

ORIGINAL ARTICLE

Occurrence and antimicrobial profiling of *K. pneumoniae* in burn patients at burn ward, Allied Hospital, FaisalabadMUHAMMAD USMAN QAISAR¹, MUHAMMAD AAMIR ASLAM¹, KALEEM ULLAH¹, RABIA KANWAR¹, SAQIB ALI¹, IFRA FARZAND¹, ZAIN MEHMOOD¹, AMMAR HUSSAIN²,¹Institute of Microbiology, University of Agriculture Faisalabad, 38000, Pakistan²Department of Epidemiology and Public Health, University of Agriculture Faisalabad, 38000, PakistanCorrespondence to Dr. Rabia Kanwar, Email: Rabiakanwar98@gmail.com**ABSTRACT****Background:** *Klebsiella pneumoniae* is an opportunistic pathogen causing a great array of illness both in humans and animals and responsible for high mortality rate in burn patients.**Aim:** To determine occurrence of *K. pneumoniae* in burn wound patients and to check antibiotic sensitivity of *K. pneumoniae*.**Methods:** A retrospective cross sectional study was conducted and 50 samples of burn wound patients from Allied Hospital Faisalabad were taken for isolation, identification and antibiotic resistance pattern of *K. pneumoniae*. Samples then inoculated on MacConkey agar for pure colonies. For identification gram staining and biochemical test were performed. Kirby-Bauer disk diffusion technique was used to determined antibiotic sensitivity profiling *K. pneumoniae* against various disks.**Results:** On MacConkey agar mucoid, lactose fermenting pink colonies of *K. pneumoniae* were observed. Among the biochemical tests, catalase, citrate and VP test were found to be positive whereas indole and methyl red tests were found to be negative. Occurrence of *K. pneumoniae* was 28% in burn patients. Antibiotic sensitivity profiling showed that *K. pneumoniae* was found highly sensitive to Imipenem (88.94%), meropenem (79.32%), ertapenem (75%), moderately sensitive to aminoglycoside group (amikacin 59.13%, gentamicin 52.40%, Netilmicin 50.96%), piperacillin-tazobactam (53.84%) mildly sensitive to tobramycin (49.51%), nitrofurantoin (48.07%), levofloxacin (45.19%)**Conclusion:** *K. pneumoniae* and other gram negative bacilli are frequently associated with nosocomial burn infection. Furthermore, most isolates of *K. pneumoniae* from burn units were MDR *K. pneumoniae*.**Keywords:** Opportunistic pathogen, Antibiotic sensitive, Burn, Mortality, Nosocomial.**INTRODUCTION**

Klebsiella pneumoniae (*K. pneumoniae*) is a facultative anaerobic Gram-negative bacterium normally this bacterium found on skin, mouth and intestinal tract and frequently related with hospital acquired infections. It causes various illnesses and disorders such bacteraemia, wound infections, surgical site infections. In hospital settings, it causes meningitis and sepsis in premature neonates and infants as well as serious infections in immune-compromised and malnourished children¹.

K. pneumoniae accounts about for 25 to 43% of the community and hospital acquired pneumonia, predominantly in immune comprised patients. It has a quickly advanced medical course that was frequently complicated by the multi-lobular participation and the lung abscesses which leaves less time to the effective antimicrobial or antibacterial treatments. Consequently, even in treated cases the mortality rates may exceed to 50%. The community or populations that were at risk include individuals having low immunity, neonates and the patients predisposed by some types of previous surgeries or malignancy².

Klebsiella, the most widespread species of the genus Enterobacteriaceae, is notorious for producing horizontally transmissible plasmid-mediated ESBLs. MDR *Klebsiella* has been identified as an important barrier to treating infections³. Emergence of Multi drug resistance *K. pneumoniae* is threat to public health worldwide. It showed resistance to levofloxacin, moxifloxacin, chloramphenicol, trimethoprim, ampicillin and piperacillin⁴.

