

Types of Bacteria and Bacterial Cultures Isolated From Mobile Phones of Medical and Health Staffs at Al-Kindy Teaching Hospital in Baghdad City

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Abstract

Background: Cell phones are important source of the microbial transmission as human pathogens also may be cause increased risk for incidence of fungal or bacterial infections as well as natural microbiota of human skin (Shahaby, 2012).

Objective : aim of this study was determine the existence and type of bacteria isolated from the mobile phone which used by medical and health hospital staff, Collected swabs from (150) mobile phone of medical and health staffs working at Al-kindy teaching hospital during the period from October - 2016 to February 2017, all swab inoculated on macConkey and blood agar and incubated at 37°C for (24 - 48) hours, then the bacterial growth was diagnosis and identified by routine standard of bacteriological technique as well as IMVIC test and Api system .

Result : The positive culture was (52 %) which is more than negative culture(48%). But higher positive culture found in mobile of technician, followed by doctors , as well as highest number and percentage of bacterial contaminated on phone of medical and health staffs were coagulase-negative *staphylococci* (25.6%), followed by *Bacillus spp* (21.7%) , *E.coli* (16.6%), *Staph.aureus* (15.5%) , and *Klebsiella sp* (9%), mixed bacterial cultures found more than single bacterial cultures as .the highest single culture isolated from mobile of nurses while the highest mixed bacterial cultures isolated from mobile of both nurses and Workers. The single bacterial cultures found at higher rate among age groups (31-40) years, where mixed bacterial cultures were the highest at age groups (25-30) years. But the female showed higher rate of both single and mixed bacterial cultures compares to males.

The most common bacteria isolated from mobiles of doctors was CONs bacteria (44.4 %) as do with nurses , technician , workers and Pharmacists while the second most prevalent bacteria was *Bacillus spp*. isolated from mobiles of doctors, nurses, technicians, workers and Pharmacists.

Conclusion: The positive bacterial culture isolated at higher rate from mobile of technicians and doctors .Coagulase-negative *staphylococci* and *Bacillus spp*. were the predominant contaminated bacteria isolated from medical staffs and health workers.

Keyword : Mobile phone , bacterial contamination .

الخلاصة

تعتبر الهواتف النقالة مصدرا هاما من مصادر انتقال الجراثيم كمسببات للأمراض البشرية التي تزيد أيضا من خطر الإصابة بالعدوى للكائنات المجهرية لاسيما الفطرية و البكتيرية اضافة الى المايكروفلورا الطبيعية (Shahaby, 2012).

الهدف: هدفت هذه الدراسة إلى تحديد درجة ونوع البكتيريا الملوثة للهاتف النقال الذي يستخدمه الكادر الطبي و الصحي في المستشفى حيث جمعت (150) مسحة من الهاتف النقال لكادر مستشفى الكندي التعليمي خلال الفتره من أكتوبر - 2016 إلى فبراير 2017، وقد زرعت جميع المسحات على وسطي ماكونكي والدم وحضنت عند 37 درجة مئوية لمدة (24 - 48) ساعة وقد شخص النمو البكتيري باستخدام الطرق البكتريولوجية الكلاسيكية اضافة الى اختبار IMVIC ونظام API

النتائج: اظهرت النتائج ان الزرع البكتيري كان اعلى ما يمكن (26%) من نقال الفنيين العاملين وقد كانت أعلى نسبة للبكتيريا المعزولة من نقال العاملين هي CONS (25.6%)، تليها *Bacillus SP* (21.7%) ، و *Klebsiella pneumonia* (9%)، وقد بينت الدراسة ان العزلات البكتيرية المختلطة (34.6%) أكثر من العزلات البكتيرية المفردة (30.7%)، وبالتالي فإن البكتيرية المفردة المعزولة من نقال الممرضات كانت أعلى نسبة (33.4%)، أعقبها أعلى عزلة من العزلات البكتيرية المختلطة من نقال كلا من الممرضات والعمال و بنسبة (33,3%) يليها (11,2، 14,8) % من نقال الفنيين العاملين والأطباء على التوالي، وكذلك (4) % من نقال الصيادلة، اما أعلى عزلات بكتيرية المختلطة فقد كانت لدى الفئة العمرية (25 - 30) وبنسبة (41.7%)، تليها (31 - 40) بنسبة (29.6%) ، بينما بلغت نسبة الرجال في المجموعتين (41 - 50 سنة و 51 سنة) (11.1%، 3.7%) على التوالي، وكذلك كلا من ان العزلات البكتيرية المفردة و المختلطة في الاثناث (51.8%) أكثر من الذكور (48%) ، اما البكتيريا الأكثر شيوعا المعزولة من الأطباء هي

