Analysis Of Routine Bacterial Contamination Checking Feedback Of Nasiriyah City Hospitals During 2016

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Abstract

Hospital contamination is an important cause of nosocomial infection. This study aims to assess the occurrence of bacterial contamination in 70 different departments of two private and five public hospitals in Nasseriah city (south of Iraq) during 2016. From 50 to 200 swabs collected weekly from each wards, were isolated 213 positive culture bacterial isolates, comprised 11 bacterial species detected by biochemical and enzymatic tests. The contamination was ranged between *Pseudomonas* species that represent the most contaminant species (30%) to *Micrococcus* spp. and *Citrobacter*s pp were the fewest (0.46%). Generally, the private hospitals were less contaminated than public ones, the winter and summer months were less contaminated than spring and autumn, and multi-specialty hospital have more contamination than single-specialty one.

Introduction

Nosocomial infections (also called Healthcare-Associated Infections HAIs) are defined as infections that occurred during a hospitalization and are not present prior to hospital attendance (1).Therefore, the hospital contamination have been recognized as a crucial problem affecting the quality of provided health care that can leads to increasing of patients' morbidity and mortality, length of hospital staying and elevate costs of health care.

Despite some normal flora do not cause a threat to healthy hospital staff, but may cause serious problem to some patients, other virulent species (such as *Klebsiella* spp, E. coli, *Enterobacter* spp., *Citrobacter* spp., *Acinetobacter* spp), that frequently shed by patients, contaminate surfaces for days, where-upon they increase acquisition risk for all other hospitalized patients (2-4).

One critical aspect of surfaces contamination spreading, is the ability of the pathogenic bacteria to survive for prolonged enough time to make it difficult to eradicate by cleaning and disinfection (5),increases therisk of infection transmission to a susceptible patient or healthcare worker (6).Therefore, many previous studiesdocumented the persistence of various bacterial species in thehospital inanimate environment for broad range period of time, for example: *Acinetobacter* spp. may be detected within 3 days to 5 months, *E. coli* from 1.5 h to over 30 months, Enterococcus spp. from 5 days to 4 months, and for *S. aureus* from 7 days to 7 months (7)and which may be carried in symptom-less the nasal passages of 30- 60% of personnel carriers. *Pseudomonas* survived for months in a wet environment, but only from a few hours to a few days on dry surfaces(3). Also,

the bacterial features that influence the resistance against disinfectant and ultimately enhance survival rate, varies among bacterial species.Whereas Gram-negative bacteria have an outer membrane acting as a barrier preventing the uptake of disinfectants, some able to survive by biofilms formation or by virtue of their higher concentration on surfaces(8).

The contamination through direct contact occurs via cross-transmission and dissemination with contaminated inanimate surfaces (9). For example: *Pseudomonas* spp and *Stenotrophomonas* spp can adhere to biofilm of surfacesthat protecting them from chlorine-containing and other types of disinfectants (10). Rogues et al. reported that 14% of ICU health care workers hands were *Pseudomonas* positive when washed with contaminated tap water and 12% were positive when the last contact was with a *Pseudomonas* positive patient (11), make it have a greater propensity to cause contamination.

E. coli and *Enterobacter* spp. are fecal bacteria and this suggests that stool of patients and hospital staff, urinary tract infected patients, food and water supply may be sources of fecal contamination. *Acinetobacter* spp infection was described in twooutbreaks in (12, 13), which infected more than 30 patients and 60 patients in ICUs and in CCU respectively. While, suchstudiesrevealed the role of frequently handled clinical equipment andmandatory glove use for staff were an outbreak reservoir (14).Other studies attributed the causes of the spread of bacterial contamination to common hospital materialsparticularly those taken from patient to patient such as cotton, propylene plastic, and polyester(3),immobileobjects like: stainless steels, plastic and computerkeyboards (15, 16)differences offurniture materials in hospital wards affected the adhesion of bacteria thatmakethe survival rate depending on the material made.Thus, the evaluation of surface bacterial contamination is useful in checking the effectiveness of thedisinfecting and cleaning practicesto prevent microbial colonization on hospital surfaces.

