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ORIGINAL ARTICLE

Antibacterial susceptibility of bacteria isolated from burns and wounds of cancer patients

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Abstract In this study 540 burns and wound swabs were collected from cancer patients of some Egyptian hospitals. The single infection was detected from 210, and 70 cases among wounded and burned patients, while mixed infection was 30 and 45, respectively. We recovered where 60 isolates of *Pseudomonas aeruginosa*, 60 isolates of *Staphylococcus aureus*, 7 isolates of *Staphylococcus epidermidis*, 4 isolates of *Streptococcus pyogenes*, 25 isolates of *Escherichia coli*, 23 isolates of *Klebsiella pneumoniae* and 27 isolates of *Proteus vulgaris* from 355 burn and surgical wound infections . All bacterial isolates showed high resistance to the commonly used β-lactams (amoxycillin, cefaclor, ampicillin, vancomycin, amoxicillin/clavulonic), and low resistance to imepenim and ciprofloxacin. Plasmid analysis of six multidrug resistant and two susceptible bacterial isolates revealed the same plasmid pattern. This indicated that R-factor is not responsible for the resistance phenomenon among the isolated opportunistic bacteria. The effect of ultraviolet radiation on the isolated bacteria was studied.

1. Introduction

Hospital-acquired infections remain a cause of morbidity, extended hospital stay and death for patients (Holzheimer et al., 1990; Pruitt et al., 1998; Naeem et al., 2006). The burn and wound represent a susceptible site for opportunistic colonization by organisms of endogenous and exogenous origin (Pruitt et al., 1998). Bacterial infections in burn and wound patients are common and are difficult to control. Sepsis consequently is common and sepsis is often fatal (Lee et al., 1990; Armour et al., 2007). In Egypt, nosocomial infection constitutes a major problem. It requires more interest and attention than it currently receives as it is responsible for a great deal of morbidity and mortality among hospitalized patients in addition to unavailability of records, statistics or enough information about the problem as well as lack of universal program or approach to control it (Abdel Rahman et al., 2010). Burns, wounds, trauma, multiorgan failure and use of invasive devices for surgery, and exposure of microorganisms in the environment of hospital to a number of antimicrobial agents leading

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to selective resistance are all some of the factors facilitating colonization, transmission and susceptibility to infection (Poh and Yeo, 1993).

The infection of burn wounds with multiple organisms, with superadded problem of drug resistance, illustrates the need for a drug policy by the hospitals for burn patients. The isolated bacteria exhibited multiple resistance to antibiotics (Roberts et al., 2008). Burns provide a suitable site for bacterial multiplication and are more persistent richer sources of infection than surgical wounds, mainly because of the larger area involved and longer duration of patient stay in the hospital (Agnihotri et al., 2004). Bacterial infections in burn and wound patients are common and are difficult to control. Sepsis consequently is common and sepsis is often fatal (Lee et al., 1990; Armour et al., 2007).

Plasmids are extrachromosomal self-replicating genetic materials found in a variety of bacterial species and not essential for growth of bacteria. Plasmids could carry genes that code for drug resistance, virulence, production of antimicrobial agents and metabolic activities (Ibrahim, 2002).

The aims of this paper are to isolate and identify bacterial species causing burn and surgical wound post infections from some Egyptian hospitals as well as determination of the antimicrobial susceptibility of the isolated microorganisms and plasmid profile analysis of the most frequent isolated organisms which acquired multiple drug resistance.

2. Materials and methods

2.1. Sample collection

Swabs were collected from 540 cancer inpatients (radiotherapy treated) of burn and surgical units and transported aseptically to bacteriological labs for analysis. The patients' samples comprise 365 post operative wounds and 175 burns from three hospitals namely: El-Hussein University, Ain-Shams University and Mansoura University.

2.2. Media

The following media were prepared according to the instructions of the manufacturer, which include MacConkeys agar, nutrient agar, nutrient broth, mannitol salt agar, trypticase soya agar and urea agar base. On the other hand, blood agar medium, indole test medium, sugar fermentation medium, gelatin liquefaction medium and motility test medium were prepared according to Collee et al. (1996).

Swabs were taken from all septic wounds, one week after radiotherapy treatment. Swabs were transported into 2 ml trypticase soya bean broth and incubated aerobically at 37 °C for 18 h. Then, one loopful from each sample was streaked on MacConkey's agar, mannitol salt agar, blood agar; the plates were incubated at 37 °C for 24–48 h. Bacterial growth was identified by colony characteristics, blood hemolysis, microscopic examination of Gram stained preparations and motility techniques. Biochemical activities including oxidase test; glucose, lactose and mannitol fermentation, indole production, gelatin liquefaction, catalase activity, nitrate reduction, urease production, H_2S production, coagulase and pigment production were performed to confirm the identification of each isolate according to the methods of Manual of Methods for General Bacteriology (1981).

2.3. Antimicrobial susceptibility test

The identified isolates were tested using some antibiotics, such as amoxicillin (25 μg), Cefaclor (25 μg), ampicillin (30 μg), amoxicillin/clavulonic acid (25 μg), Ciprofloxacin (10 μg), Imepenim (10 μg) and Vancomycin (35 μg) (Oxoid, UK). The test was performed according to the Kirby–Bauer technique (Bauer et al., 1966) and results interpreted using chart of NCCLS (1994).

2.4. Plasmid profile

Plasmids of multi-drug resistant isolates were analyzed by rapid screening procedure for plasmid DNA (Kado and Lui, 1981). Plasmid DNA of susceptible antibiotic was used as a control for comparative studies.

2.5. Effect of ultraviolet (UV) irradiation on viability of bacterial growth

Nearly 2×10^8 cells/ml, for each isolate, were exposed to UV Lamp at 2600 nm (famed 1, Poland) at a distance of 30 cm for 0, 30, 60, 90, 120 and 150 s, respectively. 0.05 ml was spread (homogeneously) over nutrient agar plates after each exposure in order to obtain the viable cell count. Assay plates were also inoculated, after being diluted to a factor of 2×10^5 as 0.03 and 0.07 ml per plate, respectively, prior to exposure, to confirm the viable cell count in the original culture. One percent (1%) survival level of each isolate was calculated from the given results to show the killing effect of UV light. Results were expressed as viable cell count after each exposure as well as the 1% survival level of each isolate under investigation.

3. Results

Out of 540 cancer patients of burn and surgical wounds, 355 cases were infected with bacteria and represent 65.74% of total patients included in this study. From the 260 cases of El-Hussein University Hospital, 180 cases developed infections with an incidence rate of 69.23%. These comprised of 125 wounds infections out of 185 (67.57%) and 55 infections out of 75 (73.33%) burn cases. Out of 150 cases of surgical operations of Ain-Shams University Hospital, 90 (60%) developed wound infections. While out of 85 burn cases from Mansoura University Hospital, 45 (52.94%) developed infections (Table 1).

Table 2 shows single and mixed bacterial infections of cancer patients with wounds and/or burns. The prevalence of single bacterial infections among wounded patients was high (280 cases) and only 75 cases showed mixed bacterial infections. However, the prevalence of mixed bacterial infection in the case of burned patients was significantly higher than surgically wounded patients (42.8%), while single bacterial infections were (57.2%). At El-Hussein University Hospital out of 125 wounded patients only 15 (12%) were having mixed bacterial infections and only 20 (57.14) out of 55 burned patients were having mixed bacterial infection. At Ain-Shams University Hospital, 10 (11.11%) out of 90 wounded patients were infected with mixed infection. However, at Mansoura University Hospital, there were 20 (44.44%) out of 45 burned patients having mixed bacterial infection.