CONS و بنسبة (44.4%) تليها *Bacillus SP.* بنسبة (22.2%) في حين كانت النسبة (11.1%) لجميع عزلات *E.coli* و *staph.aureus* و *proteus* على التوالي، فضلا عن CONS كانت أكثر عزلة بنسبة (23.0،23.0،11.5،3.8)% من الممرضات والفنيين والعمال و الصيادلة على التوالي.
الاستنتاج: أعلى عزلات بكتيرية كانت من نقال الفنيين العاملين والأطباء، وقد كانت بكتيريا CONS و *Bacillus* هي البكتيريا الأكثر شيوعا المعزولة من الكادر الطبي و الصحي في المستشفى .
الكلمات المفتاحية: الهاتف النقال ، التلوث الجرثومي.

Introduction

Hospital acquired infections (HAI_s) are one of the most important common which causing higher morbidity and mortality , these infections increased in hospitals of Iraq, which transmission by direct contact patient to patient or by indirect contact via contaminated the hands of medical staff , as well as contaminated medical instruments and inanimate objects (Panhotra *et al.*, 2005).

H.A.I_s is caused by a various pathogenic bacteria , more than 90 % of H.A.I_s caused by the bacteria (Jain and Singh, 2007), wide range of these bacteria became more resistance to many various antibiotics (Borkow and Monk, 2012), most of source H.A.I_s from exogenous or endogenous or from environments or equipment (Eze *et al.*, 2012), first and most important step to prevent spread hospital acquired infections is hand hygiene (Edem *et al.*, 2013), moreover prevented the contaminated devices as stethoscopes ; gloves ; thermometers; bed rails ; personal bags; clothing; sheets; door knobs; surfaces and mobile phone that considered potential transmission factors of H.A. I_s (Borkow and Monk ,2012) , therefore using mobile phones in the hospital play important role in increased rate of hospital acquired infections ,because mobile phones may be serve as breeding grounds and habitats for the microorganisms (M.O_s), via provide a direct contact with body of human, as well as mobile phone is commonly described as an instrument used by all medical staff in hospital. Therefore it can be concenter as potential vector in transmitting HAI_s in the hospital, and increasing of the transmitting antibiotic-resistant of bacteria from patient to others.

Material and Methods

This study was conducted at Al-kindy teaching hospital in Baghdad. One hundred and fifty swabs were obtained from mobile phones of medical and health staff during a period from October 2016 to February 2017. The sterile cotton swab moistened by the sterile normal saline had been rolled over the area of outer surfaces of mobile phone (included buttons ; lateral and back side of phone and areas that most contact with fingers) . Then mixing and inoculated on MacConkey and blood agar and incubated at 37°C for (24-48) hours, after then the bacterial growth was diagnosis and identified by routine standard of bacteriological technique (based on bacterial morphology, gram-stained, IMVIC test and Api system (Collee *et al.*, 1996).

Results and discussion

Table (1):Results of bacterial culture isolated from mobile phone of medical and health staffs.

Medical/ health staff	Positive culture		Negative culture		Total	
	No.	%	No.	%	No.	%
Doctors	18	23	15	20.8	33	22
Nurses	15	19	14	19.5	29	19.3
Technicians	20	26	17	23.6	37	24.7
Workers	10	13	14	19.5	24	16
Pharmacists	15	19	12	16.6	27	18
Total	78	52	72	48	150	100

Table (1) showed one hundred and fifty (150) swabs were obtained from mobile phones of medical staff and workers at Al-kindy hospital.

The percentage of culture positive (52 %) showed more than culture negative (48 %), the higher positive culture(26%) were found in mobile of technicians , followed by doctors (23 %), (19 %) from mobile of both nurses and pharmacists.

Table (2): Types and percentages of bacteria isolated from mobile phone of medical and health staffs.

Bacterial isolate	No.	%
coagulase-negative staphylococci	20	25.6
<i>Bacillus spp.</i>	17	21.7
<i>E.coli</i>	13	16.6
<i>Staph.aureus</i>	12	15.5
<i>Klebsiella sp.</i>	7	9
<i>Proteus sp.</i>	5	6.4
<i>Acinetobacter.baumanii</i>	4	5.2
Total	78	100

In table (2) the highest number and percentage of bacterial contaminated phone of medical and health staff were coagulase-negative staphylococci (25.6%), followed by *Bacillus spp* (21.7%) , *E.coli* (16.6%), *Staph.aureus*(15.5%), *Klebsiellasp* (7,9%), the lowest percentage of bacteria isolated were *proteus sp.* and *Acinetobacter baumanii* (6.4%and 5.2%) respectively.