To achieve such challenge, the objective of our study is to analysesthe routine potentially pathogenic bacterial contamination data of selected departments of various responsibility and bed capacity hospitals,with special emphasis characteristics of isolated bacteria and whether there are differences among hospitals in relation to their responsibility, capacity and annual seasons.

Material and methods

The study was conducted from January 2016 to December 2016.Aweeklysample collection was done by taking of 50-200 with cotton-tipped swabs.The surfaces ofroutinely used equipmentand furniture of seventy wardsin Nasseriah hospitals, were examined. The placesthat suggested beingpotentially more prone to patientsacquiring infection of hospital such as surgical operation halls, CCUs, ICUs,emergency rooms,birth hall,Preterm infantsrooms, blood exchange room, ENT units, ophthalmic unit were included. Routine culturing was done directly by inoculationeach swab on three culturing media: nutrient agar, MacConkey agar, and blood agar by streaking method. The inoculated plates were incubated aerobically overnight at 37 °C for 24 hours, no

anaerobic cultures were performed.Primary isolated strainswere examinedby Gram stain, colony morphology on culture media,and tentative diagnosis by several biochemical reactions like enzymatic activity,carbohydrates fermentation tests, haemolysis, pigment production, mucous secretion and swarming phenomena.

70 departments of seven hospitals (2 private and 5 public) are involved in this study .Excel office 2006 program was used for statistical analysis of data and generate illustrated figures.

Results

Investigation of bacterial contamination in hospitals during the whole year resulted in 213 bacterial positive cultures,classified within 11 species. In April we obtained the highestcount of isolated bacterial strains from the largest number of hospital facilities and achieved the highest percentage of contamination, while in July the previous results were the lowest (as shown in Figure 1) .There was tendency towards decreased bacterial contamination inboth the summer and winter seasons in comparison with increased of incidence of positive culture in spring and autumn seasons, (as shown in figure 2).

Identification of bacterial species revealedthat *Pseudomonas*spp was the most frequentlyisolated bacteria(64 time, 29.9%), followed by Enterobacterspp(41 time, 19.15%), *E. coli* (36 time, 16.82%), *Staph aureus*(26 times, 12.14%), Bacillus spp(17 times, 7.94%), *Acinetobacter*(14 times, 6.54%), *Stenotrophomonas*spp(9 times, 4.2%),*Klebsiella*spp(3 times, 1.4%), *Burkholderiacepacia*(2 times, 0.93%),while *Citrobacter*spp and *Micrococcus* spp were the fewer contaminant bacterial strains (1 time, 0.46%), (as shown in figure 3 and 4).

In terms of annual bacterial strain count,private hospitals were less contamination (only one bacterial strain for each) than public hospitals (Figure 5).To achieve a fair level of comparison, we divided the number of studied department in each hospital by the total number of bacterial isolates obtained from,to measure the level of contamination (see figure 6).Overall, the results showed improper levels of required disinfectingand cleaning, especially in the most crowded and reviewed governmental hospitals in the region.

