Detection of antimicrobial susceptibility patterns of bacterial species isolated from burns and wounds infections in Basrah Hospitals

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Abstract

Burn and wound infection is one of the most frequent serious sicknesses caused by pathogen, chiefly by both gram positive and gram negative bacteria. This study was carried out to identify 25 bacteria isolated from burns and wounds surgical belong to the species: (Staphylococcus aureus, Staphylococcus lentus, Staphylococcus intermedius, Staphylococcus lugdunensis, Pseudomonas aeruginosa, Pseudomonas oryzihabitans, Pantoea spp., E.coli, Rhizobium radiobacter, Ochrobactrum anthropic, Burkholdria cepacia, Sphingomonas paucimobilis, Klebsiella pneumoniae, Aeromonas sobria.. Staphylococcus 9(36%) was the most dominant organism, followed by Pseudomonas 6(24%). Antibacterial activity of some antibiotics was investigated against bacterial isolates. The data demonstrate the most commonly isolated from burns and wounds surgical were Staphylococcus followed by Pseudomonas. All bacterial isolates revealed high resistance to antibiotics were used, Whereas Staphylococcus aureus revealed resistance for three antibiotic: Amikacin, Nitazoxanide, Neomycin. Pseudomonas aeruginosa revealed resistance for four antibiotic: Neomycin, Amoxicillin/Clavulanic acid, Cephalothin, Cefotaxime. Pantoea spp revealed resistance for five antibiotics: Neomycin, Trimethoprim, Amoxicillin/Clavulanic acid, Cephalothin, Cefotaxime. E.coli revealed resistance for four antibiotics: Neomycin, Trimethoprim, Amikacin, Cephalothin.

Key words: Staphylococcus; wounds; infections; Neomycin


Introduction

Burn wound infections are a major medical problems in all areas of the world (Hammoudi, 2014). They can be caused by heat, scalds, electricity, chemical agents (Mirmohammadi et al., 2013). Infections of burns caused by pathogenetic bacteria is one of the most frequent hospital problems in world, especially in modern countries (Aljanaby and Alhasnawi, 2017). Hospital acquired infection in burn patients might be caused by exogenous or endogenous. Exogenous infection is obtained during exposure to the hospital workers or medical devices, hospital environment, while Endogenous infection is induced by microorganisms present as the normal flora of the patients (Samuel et al., 2010). Infection is still source of mortality and morbidity in burn patients. It is assessed that approximately 75% of the mortality associated with burn infections is related to sepsis particularly in modern countries (Shahzad et al., 2012; AL-Aali, 2016). Burn injury is one of the most frequent and destructive forms of trauma. Patients with serious thermal injury require specialized care to minimise mortality and morbidity (Kavitha et al., 2018). Human skin surface is the main layer that represents the natural protection of the body tissues from the invasion of potential pathogens, and the occurrence of burns or injury in the skin can lead
to destroy and destruction of these tissues and may happen infections of bacteria transmitted to the blood and internal tissues, which is a proteins-rich environment and encourage the growth of microorganisms that play an important role in the pathogenicity (Mahzounieh et al., 2014). Burn injuries of patients are high risk of infections for a variety of reasons. For instance, immune compromizing effects of burns, available exposed body surface, prolonged hospital stay, invasive diagnostic and therapeutic procedures (Saaiq et al., 2015). Wounds are defined as a crash in the defensive function of the skin and damage of continuity of epithelium with or without loss of underlying connective tissue. Tainted wounds are probably to be more grievous, allergic and odoriferous, resulting in increased disquiet and malaise for the patient [Kotz et al., 2009]. Surgical wound infection is determined as festering execute from the surgical wound. It is distinguished by inflammation encircling periwound area. Surgical wound infections are the second most common cause of nosocomial infections (Bowler et al., 2001; Burke, 2003). Microorganisms that are liable for surgical wound infection cause activation of immune system results tissue destruction and inflammation. (Hosimin, 2012). The dominant microorganisms that associated with wounds infections comprise multi-drug resistant gram –positive and gram-negative bacteria, the most common microorganisms are Staphylococcus aureus which from different studies have been found to form 20-40% and Pseudomonas aeruginosa 5-15% .Escherichia coli, Klebsiella spp and Acinetobacter spp. of the nosocomial infection, with infection chiefly following surgical operation and burns (Shreshta and Sharma, 2013; Forson et al., 2017; Sida et al., 2018). Pseudomonas aeruginosa is one of the significant species among the genus Pseudomonas. P. aeruginosa is widespread distribution in nature, its virulence and its high antibacterial resistance. P. aeruginosa is nosocomial infection pathogen and an opportunistic, that causes diseases in immuno-compromised individuals (Angadi et al., 2012; Sani et al., 2012). The aim of this study is to isolate and characterize bacterial species causing burns and wounds infections from patients admitted in Basrah hospitals and determination of the antimicrobial susceptibility of bacterial isolates.

