



Prevalence of Methicilin –Resistant *Staphylococcus aureus* (MRSA) in Mobile Phone of Healthcare Workers in Baghdad Teaching Hospital

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Abstract

All of the tested healthcare workers and patients mobile phones in ICU, Dialysis unit, Operation room and Laboratory hospital in Baghdad teaching hospital were contaminated 100% : 54% were Gram positive and 56% were Gram negative with 9 bacterial isolates included 4 Gram positive bacteria :MRSA *S.aureus*, *CoNS* coagulase negative staphylococci, *Streptococcus viridans* and *Bacillus spp*),while Gram negative bacteria: *E.coli*, *Pseudomonas aerogenosa*, *Klebsiella pneumonia*, *Salmonella spp* , and *Proteus spp*). The most prevalent organism was found to be MRSA *S.aureus* from workers ,nurses and patients mobile phone at (10%,8%,2%) respectively except doctor mobile phone were not contaminated by MRSA ,while highest bacterial contaminate of Gram negative bacteria *Klebsiella spp* followed by *E.coli* in all health workers and patients mobile phones at (20%,17%) respectively, while the low percentage rate in *Salmonella spp* at 3% in workers and patients mobile phone, in this study 35% of screened mobile phones of operation room healthcare workers showed bacterial contamination because of their poor health status in addition to the use of intensive equipment like catheters and canola. Samples were cultured and the resulting isolates were identified and subjected to antimicrobial susceptibility tests by standard procedures using disc diffusion method. The resistance rates to commonly used antimicrobials in isolated bacteria from mobile phones varied from 100% for Methicillin to 14% for Refamin.

Keywords: healthcare workers, mobile phone, nosocomial infection.

INTRODUCTION

Mobile phones have become an indispensable part of our lives, though they offer plenty of advantage, they are profile breeding grounds for infectious pathogens in communities and hospitals .Mobile devices used in hospitals are of particular interest, as they have been implicated in the spread of nosocomial infections ^(1,2). Microbial contamination is most commonly found on the

mouthpiece, although While indirect contamination from person to person has decreased with the decline in the use of public payphones, cell phones with buttons and keyboards and other personal mobile phones in general has been found to be even more conducive to bacterial contamination ^(3,4).

Nosocomial infections pose a serious threat to hospitals all over the world. Healthcare workers

(HCW) play a crucial role in the transmission of bacteria to hospitalized patients. Strict hygiene standards to prevent nosocomial infection are of paramount importance in a hospital setting^(5,6,7). Therefore, the presence of a pathogen on a surface at any concentration may be a risk for transmission, and this is reflected in proposed guidelines for microbiological hygiene standards. In recent years, some studies have been conducted on the potential role played by hands and the mobile phones belonging to inpatients in the transmission of important nosocomial pathogens^(8,9). The present study seeks to identify the types of bacteria contaminating mobile phones used by health workers (HCWs) and patients at Baghdad teaching hospital; it also tries to investigate the antimicrobial resistance profiles.

Material and Methods

Sample Collection

Across section study was conducted from October 2014 to March 2015, One hundred Samples were collected from mobile phone for healthcare workers and patient from four department included operation room, hospital's laboratory, dialysis unite and intensive care unit (ICU) of Baghdad teaching hospital, Each swab was rotated over the surface of both sides of the tested mobile phone keypad and screen phones. Each cotton ends of these swabs was soaked separately in tubes containing 10 ml of sterile buffered peptone water.

Isolation and identification of bacteria

Samples from mobile phones were cultured onto Blood, MacConkey, and Chocolate agar then incubated at 37°C for 24 hours. The inoculated peptone water were taken a one ml from each sample was placed in sterile petridish, then 15 ml of melted plate count agar medium was poured over the sample, the agar was thoroughly mixed with the sample and allowed to set and solidity. The plates were then inverted and incubated aerobically at 37°C for 24 hours. Pure cultures were obtained by sub-culturing distinct colonies.

Control samples underwent the same processes. Bacterial isolates were identified using standard techniques as briefly follow.

For Identification of isolates:

Isolated bacterial agents were identified according to the standard microbiological methods described by Collee *et al.*, (1996)⁽⁷⁾. They were identified using Gram's staining, colony morphology and appropriate biochemical tests.