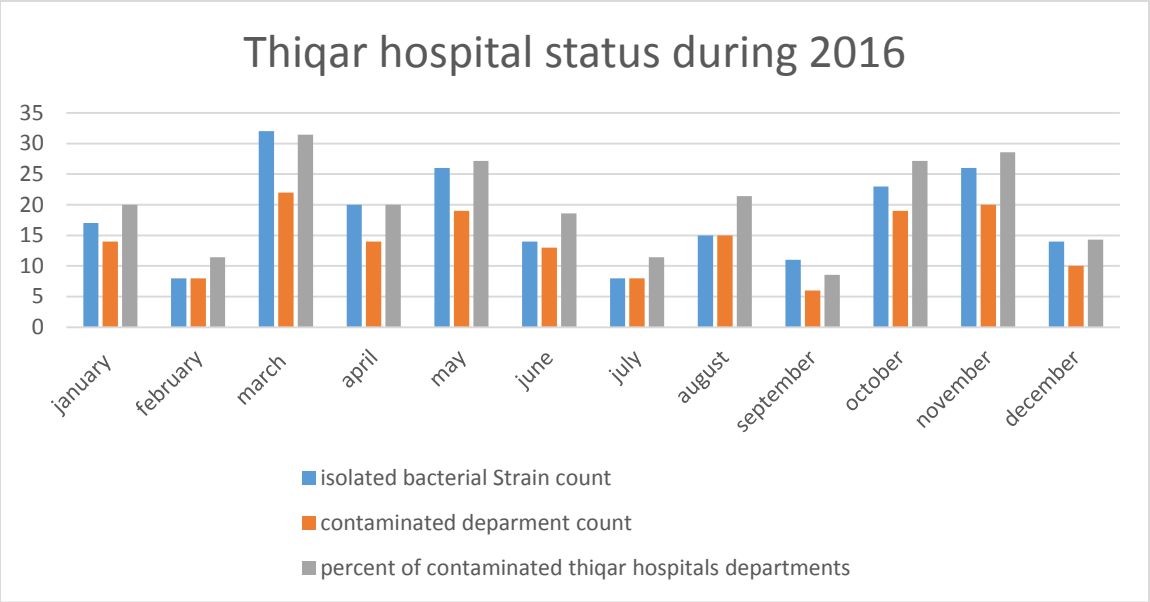

Figure 1: Nasseriah hospital state during 2016:*illustrated as isolated bacterial strain count (blue column), number of contaminated departments (orange column) and percent of contaminated departments (grey column) as a part of 70 studied one.*

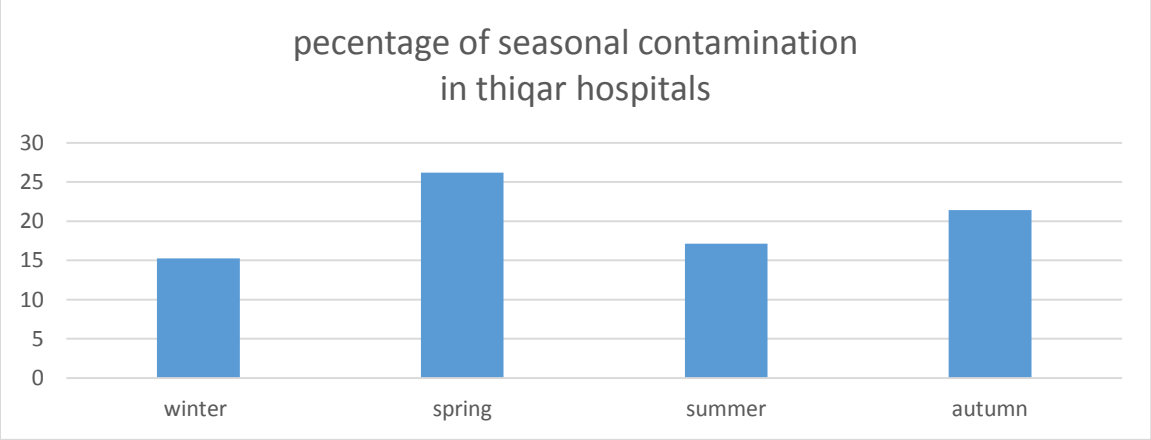

Figure 2: Seasonal emergence of contaminant bacteria in Nasseriah hospitals:*duringspring and autumn, Nasseriah Hospitals have more contamination than other seasons.*

