Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/burns

Changing trends in antimicrobial susceptibility pattern of bacterial isolates in a burn unit

Narendra Pal Singh [a], Mayuri Rani [a], Kavita Gupta [a,*], Tanu Sagar [b], Iqbal Rajinder Kaur [a]

[a] Department of Microbiology, University College of Medical Sciences and Guru Teg Bahadur Hospital, Dilshad Garden, Delhi-95, India

[b] Department of Microbiology, All India Institute of Medical Sciences, Delhi, India

ARTICLE INFO

Article history:
Accepted 7 January 2017

Keywords:
Multi-drug resistant isolates
Burn infections
Antibiogram
Therapeutic options

ABSTRACT

Introduction: Emerging antimicrobial resistance in nosocomial bacterial isolates, limits the available treatment options for burn wound infections, among them multi-drug resistant Gram negative bacteria and methicillin-resistant *Staphylococcus aureus* (MRSA) are major contributors to the increase in morbidity and mortality rates.

Material and methods: A retrospective cross-sectional study was done in the Department of Microbiology, University College of Medical Sciences & Guru Teg Bahadur Hospital, Delhi. A total of 818 wound samples from patients admitted in the burn wards and Intensive Care Units (ICUs) examined between 2010-2014 (5 years period). *Pseudomonas aeruginosa* was found as the most common isolate (37%) followed by *Klebsiella pneumoniae* (15%) and *Acinetobacter baumanii* (12%) among Gram negative organisms while *S. aureus* (12%) remained the major isolates among Gram positive organisms. A significant decrease in incidence of Gram positive organisms was observed in comparison with previous study. However, resistance to ceftazidime and aminoglycosides were increased significantly in Gram negative organisms. Multi-drug resistant *P. aeruginosa* (MDR PA) accounted for 15.2%, multi-drug resistant *A. baumanii* (MDR AB) was prevalent in 13.8% and MRSA in 77.4% of burn wound infections.

Discussion and conclusion: Emerging bacterial drug resistance has both clinical and financial implications for the therapy of infected burn patients. Spectrum of bacterial drug resistance in an institution is important for epidemiological as well as clinical purposes. Rising frequency of MDR strains in burn patients is alarming for clinicians as it downgrades the treatment efficacy.

1. Introduction

In spite of continual advances in treatment of the burns, wound infections still remains a huge threat to burn patients. Septic processes account for approximately 73% of all death within the initial five days of post-burn [1,2]. Presence of large amount of necrotic tissue with protein-rich wound exudates at the burn site provides a highly nutritive medium for proliferation of microbes, leading to increased rate of wound infection in these patients. Endogenous Gram negative

* *Corresponding author at*: H-204, DDA LIG Flats, Mohan Estate, All India Institute of Ayurvedic Sciences, New Delhi 110044, India.
E-mail addresses: singhnanjna@yahoo.com (N.P. Singh), dr.mayurirani@gmail.com (M. Rani), drkavitagupta2010@gmail.com, kpgsbi@gmail.com (K. Gupta), tanusagar18@gmail.com (T. Sagar), iqbalrk@yahoo.com (I.R. Kaur).
http://dx.doi.org/10.1016/j.burns.2017.01.016

bacteria originating from the patient's gastrointestinal flora, rapidly colonize the burn wound surface in the first few days after injury whereas the source of Gram positive bacteria, is from the patient's endogenous skin flora or the external environment [3,4]. Contaminated environmental surfaces, surrounding air, water, fomites and the soiled hands of health care workers are also responsible for transfer of bacteria to patient's skin surface [5].

The emergence of antimicrobial resistance among a wide variety of bacterial pathogens, particularly nosocomial isolates, restricts use of available therapeutic options; among them multi-drug resistant *Pseudomonas aeruginosa* (MDR PA), *Acinetobacter baumanii* (MDR AB) and methicillin-resistant *Staphylococcus aureus* (MRSA) are major contributors to the increase in morbidity and mortality rates [6].

The bacteriological profile and antibiogram pattern of burn wound infections usually vary in different health care settings [7,8]. Keeping this in view present study was done to retrospectively analyze the susceptibility patterns of bacterial burn wound isolates in our setting for the period of five year (2010-2014), and compared it with our previous data (1997–2002) to look for the change in resistance pattern which would enable the clinicians to determine or change the empirical antibiotic strategies for the early treatment and prevention of infections.