Infection is the main reason of death among burn patients and the number of deaths doubled because of increase in antibiotics resistance which was due to excessive use of antibiotic during admitted in the hospital. Antibiotic resistance in bacteria especially in gram negative has risen an issue among burn patients. Burn patients are immune-sensitive and main protective layer of skin is damaged, which enhance infection⁵. To overcome this problem, it is necessary that knowledge should be about which organism was causing infection in the burn wounds and which antibiotic should be used against that specific microorganism⁶. In burn patients the most prevalent pathogens found in patients were *P. aeruginosa*, *K. pneumoniae*, *A. baumannii*, and *E. coli*⁷.

This study was conducted to estimate the burden of *K. pneumoniae* in burn patients admitted in Allied hospital Faisalabad. Results from this study will help in management and making policies for antibiotic use in burn patients against this bacterium. The objective of this study is to determine the occurrence and antibiogram of *K. pneumoniae* in burn patients admitted in Allied Hospital Faisalabad.

MATERIALS AND METHODS

Isolation and Biochemical confirmation: After IRB permission, a retrospective cross sectional study was conducted from 1st January 2022 to 30th June 2022. A total of 50 swab samples were taken from burn patients admitted in Allied Burn and Reconstructive Surgery Center of Allied Hospital Faisalabad were taken with the agreement of ethical authorities. Then the collected sample was taken to the microbiology laboratory of university of Agriculture Faisalabad. Swab samples were inoculated on MacConkey Agar and Nutrient Agar to determine the colony morphology. Gram staining and different biochemical test including catalase, Indole, Methylene Red, Voges-Proskauer, Citrate (IMVC) and TSI were performed for confirmation of *K. pneumoniae*⁸.

Susceptibility test: Antibiotic sensitivity of all isolated *K. pneumoniae* was checked against various antibiotics including Imipenem (10µg), Meropenem (10µg), Ertapenem (10µg), Amikacin 30µg, Gentamicin (10µg), Netilmicin (30µg), Piperacillin/Tazobactam (100/10µg), Tobramycin (10µg), Nitrofurantoin (300µg), Aztreonam (30µg), Levofloxacin (5µg), Chloramphenicol (30µg), Amoxicillin (10µg) and Cefuroxime (30µg). Muller Hinton (MH) agar was used and antibiotic sensitivity of *K. pneumoniae* was checked by Kirby-Bauer disk diffusion technique. Disks of various antibiotics were placed over bacterial growth and incubated at 37°C. Zone of inhibitions were formed around the disk. Diameter of each zone of inhibition was measured⁹.

RESULTS

K. pneumoniae appeared large as mucoid and white color colonies on Nutrient Agar and appeared as mucoid, lactose fermenting pink colonies on MacConkey Agar (Fig. 1). It is Gram negative red colored rods under microscope after Gram staining. *K. pneumoniae* positive for catalase, Voges-Proskauer and Citrate

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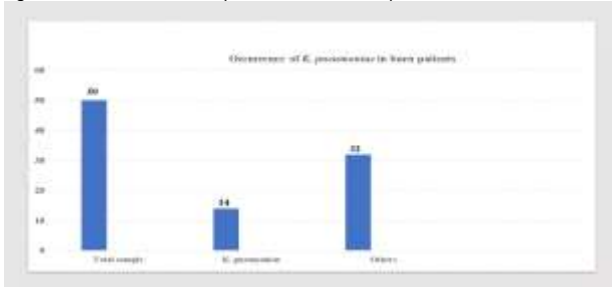
and negative for Methyl Red and Indole. The slant was yellowish on the Triple Sugar Iron (TSI) test, with no changes in butt and no H₂S produced, but a gas bubble appeared confirming *K. pneumoniae*.

Figure 1: Pink mucoid colonies on MacConkey agar of *Klebsiella pneumoniae*



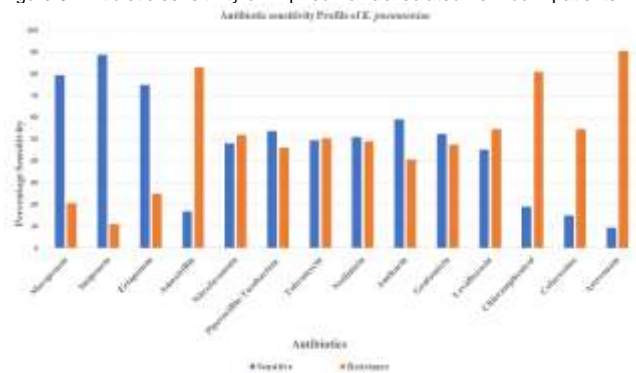
Occurrence of *K. pneumoniae* in Burn wound patient: Out of 50 samples from burn wounds of patients, 14 samples were positive for *K. pneumoniae* which make 28% occurrence and 36 were both Gram positive and other gram bacteria.