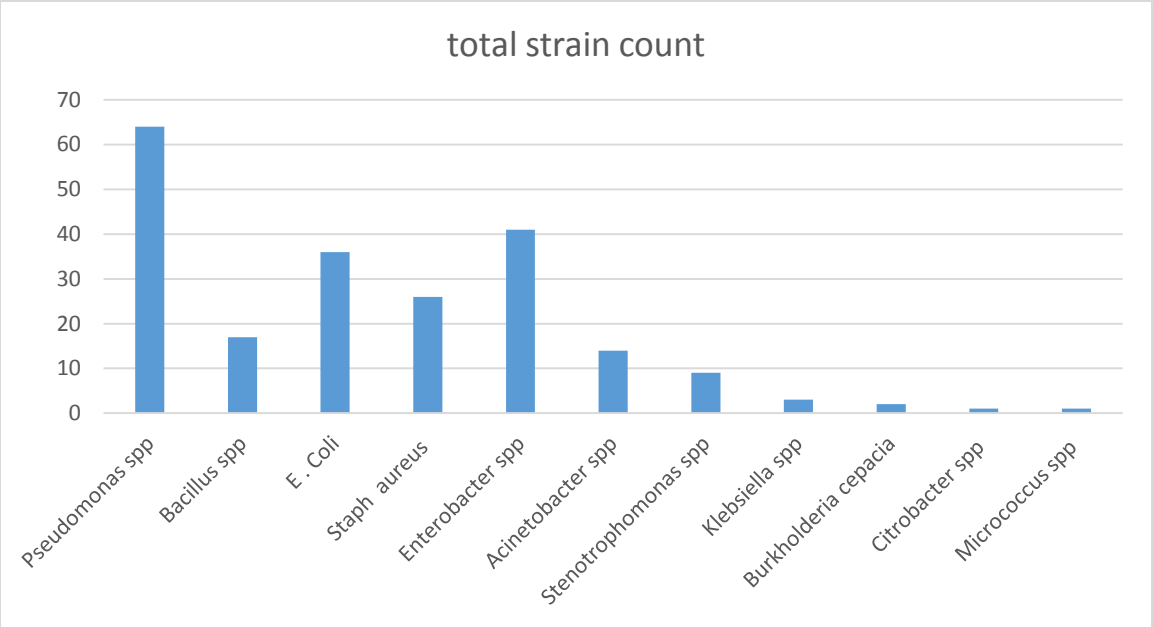

Figure 3: Bacterial species prevalence in Nasseriah hospitals:*illustrated as frequencyof bacterial isolation*