Antibiotic Susceptibility Test (AST):

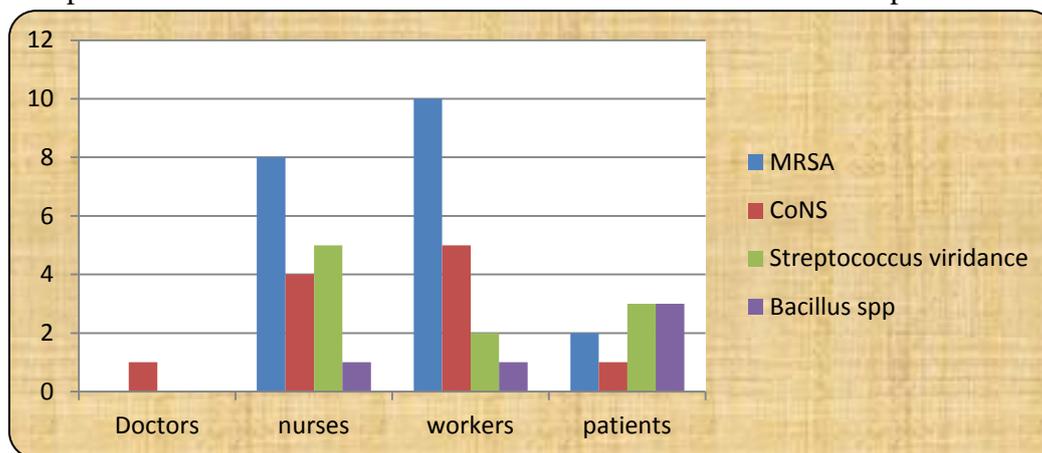
Antibiotic susceptibility were determined by the agar diffusion technique on Mueller-Hinton agar (Kirby-Bauer NCCLS modified disc diffusion technique) using 9 antibiotic discs (Biotec Lab. UK) corresponding to the drugs most commonly used in the treatment of human and animal infections caused by bacteria; Ampicillin (Amp) (10?g), Tetracycline (Tet) (10?g), Penicillin (Pen) (10IU), Erythromycin (Ery) (5?g), Ampecillin (AM) (30?g), Methicillin (ME), RA(Rifmpin) (5 µg). and Chloromphenicol (CL)(30 µg).

Results and Discussion

Out of 127 clinical samples were contaminated by different bacterial isolates, 54% were Gram positive and 56% were Gram negative, nine bacterial species isolates were included (MRSA *Staphylococcus aureus*, CoNS. *Streptococcus viridance*, *Bacillus* spp, *E.coli*, *Klebsiella* spp, *Pseudomonas aerogenosa*, *Salmonella* spp, *Proteus* spp) in health workers mobile phone at Baghdad teaching hospital .

Workers mobile phone were most contaminated by four gram positive bacteria ((MRSA *Staphylococcus aureus*, CoNS .*Streptococcus viridance*, *Bacillus* spp) by different ratio compared with other, followed by nurses mobile phone ,patients mobile phone at (19%,10%) respectively ,while Doctors mobile phone at 3% . Fig (1).

Figure (1); Gram positive bacteria isolated from different healthcare workers and patients.