2. Materials & methods

A retrospective cross-sectional study was conducted in the Department of Microbiology, University College of Medical Sciences & Guru Teg Bahadur Hospital, New Delhi. A total of 818 samples (805 wound swabs and 13 biopsy samples) from patients admitted in the burn wards, intensive care units (ICUs) were received between year 2010-2014 (5 years). All wound swabs and biopsy specimens were collected from the leading edge of the wound showing signs of infection such as skin discolouration, eschar and pus. Any topical ointment applied on the site was removed with sterile gauze before sample collection.

3. Collection of surface swabs

Wound samples were collected with the help of disposable swabs and immediately put onto sterile buffer/normal saline.

4. Collection of biopsy specimens

Tissue biopsies were collected by a scalpel. Approximately 1 gm of tissue is taken and was cut into small particles then homogenized in 1 cc of sterile normal saline. 0.1 cc of each serially diluted sample inoculated on the culture media. Blood samples were also cultured after collection. All samples were subjected to microbiological analysis. Isolates were identified by conventional methods using standard techniques [9]. Antimicrobial susceptibility testing for all clinical isolates was done by Kirby-bauer disc diffusion method following CLSI guidelines by using Hi-media discs [10]. Twelve antibiotics were tested against Gram-negative bacteria which included amikacin (30 mcg), gentamicin (10 mcg), tobramycin, ceftazidime (30 mcg), cefotaxime (30 mcg) aztreonam (30 mcg), ciprofloxacin (5 mcg), carbenicillin, piperacillin + tazobactam (100/10 mcg), imipenem (10 mcg), meropenem (10 mcg) and colistin (10 mcg). For Gram positive isolates cefoxitin (30 mcg), erythromicin (15 mcg), clindamycin (2 mcg), ciprofloxacin (5 mcg), gentamicin (10 mcg), vancomycin, teicoplanin (30 mcg), linezolid (30 mcg) were tested.

MDR PA was detected, when resistant to three or more anti-pseudomonal anti-microbial classes (ceftazidime, piperacillin + tazobactam, and imipenem). MDR AB strains were identified when it was resistant to same drugs (ceftazidime, piperacillin + tazobactam, and imipenem).

Among Gram positive bacteria, methicillin-resistant *S. aureus* (MRSA) strains identified with cefoxitin disc (30 mcg) as per recent CLSI guidelines and all MRSA strains labelled as MDR *S. aureus*. MIC testing for vancomycin by E-strip method was performed in all MRSA isolates [10]. Statistical comparison of resistance patterns of all burn isolates with the previous study conducted during 1997–2002 data based on similar methodology was done using chi-square test and the p value < 0.05 was taken as significant.

5. Results

Culture positivity rate including all Gram positive & Gram negative isolates was 93.2% (762 strains were isolated out of 818 wound samples). Wound samples showing no growth and contaminants were 42 (5.1%) and 13 (1.6%) respectively. *P. aeruginosa* was the most common isolate (37%, 303/818) followed by *Klebsiella pneumoniae (K. pneumoniae)* 15% and *A. baumanii* 12% in Gram negative organisms while *S. aureus* accounting for 12% of isolates remained the major one in Gram positive organisms. A significant decrease in incidence of *Staphylococcus* sp. and *Enterococcus* sp. was observed in comparison with the previous study (Table 1). Antibiogram results from in-vitro Kirby bauer disc diffusion method demonstrated that 95% strains of *P. aeruginosa* were resistant to ceftazidime, while aminoglycosides, gentamicin and amikacin were resistant in 93% of isolates. Resistance for carbenicillin, piperacillin–tazobactam, ciprofloxacin were detected in 74.7%, 6.8%, and 90.7% respectively. Imipenem resistance was found in only 27.2% strains of *P. aeruginosa* strains. However, resistance to ceftazidime and aminoglycosides was increased significantly among Gram negative organisms.

In *A. baumanii*, Ceftazidime was found to be resistant in 98.5% isolates, gentamicin, amikacin, ciprofloxacin and piperacillin–tazobactam were resistant in 96.2%, 97.6%, 90% and 62.8% isolates respectively. Resistance for imipenem was high, 71% in Acinetobacter infections. Comparison of antimicrobial resistance in bacterial isolates of burn unit with the previous study is shown in Table 2.

In the present study MDR PA accounted 15.2%,with highest prevalence in 2011 (23.6%), and MDR AB was prevalent in 13.8% and MRSA in 77.4% of with highest prevalence in the year 2011 (88%) of all burn patients during