Table (3): Type of bacterial culture isolated from mobile phone of medical and health staffs .

Medical staff	Single bacterial cultures		Mixed bacterial cultures		Total	
	No.	%	No.	%	No.	%
Doctors	3	12.5	3	11.2	9	11.5
Nurses	8	33.4	9	33.3	26	33.4
Technician	2	8.3	4	14.8	10	12.8
Workers	6	25	9	33.3	24	30.8
Pharmacists	5	20.8	2	7.4	9	11.5
Total	24	30.7	27	34.6	78	100

Table (3) showed that mixed bacterial cultures appears in higher percentage (34.6 %) compares with single bacterial cultures (30.7%).

Table (4): Distribution of single and mixed bacterial cultures isolate according to age and gender of medical and health staff .

Age groups (years)	Single bacterial cultures		Mixed bacterial cultures		Total	
	No.	%	No.	%	No.	%
<25	2	8.4	5	18.5	7	13.6
25 – 30	4	16.6	10	37	14	27.4
31 – 40	13	54.1	8	29.6	21	41.6
41 – 50	4	16.6	3	11.1	7	13.6
≥ 51	1	4.2	1	3.7	2	3.8
Total	24	47	27	53	51	100
Gender						
Male	10	41.7	13	48	23	45
Female	14	58.3	14	51.8	28	55
Total	24	100	27	53	51	100

The table (4) showed from the total 51 samples of medical and health staff regarding single and mixed bacterial cultures, but the highest isolated single bacterial cultures (54.1 %) found in age group (31 - 40) years mixed bacterial cultures found in higher percentage (37%) in group aging (25 - 30) years.

But single bacterial and mixed bacterial cultures were found respectively more in females(58.3% and 51.8 %) than males (41.7% and 48 %).

Table (5): Distribution of bacterial isolate according to classification of medical and health staff who used mobile phone.

Bacterial isolate	Doctors		Nurses		Technician		Workers		Pharmacists		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
CONs bacteria	4	44.4	6	23.0	6	60	3	12.5	1	11.1	20	25.6
<i>Bacillus spp.</i>	2	22.2	6	23.0	1	10	6	25	2	22.2	17	21.7
<i>E.coli</i>	1	11.1	3	11.5	0	0	9	37.5	0	0	13	16.6
<i>Staph.aureus</i>	1	11.1	3	11.5	2	20	3	12.5	3	33.3	12	15.4
<i>Klebsiella sp.</i>	0	0	5	19.2	0	0	1	4.1	1	11.1	7	9
<i>Proteus sp.</i>	1	11.1	2	7.6	0	0	1	4.1	1	11.1	5	6.5
<i>Acinetobacter baumannii</i>	0	0	1	3.8	1	10	1	4.1	1	11.1	4	5.2
Total	9	11.5	26	33.4	10	12.8	24	30.8	9	11.5	78	100

In table (5) showed most common bacterial isolated from doctors was CONs bacteria in (44.4%), *Bacillus spp.*(22.2%) and (11.1%) for all isolate of *E.coli*, *Staphylococcus aureus* and *Proteus sp*, as well as CONs bacteria was more isolate (23.0% and 60%) in nurses and technicians respectively . As well as *Bacillus spp* was found at higher percentage among nurses (23%) . *E coli* was the highest (37.5%) among workers, while *Staph.aureus* found in (33.3%) among pharmacist as well as among nurses and workers *Klebsiella sp.* reported in nurses (19.2%).*Proteus sp.* and *Acinetobacter baumannii* were found in least percentage.

Discussion

Mobile phones which used by medical staffs and health workers play important role in spread the pathogenic microorganisms(Kokate *et al.*, 2012)and these pathogenic organisms can be causing drug resistant and causing difficult to treatment (Angadi *et al.*, 2014).

Results of current study appeared that , the percentage of positive culture (52%) more than negative culture (48 %), and more in mobile of technician and doctors .