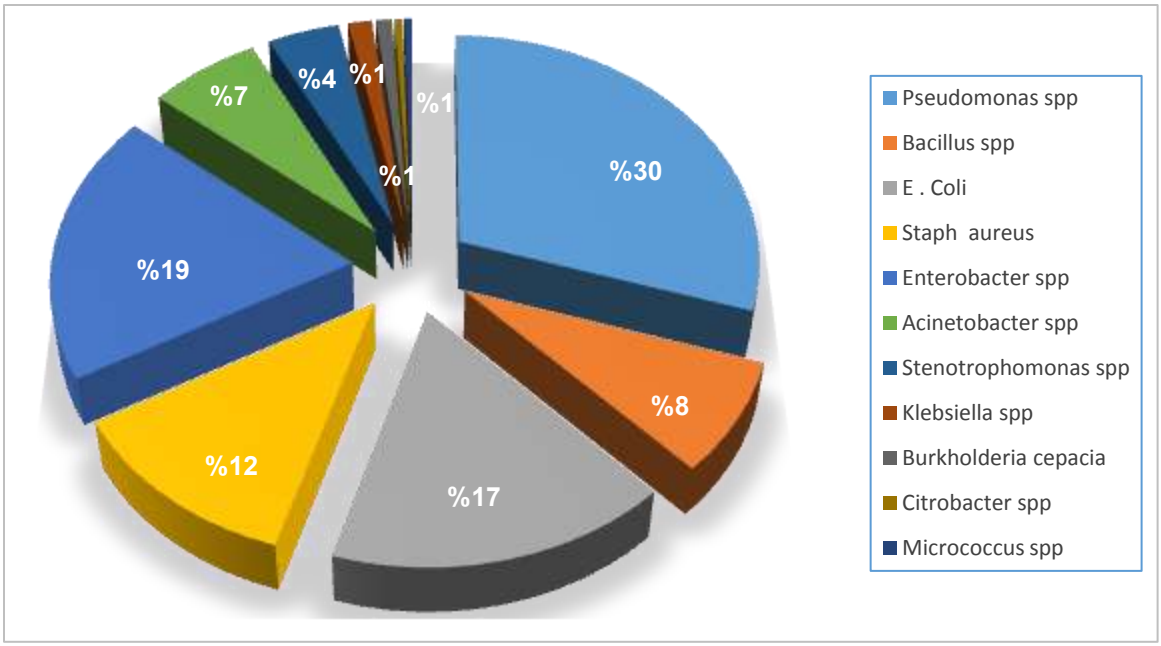

Figure 4: Percentage of isolated bacterial species from total 214 isolates*.Pseudomonasspp was the more prevalence strain while, Citrobacter andMicrococcus were more rare contaminant ones.*

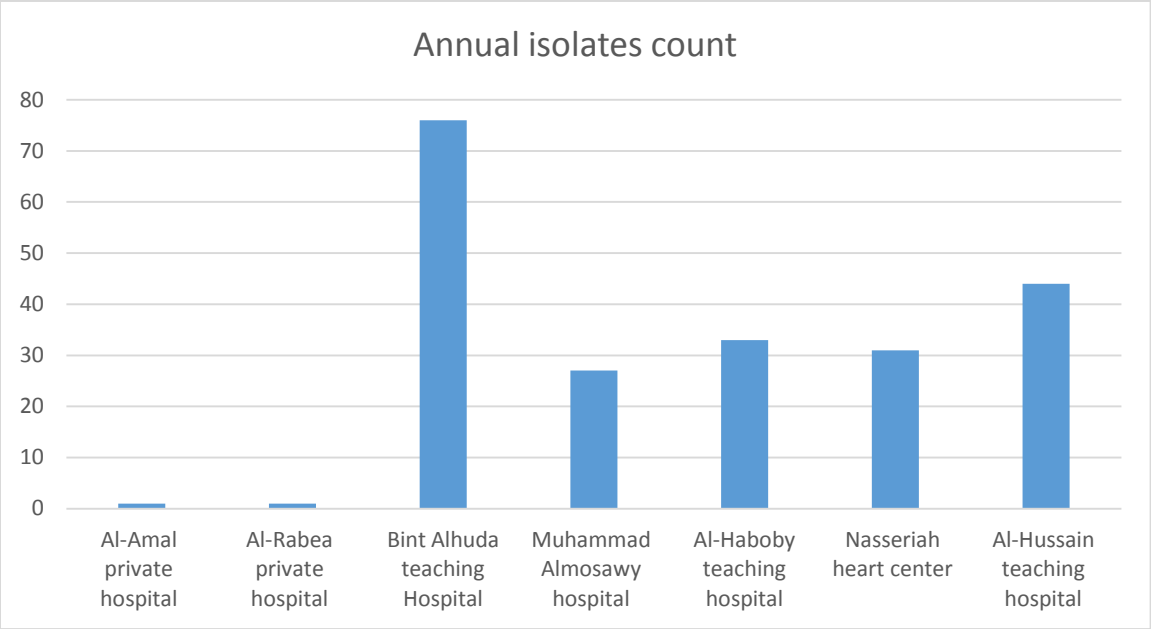

Figure 5: Annual isolated bacterial strain count of Nasseriah hospitals: *total bacterial strains isolated from different departments of city hospitals. Clearly the public hospitals were more bacterial contaminated than private one.*