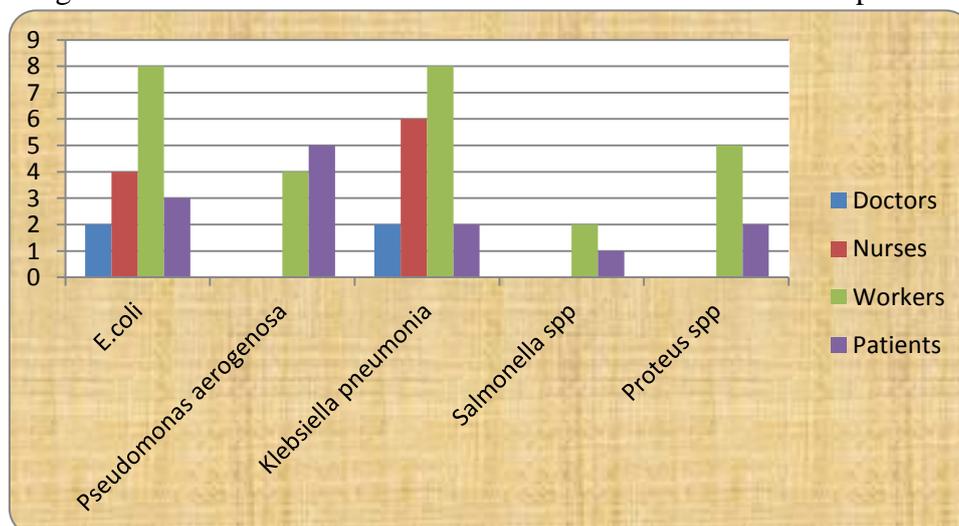
The most prevalent organism was found to be MRSA *S.aureus* from workers, nurses and patients mobile phone at (10%,8%.2%) respectively except doctor mobile phone were not contaminated by MRSA, while *Streptococcus viridance* were isolated from nurses mobile phone at 5% followed by workers and patients mobile phone at (2%,3%).

CoNS (coagulase negative *staphylococcus aureus*) and *Bacillus* spp are considered ubiquitous in the environmental are rare to cause disease but perhaps cause nosocomial infection in hospitals and immune compromise patients, from our results, CoNS and *Bacillus* spp were isolated at high percentage from nurses and workers mobile phone at (5%,3%) (4%, 2%) respectively Fig(1). Mobile phone could be a source of transmission of infections⁽¹⁰⁾.

Some mobile phones were colonized with non-pathogenic bacteria especially CoNS that constitute the normal flora of the skin, CoNS have relatively low virulence but are becoming increasing recognized as the most common cause of nosocomial bacteraemia associated with indulging devices^(11,12).

It was apparent from figure (2) that highest bacterial contaminate of Gram negative bacteria *Klebsiella* spp followed by *E.coli* in all health workers and patients mobile phones at (20%,17%) respectively ,while the low percentage rate in *Salmonella* spp at 3% in workers and patients mobile phone .The results which we have been get it from this study was important and should be taken seriously because 56% of mobile phone are contaminated and this coincide with other studies^(13,14,15).

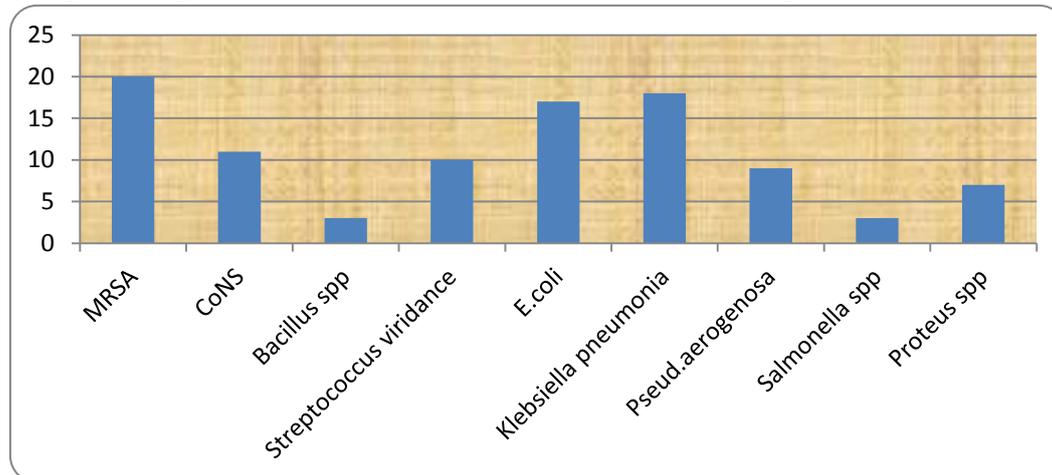
Figure (2); Gram negative bacteria isolated from different healthcare workers and patients mobile phones



From Figure (2) we notice that the percentage rate of bacterial contamination in mobile phone of health workers and patients in Baghdad teaching hospital, there are nine bacterial isolated included (MRSA *S.aureus*, CoNS coagulase negative staphylococci, *Streptococcus viridans* and *Bacillus* spp, *E.coli*, *Pseudomonas aerogenosa*,

Klebsiella pneumonia, *Salmonella* spp, *Proteus* spp)., this study showed also that the growth of Gram negative bacteria was high 56% compared with Gram positive bacteria 44%.The most prevalent organisms among gram positive and negative bacteria MRSA *S.aureus*, *Klebsiella* spp, *E.coli* at (20%,18%, 17%, 11%) respectively.