Our results in agreement with study of (Kokate *et al.*, 2012)which showed that doctors and others medical staff who working in operating units and intensive care units (ICUs) are highly exposed to pathogenic microorganisms. Also Selim and Abaza, 2015 showed all mobile phones of medical staff were contaminated (100%) by mixed bacterial isolate or by single bacterial isolate, and high percentage of bacterial contaminants were methicillin resistant *S. aureus* (MRSA) and coagulase-negative staphylococci (CONS) (Selim and Abaza ,2015).

In addition , results of this study showed that single bacterial and mixed bacterial cultures were found in female medical and health staffs more than males this disagree with results of Auhim, 2013 who showed that , the rate of bacterial contamination of mobile phones of male (85%) was more than in female (80%) (Auhim, 2013).

Similarly, the studies of Ulger *et al.*,(2009) showed that 94.5% of cell phones used by healthcare workers were bacterial contaminated and differences bacterial species which isolated from the mobiles surface of workers may be attributed to the changing in properties of skin of the mobile users, that appear with increase the age(Ulger *et al.*,2009).

Current study showed most common bacteria isolated from mobile phone of doctors was CONs bacteria and *Bacillus spp.* , followed all isolate of *E.coli*, *Staphylococcus aureus* and *Proteus sp.*, because coagulase-negative staphylococci (CONS) are main component of the mucosal microbiota and normal skin ,that responsible for the catheter and other medical device related the infections(S.Sujata *et al.*, 2012),also *Bacillus spp.* giving its greater ability the colonization and spores ability to resist changes of environmental . As well as some *Bacillus spp.* as *Bacillus cereus* as normal flora of the vegetables ; water and cooked food that causing food poisoning and opportunistic infections in the immune compromised patients , also *E. coli* constitute about (0.1%) of gut flora, and fecal oral transmission is the major route through which pathogenic strains of the bacterium that causing infections (Ezhilarasan *et al.*, 2010), the presence *E. coli* in the mobile phones suggested faecal contamination of these phones, which can result in community-acquired infections (Shahaby *et al.*, 2012).

As well as the *Staphylococcus aureus* consider as micro biota of the skin could be transferred via mobile phone by contact or by hand to hand (Suganya *et al.*, 2012).

This result similarly to result of Shadi *et al.*, 2016 who showed the most isolates isolated from cell phones were Coagulase-negative staphylococci (CONS) as percentage (68%), followed (19%) of Gram-positive bacilli ,whilst (16.2%) for *Staphylococcus aureus*(Shadi *et al.*, 2016), But our results disagree with Auhim, 2013 who showed the *Bacillus spp.* most isolate as percentage (52.5%) ,followed by *Staphylococcus aureus* (45%); *Staphylococcus epidermidis* (27.5%), and *E.coli* (12.5%) (Auhim, 2013). However, Suganya and Judia, 2012 showed that the *Staphylococcus aureus* is a microbiota of skin that may be transferred into the cell phone by contact or by hand (Suganya *et al.*, 2012), But our result disagree with

results of Misgana *et al.*, 2014 who showed in his study that the bacterial isolate isolated from mobile phone was 33 isolate *Staphylococcus aureus* followed 61 isolate coagulase negative staphylococci; 12 isolate of *Bacillus* species and only 4 isolate of *Micrococcus* species, as well as isolate of both *Serratia* species and *Klebsiella pneumonia* (Misgana *et al.*, 2014).

As the study groups never washing the hands after using mobile phone (Misgana *et al.*, 2014), the study of Trivedi *et al.*, (2011) showed 12 various types of bacterial organisms from cell phones as *S. aureus*; coagulase-negative *Staphylococcus* (CONs); *Enterococcus. fecalis*; *Pseudomonas. aureginosa*; *E.coli*; *Actinobacter baumaniee*; *Klebsiella spp.* and *Bacillus* (Trivedi *et al.*, 2001), the studies of Coutinho *et al.* (2008) indicate that increasing the prevalence of bacterial isolate isolated from mobile phones of medical staff were attributed to the sanitary practices and poor hygienic(Coutinho *et al.*, 2008).

Conclusion

- 1-higher positive culture from mobile of technician and doctors as well as highest percentage of bacterial contaminated on phone of medical staff were coagulase-negative staphylococci and *Bacillus spp* followed by *E.coli*; *Staph.aureus* and *Klebsiella sp.*
- 2-Mixed bacterial cultures were more than single bacterial cultures
- 3-Single bacterial cultures isolated at highest percent in age group (31 - 40), while mixed bacterial cultures at age group (25 - 30), mixed bacterial cultures in female medical staff more than males medical staff
4. CONs bacteria and *Bacillus spp.* were most common bacteria isolated from medical and health staffs.

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