Figure 2: Occurrence of *K. pneumoniae* in burn patients



Antibiotic sensitivity: Antibiotic sensitivity of *K. pneumoniae* was checked against various antibiotics. *K. pneumoniae* was found highly sensitive to Imipenem (88.94%), meropenem (79.32%), ertapenem (75%), moderately sensitive to aminoglycoside group (amikacin 59.13%, gentamicin 52.40%, Netilmicin 50.96%), piperacillin-tazobactam (53.84%) mildly sensitive to tobramycin (49.51%), nitrofurantoin (48.07%), levofloxacin (45.19%) and least sensitive (below 20%) to chloramphenicol, amoxicillin, cefuroxime, aztreonam as shown in fig 3.

Figure 3: Antibiotic sensitivity of *K. pneumoniae* isolated from burn patients.



DISCUSSION

The global prevalence of antibiotic resistance is becoming alarming and the extent of this prevalence is destined to become worse in future. A judicious and managed use of antibiotics are helpful in limiting the antibiotics resistance. Despite safety the measures taken by the European Union in the veterinary fields, including the ban for growth promoting purposes, no significant improvement have been observed in the past few years. The

adoption of adequate prophylactic interventions i.e. immunization programs is mainly required in the present era. It ensures a reduced pool of the infective agents and also limits the antibiotic resistance.

In current study Burn wound samples from 50 different patients from Allied Burn and Reconstructive Surgery Center of Allied Hospital Faisalabad were taken and 14 samples were positive for *K. pneumoniae* contributing 28% of its occurrence. Similar study was taken in which he found occurrence of *K. pneumoniae* 52% in burn patients. *K. pneumoniae*, isolated from the samples was inoculated on MacConkey Agar and showed mucoid lactose fermenting pink colonies on the media. Color and turbidity changes were observed by inoculating on lactose broth in test tubes. The bacteria appeared as gram negative rods when viewed under a microscope after gram staining. Macroscopic examination of *K. pneumoniae* showed pink coloured mucoid colonies on petri plates⁴.

In the conducted study resistance was found against chloramphenicol, amoxicillin, cefuroxime, aztreonam, tobramycin, nitrofurantoin, levofloxacin and sensitive to Imipenem, meropenem ertapenem, amikacin, gentamicin, Netilmicin, piperacillin-tazobactam. Similarly in a study antimicrobial resistant pattern of *K. pneumoniae*, using data from "The Surveillance Network". The largest increase in antimicrobial resistance observed for ceftazidime (5.5%-7.2%), aztreonam (7.7%- 22.2%), and ciprofloxacin (5.5% - 16.9%). In our study it is also most resistance to aztreonam (9.4%), cefuroxime (15%), chloramphenicol (19%) and amoxicillin (17%)⁹. These findings emphasized the necessity of disinfecting the hospital environments and controlling interactions with both patients and staff in order to reduce *Klebsiella pneumoniae* transmission in Burn Units. Furthermore, due to the presence of increased resistance, the usage of some antimicrobials must be limited. It is also advised to use a combination of effective antibiotics.

CONCLUSION

Bacteria that were isolated from patients in the Burn Unit provide the best examples for the study of pathogenic bacterial species, particularly *K. pneumoniae*, other enteric bacilli, and *Staphylococcus aureus*, all of which are frequently responsible for human colonization. Additionally, *K. pneumoniae* and other gram-negative bacilli are commonly linked to nosocomial burn infections. Additionally, the majority of *K. pneumoniae* isolates from burn units were multidrug-resistant *K. pneumoniae*.

Conflict of interest: Nil

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