Materials and methods

Collection of specimens

Fifty three swabs have been collected from patients of burns and wounds surgical units with different sex and ages and dissolved into 2ml brain heart infusion broth media after then transported to bacteriological lab and incubated at 37°C for 48 hours. Transported samples comprise 25 post operative wounds and 28 burns from two hospitals: Al-Fayhaa General hospital, Al-Basrah General hospital.

Isolation and characterization of bacterial isolates

The swabs sticks used for collection of specimens were streaked on Nutrient, MacConkey, Blood and Mannitol salt agar and incubated overnight at 37°C. Growth of bacteria have been identified by appearance of colonies, blood hemolysis, microscopic examination by Gram stained. Then bacterial isolates were identified at level of species by using Vitek-2 compact was performed with ID-GN,ID-GP cards, according to the manufacturer’s instructions.

Antimicrobial Susceptibility tests

The antimicrobial susceptibility tests have been accomplished as present in Kirby –Bauer (1966) technique using nutrient agar and different single antimicrobial discs fitted out commercially. Zones of inhibition around the discs have been measured by millimeter(mm) using a metric ruler as present in clinical laboratories standards institute (2011). The antibiotics tested were: amikacin 30μg, cefotaxime 30 μg, cephalothin 30μg, tobramycin 10μg, trimeth- oprim 5μg, neomycin 30 μg, nitazoxanide 30μg, imipenen 10μg, meropenem 10μg, amoxicillin/clavulanic acid 20/10μg, nalidixic acid 30μg.

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Results

Out of 53 patients of burn and surgical wounds, 50 cases infected with bacteria, these isolates were identified to Gram negative and Gram positive bacteria by using conventional methods. Whereas the isolates exhibited differential pattern on blood agar and some of isolates ferment lactose when grown on MacConkey media. The identification results with Vitek2 compact system were grouped in fig 1. Among 50 bacterial isolates, 25 isolates identified to species (Staphylococcus aureus, Staphylococcus lentus, Staphylococcus intermedius, Staphylococcus lugdunensis, Pseudomonas aeruginosa, Pseudo monas oryzihabitans, Pantoea spp., E. coli, Rhizobium radiobacter, Ochrobactrum anthropic, Burkholderia cepacia, Sphingomonas paucimobilis, Klebsiella pneumoniae, Aeromonas sobria). The study revealed the commonest organism was Staphylococcus with percentage 36% (9 isolates) followed by Pseudomonas 24% (6 isolates), E. coli 8%, Pantoea 8% with (2 isolates for each), Klebsiella 4%, Rhizobium 4%, Ochrobactrum 4%, Burkholderia 4%, Sphingomonas 4% Aeromonas 4% with (1 isolate for each). The results demonstrated that the bacteria isolates characterized at species level by Vitek2 compact system was separated into four groups based upon the probability of accurate identification as follows: 8 (32%) isolates with probability of accurate identification (96 - 99%), 4 (16%) isolates with (93 - 95%), 7 (28%) isolates with good (89 - 92%), 6 (24%) isolates with (85 - 88%) as show in fig 2.