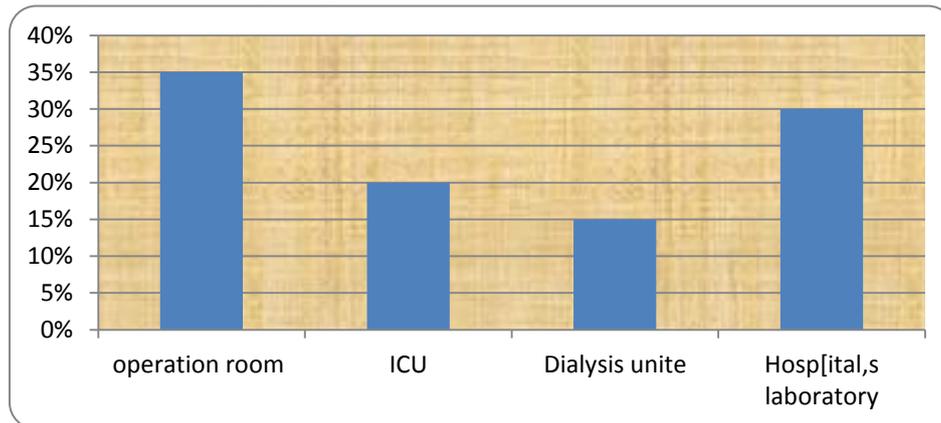
Figure (3): Total percentage rate of bacterial contamination from mobile phone health workers and patients.



It has been reported that both Gram positive and Gram negative bacteria are able to survive up to months on dry inanimate surfaces with longer persistence's under humid and lower -temperature conditions, factor that may affect the transfer of microorganisms include hand hygiene compliance. The majority of bacterial species that have been found on phone surfaces are those that are part of the normal flora of the skin and body, due to the constant contact with the hands and face. The most common normal flora of the skin species being *Staphylococcus epidermidis* and *Corynebacteria* (16,17,18). In addition, bacteria found in the mouth and the upper respiratory tract can also spread through aerosols and droplets that are released while breathing or talking into the mouthpiece (19,20). Many species are resistant to desiccation and can persist on phone surfaces for weeks, with Gram-negative bacteria usually persisting longer than their gram-positive counterparts (21). Despite this, actual colonization and growth of bacteria is rare due to the general lack of nutrients and moisture on the plastic and glass surfaces of phones.

According to the place (operation room, dialysis unit, hospital laboratory and ICU (Intensive care unit), a maximum contamination rate was observed in operation room and hospital's laboratory at 35%, 30% respectively. While the low percentage rate of contamination in Dialysis unit at 15% Fig (4). Our finding revealed the correlation between place and contamination was interesting in spreading nosocomial infections. Several published studies are in accordance with these data, a study by (21,22) demonstrated that mobile phone are highly contaminated and posed substantial risk for developing a food borne diseases or nosocomial infection.

Figure (4): Percentage rate of bacterial contamination from healthcare workers and patients mobile phones of different place in Baghdad teaching hospital .



There were many reason for the highest contamination of operation room included the inanimate environment in operation room (e.g., walls, tables, floors and equipment surfaces) has been considered a potential source of pathogens that may cause surgical site infections, despite standard environmental cleaning, these pathogens can then be transmitted to the hands of personnel and then to patients and may result infection outbreaks⁽²³⁾.

The present finding also support authors studies which concluded that there was a correlation between isolated bacterium found on health care workers' hands and their respective mobile devices, demonstrating the cross-contamination potential of mobile phones in the hospital environment. Furthermore, there is also the risk of further transmitting nosocomial pathogens outside of the hospital if health care workers use the same cell phone for personal use.

Also contamination may include infectious organisms within the healthcare sitting ,special concern should be given to contact with blood and its components, or body fluids consisting to feces ,urine ,vomits , nasal secretions ...etc. the spread of such biological material and organisms can produce illness ,infection or death especially in susceptible individuals, it should be realized that performing/conducting certain procedures /operations within healthcare /and related settings can generate especially large amounts of contamination^(24,25).

