Cockroaches (Periplaneta americana L. and Blattella germanica) as Potential Vectors of Nosocomial Infections in Hospitals of Lahore, Pakistan

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ABSTRACT

Cockroaches are termed as one of the common place pest because of its wide distribution in human dwelling localities including houses, hospitals, food industries and kitchens. Its wide distribution in hospitals can be related to poor sanitary conditions, unhygienic environment, plenty of food sources and moist shady places. Their foraging behavior make them ideal vector for spreading pathogenic microbes. Worldly 7-73% of neonatal mortality is associated with nosocomial infections. Frequency of nosocomial infections is increasing day by day. Previous studies have implicated cockroaches as potential carriers of microorganisms in different parts of the world. This study was carried out to evaluate causal relationship between nosocomial infection causative agents and microbial fauna of cockroaches. Clinical samples were collected from those patients who admitted in hospitals and caught fever or any site-specific infections after 48 hours of admission into ICU and surgical wards. The collected samples were grown onto selective culture media and isolated bacteria were identified by using biochemical tests. Cockroaches were aseptically trapped from ICU and surgical wards. Microbial screening was done for cockroaches by growing saline suspension onto selective and differential media and bacterial isolates were identified by chemical tests. Pseudomonas aeruginosa (P. aeruginosa), Escherichia coli (E. coli), Staphylococcus aureus (S. aureus), Klebsiella pneumoniae (K. pneumoniae), Shigella, Salmonella and Enterococcus spp., were more prevalent isolates in all samples. Bacterial presence in clinical samples of suspected patients and on cockroach's body parts revealed their close relationship. Thus, cockroaches are probably playing a key role as vector for spreading nosocomial infections in ICU and strict environmental cleaning standard operating procedures (SOPs) should be adopted to reduce the risk of infection of this vector. 

Key words: Nosocomial infections, cockroaches, pathogenic bacteria, HAIs, hospitals, Pakistan

INTRODUCTION

Of the total 4500 species of cockroaches in the world, human inhabitation is infested with almost 30 species. However, three species of cockroaches are considered as most common pests of human dwellings. These species include: the American cockroach (Periplaneta americana L.), Oriental cockroach (Blatta orientalis) and German cockroach (Blattella germanica) (Hojat, 1996). American cockroaches are more abundant as compared to Oriental cockroaches and German cockroaches in Pakistan. Cockroaches are medically important as many illnesses and health problems have been associated with them. They carry viral and bacterial pathogens on their bodies in their faeces which can cause food poisoning, diarrhea and dysentery. Cockroaches isolated from hospitals and residential areas carry medically important microorganisms (Mlso et al., 2005).

Hospital’s environment is always assumed a huge reservoir of pathogenic microorganisms, nevertheless, they are found everywhere in this world. However, in the developed countries nosocomial infection ratio is from 5 to 10% while in developing countries above 25% of hospitalized patients (Lee, 1995). Recent studies indicated that hospital acquired infections (HAI) could be a major cause of illness and death in people who were exposed to hospital environment most of the time. Some studies have also reported that cockroaches found in hospitals are playing important role in deteriorating hospital environment and patient’s health by imposing stress, infections, anxiety, asthma, allergy in persons who have deficient immunity. Cockroaches have been found in hospital vicinity inside intensive therapy zone, medical wards, surgical wards and canteen and medical store (Sabra & Abdel-Fattah, 2012).

Hospital admitted patients are potentially exposed to environmental infections through several body passages such as open wounds, respiratory tract, urinary tract and intravenous catheters. Methicillin resistant S. aureus (MRSA) is also one of the supreme causes of nosocomial infections in hospitals. 40% to 70% hospital associated infections...
are chiefly caused by *S. aureus* in intensive care units (ICUs) in which MRSA is a major cause of HAIs. Health workers and medical staff are more likely to contract MRSA infections. These infections will ultimately lead to severe illness and deaths of medical staff and workers working on pathogenic microorganisms (Mahmood et al., 2010). Akhtar (2010) carried out research to determine the frequency of causative organisms of nosocomial infections and rate of nosocomial infections at the eight-bed medical ICU (MICU) of The Holy Family Hospital in Rawalpindi, from May 2007 to April 2008. RTIs (47.95%) and UTIs (25.3%) were the commonest infections in these patients and this is in agreement with other studies from Pakistan (Wahid et al., 2005; Shaikh et al., 2008). There are very few published reports on the epidemiology of Hospital associated infections (HAIs) in ICU patients from Pakistan. Therefore, this study was designed to find any connection between microorganisms present on, medical ICU patients acquiring nosocomial infections and, cockroaches associated with the same environment.