Fig 1: Bacterial species identified by Vitek 2 compact system

Fig 2: Probability of identification of bacterial spp. by Vitek2 compact
Antibiotic susceptibility patterns

*Staphylococcus aureus*

The present study showed that *Staphylococcus aureus* exhibited the highest resistance against antibiotics: Amikacin, Nitazoxanide, Neomycin, while they were sensitive to antibiotics Tobramysin, Imipenem as shown in fig 3.

*Pseudomonas aeruginosa*

The most effective antibiotics on *Pseudomonas aeruginosa* were Tobramysin, Imipenem while the highest resistance were to Neomycin, Amoxicillin/Clavulanic acid, Cephalothin, Cefotaxime as show in fig 4.

*Pantoea spp.*

The study revealed that *Pantoea spp.* exhibited the highest resistance against antibiotics: Neomycin, Trimethoprim, Amoxicillin/Clavulanic acid, Cephalothin, Cefotaxime while they were sensitive to antibiotics Tobramysin, Imipenem, Amikacin as showed in fig 5.

*E. coli*

In our study, *E. coli* exhibited the highest resistance against antibiotics: Neomycin, Trimethoprim, Amikacin, Cephalothin while they were sensitive to antibiotics Tobramysin, Imipenem as shown in fig 6.

![Fig 3: Antibiotics resistance for *Staphylococcus aureus* isolated from burns and wounds infections](image1)

![Fig 4: Antibiotics resistance for *Pseudomonas aeruginosa* isolated from burns and wounds infections](image2)
The results revealed that both Staphylococcus aureus and Pseudomonas aeruginosa exhibited high resistance against antibiotic Neomycin while both of them showed sensitive to Tobramycin, Imipenem as showed in Fig7.

Antibiotics resistance for Staphylococcus aureus and Pseudomonas aeruginosa

Fig 5: Antibiotics resistance for Pantoea spp. isolated from wounds infections

Fig 6: Antibiotics resistance for E. coli isolated from burns and wounds infections
Fig 7: Antibiotics resistance for *Staphylococcus aureus* and *Pseudomonas aeruginosa*.

Fig 8: Zone of inhibition of certain antibiotics against A:*Staphylococcus aureus*, B:*Pseudomonas aeruginosa*, C:*Pantoea* sp., D:*E. coli*.
Discussion

Bacterial infection of wounds is a grave problem in hospital, chiefly in surgical usage where the place of a sterile operation can become contaminated and subsequently infected (Pondei et al., 2013). In this study, the majority isolated organisms from burns and wounds surgical were *Staphylococcus* followed by *Pseudomonas*. The reasons for this high diffusion may be due to factors associated with the acquisition of nosocomial pathogens in patients with long term hospitalization, prior administration of antimicrobial agents, complicating illnesses, recurrent, or the immunosuppressive effects of burn; these results are not agreement with the work of Mohammed et al., (2011) but agreement with results from previous study (Kenneth, 2017). Findings from study accomplished at hospital in Nigeria revealed that the most common microorganism were *Staphylococcus aureus* (25%) and *Pseudomonas aeruginosa* (20%) (Adegoke et al., 2010). *Pseudomonas aeruginosa* in this study was resistance to four antibiotics as showed in Fig.4. A primary cause of drug resistance in gram negative bacteria is their ability to generate extended spectrum β-lactamase (Obi, 2015). In results showed that most bacterial isolates exhibited multi drugs resistant. *Pseudomonas aerogenosa* is adapted to the habitat of hospital due to biofilm construction that provides long survival advantage for the pathogens, and prevent elimination by the host immune system or antibacterial drug treatment (Groenewold et al., 2018).

Conclusion

The most common causative agents of wound, burn infections and antibiotics resistance in the present study were *Staphylococcus aureus* and *Pseudomonas aeruginosa* respectively, also the study observed that *Staphylococcus aureus* and *Pseudomonas aeruginosa* were multidrug resistant.

Acknowledgements

The author is very thankful to the department of Biology, College of Sciences, University of Basrah, Iraq where the study was accomplished.

References


