2. The resistant rate to different antibiotics among MRSA strains was higher than those sensitive to methicillin. While all the MRSA strains are resistance to cefoxitin, oxacillin and penicillin, no MRSA strain resistance to vancomycin is detected from both hospitals. Resistance to other tested antibiotics was highly variable between two hospitals. In KKH, a low level of MRSA resistance to fosfomycin, teicoplanin (one strain) rifampin (2 strains) and linezolid, mupirocin, &trimeth/sulfa (3 strains) were recognized. Resistance to other antibiotics was variable with higher resistance to clindamycin, erythromycin, fusidic acid, tetracycline and moxifloxacin. In MCH, all MRSA strains were sensitive to fosfomycin, linezolid, moxifloxacin, mupirocin, tecoplanin and tetracycline but Resistance to rifampicin and fusidic acid was seen in the most isolates.

Eighty eight percent of Gram negative rods were multi-drug resistance. All Gram negative organisms tested showed low to moderate resistance (20-56%) to ciprofloxacin. Most common Gram negative isolates from SSIs were found to be highly resistant to third generation cephalosporin's frequently used for surgical prophylaxis. Most (92%) of 24 *Pseudomonas aeruginosa* isolates were sensitive to both gentamycin and ciprofloxacin.

DISCUSSION

In the current study 152 bacterial isolates were investigated to determine their types and antimicrobial susceptibility pattern. Our finding demonstrates the predominance of Gram positive bacterial isolates in SSIs, *S. aureus* being the commonest isolated organism followed by *Pseudomonas aeruginosa*, *E. coli*, and *Klebsiella pneumoniae*. This pattern of organisms causing SSIs in the current study is in agrement with previous studieswhich reported *S.aureus* as the most common SSI bacterial pathogen (Mawalla et al., 2011 and Ussiri et al., 2005).

Regarding the frequency of isolation of organisms in different surgical units in the present study, *S. aureus* was the most common isolates from orthopedic surgery while *Klebsiella pneumoniae* and *Escherichia coli* were among the most common isolates from general surgical wards. This observation is similar to findings from East central Africa by Bercion et al (Bercion et al., 2007) who reported *S. aureus* as the most frequent species isolated in orthopedics unit followed by Enterobacteriaceae and *P. aureginosa*, while Anvikar et al from developing country (Anvikar et al., 1999) documented that *Klebsiella pneumoniae* was the commonest bacteria isolated from general surgical wounds. These findings suggest that the aetiologic agents of SSIs depend on where the procedures are performed and whether skin was incised or gastrointestinal tract was opened. When gastrointestinal tract is opened, organisms usually include aerobic Gram negative rods. In the present study the majority of general surgery procedures involved colon operation, likely explaining the increased isolation of Enterobacteriaceae in surgical wards. The current investigation documented high rate of methicillin resistance among *S. aureus*; of *S. aureus* from SSI were MRSA. The findings that was relatively higher than that reported (Blomberg et al., 2004), and less higher than recently reported in other studies (Ojulong et al., 2009). In this study Gram negative bacteria displayed high rates of resistance to common prescribed inexpensive antibiotics such as ampicillin, sulphamethaxazole/Trimethoprim, Tetracycline and amoxicillin/clavulanic acid, this findings are in consistent with previous studies from the same hospital (Moyo et al., 2010).

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