**MATERIALS AND METHODS**

This research was conducted at ICU and Surgical Wards of the Punjab Institute of Cardiology (PIC), Lahore. 30 Cockroaches were collected from hospital by sticky traps and external microbes were isolated and identified by standard microbial screening methods. The patients were observed for fever or any infections appearing during 48 hours of hospital admission. 20 Clinical samples (sputum, pus and epidermal swabs) were collected from suspected patients and were processed at microbiology laboratory for identification by selective media, colonial morphology, Gram staining, biochemical tests like catalase, coagulase and oxidase test.

**RESULTS**

Out of 30 collected cockroaches, American cockroaches were more prevalent and harbored more bacteria as compared to German cockroaches. Eleven different bacterial species were isolated from cockroaches' external body which included *E. coli, Enterococcus spp, Bacillus cereus, Proteus spp., K. pneumoniae, P. aeruginosa, S. epidermidis, Enterobacter spp., S. aureus, Salmonella spp. and Shigella spp.* All cockroaches were infested with *E. coli* (100%), *S. aureus* (95%) and *Bacillus cereus* (92%) (Fig., 1). Remaining bacterial isolates were randomly present on different cockroaches. *S. epidermidis* (17%) was found in only 5 cockroaches showing its lower occurrence in cockroaches. *P. americana* is more infested as compared to *B. germanica* and *B. orientalis* due to its habitat and behavior. Patient’s clinical samples demonstrate that most frequent site of infection was respiratory tract as more bacteria isolates were observed in sputum as compared to wounds and skin rashes. *K. pneumonia* (100%), *P. aeruginosa* (95%), and *E. coli* (100%) were the commonest organisms isolated from respiratory tract samples (sputum). Most RTIs were associated with mechanical ventilation as it is a major factor of RTIs in ICU. Isolation rate of other Gram-negative bacteria including *S. aureus* (90%) was relatively low in sputum but observed in wounds and skin rashes. Gram negative bacterial isolates were relatively higher in number than Gram positive bacterial isolates in both types of samples.

**DISCUSSION**

The present research indicated that Gram-negative bacteria viz., *P. aeruginosa, S. aureus, K. pneumoniae* and *E. coli* were the commonest organisms isolated from both cockroaches and clinical samples. This study is in agreement with previous studies from Pakistan (Rizvi et al., 2007; Izhar et al., 2001). In another study carried out at Hyderabad, the frequency of Respiratory Tract Infections and Urinary Tract Infections were 30.1% and 39.1% respectively (Shaikh et al., 2008). This difference could possibly be due to the difference in antibiotic prescribing practices and variations in
sample collection, culture and susceptibility testing practices. Another study was conducted in Rawalpindi hospital revealed that all collected cockroaches carry \textit{S. aureus} and \textit{E. coli} on their external body surface (Mlso et al., 2005). Indoor sanitary condition has been significantly correlated with infestation of cockroaches. Cockroaches are most probably exposed to the patient’s fecal matter as this is confirmed by the presence of \textit{E. coli}. Cockroaches are also associated with many outbreaks of gastro-enteritis, food poisoning and dysentery (Devrajani et al., 2009). The present study suggests that infestation of cockroaches in hospitals is a public health problem. They have potential to cause outbreaks of infectious and lethal diseases in hospitals and nursing homes. The abundance of cockroach population in hospitals indicates the unhygienic conditions. The best approach would be to improve and implement optimal infection prevention practices in ICUs of low resource countries. One third of these HAIs can be prevented by optimal infection prevention practices. Pest route of infection should be checked to reduce the risk.

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**REFERENCES**