Susceptibility of bacterial isolates to 9 different antibiotics.

This study revealed that many resistant strains of different isolates were prevalent in the mobile phones that further emphasize the public health significance of the notes and clearly indicates a marked resistance to the commonly used antibiotics For example, isolates of various bacterial species recorded high rates of resistance collectively as MRS *S.aureus* was showed resistance to Methicillin, tetracycline, penicillin at100% while resistance absent for other isolates Fig (5). And high resistance for tetracycline were observed in *Streptococcus viridance* at 75%.

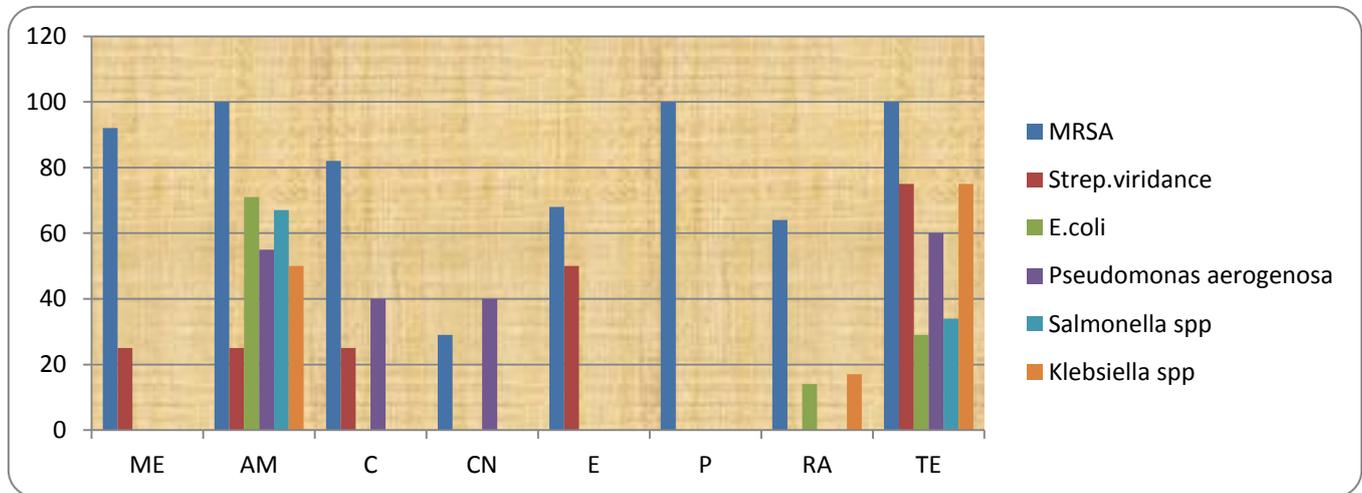
Gram negative bacteria isolates such as *E.coli*, *Pseudomonas aerogenosa*, *Klebsiella spp* and *Salmonella spp* showed vresistance to ampicillin at (71%, 55%, 67%,50%) respectively. While Salm-onella spp showed high resistance to tetracycline at 75% compared with other gram negative bacteria.

The emergency of resistance to antibiotics commonly used in bacterial isolates contaminated mobile phone which is widely recognized as responsible for many community infections for healthy persons such as MRSA *S.aureus*, *Klebsiella pneumonia*, *Pseudomonas aerogenosa*, *Streptococcus viridians* it making this mobile contagious tool (fomite) play important role in spreading and transported Drug –resistance bacteria in community which were difficult to treat.

A maximum percentage of resistance 100% was observed by MRSA *S.aureus* isolate against Methicillin, tetracycline, penicillin, this may be

due to this belonging to the same group (beta-lactam group) and their similarity in action on the cell wall⁽²⁰⁾.

Figure (5): Antibiotic Resistance Patterns of bacterial isolates from mobiles phone healthcare workers and patients to 9 different antibiotics.



AM: Ampecillin ME: Methicillin C:Cholormphenicol CN: Gentamycin E:Erethromycin P:Pencillin RA: Refamin TE; Tetracycline

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