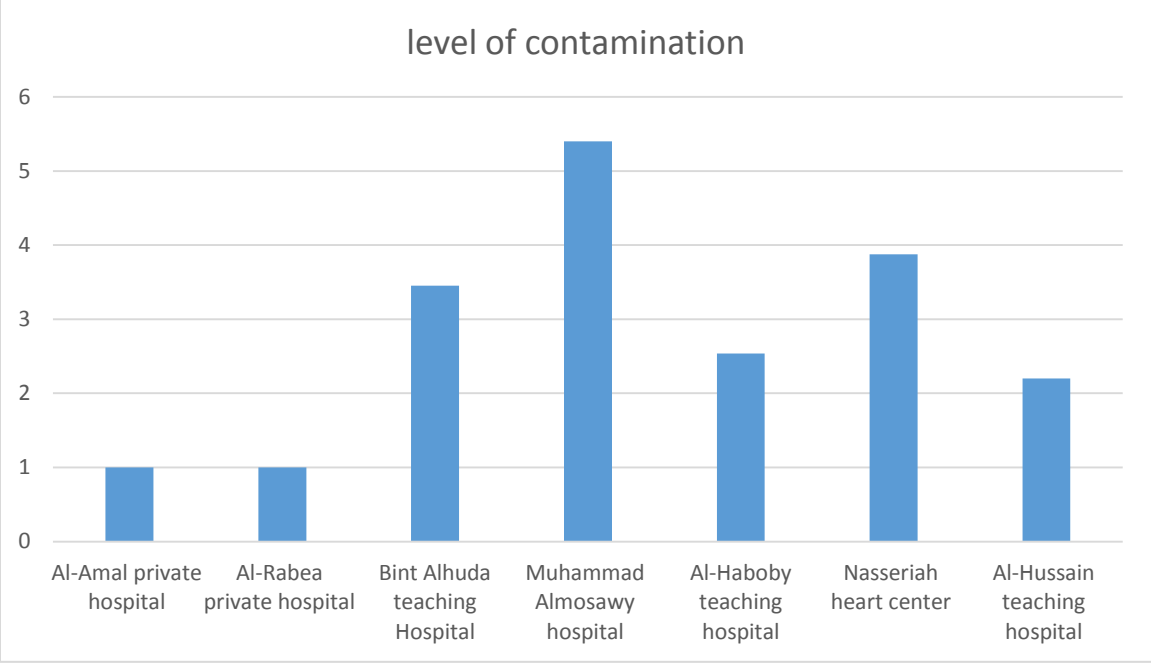

Figure 6: Level of contamination of Nasseriah hospitals: *the level is calculated by division of number of examined departments of each hospital by the number of isolated bacterial strains from the same hospital.*

Discussion

Bacterial contamination of hospital facilities was documented intensively around the world, even in hospitals with traditions implemented from reliable infection control and had trustworthy quality management system.

Unfortunately, in Iraq, the routine cleaning and disinfection of hospital wards is often inadequate, partly because of increasing the hospital occupancy density, traffic and human activities during the day, in addition to our hospitals have cleaning policies that vary considerably, even within the same governorate, and rely heavily upon available resources and governmental support. Iraq stills struggle to provide clean water, basic equipment, and trained cleaning staff. Hospital cleaners may receive little or no training for what they are supposed to be doing, and they lack the career advancement experienced by most other professions. Thus, it became clear why the government's public hospitals had such a high level of bacterial contamination in comparison to non-governmental hospitals.We witnessed such dangerous pathogenic prevalence even in CCU and ICU units in Nasseriah hospitals.

In this study, we documented the isolation of 11 different bacterial species. As similar results obtained by many previous studies (17-19), we found that Pseudomonas spp. was the most hospital contaminant bacterial species (30% of all isolated strains) as it consists one of four HAIs microorganisms most frequently isolated in the European Union (20). This bacterium is an opportunistic pathogen that can be found in water distribution systems, water containers and as normal flora on the human skin (21). Its ability to survive and spread in hospital environment partly is due to acquisition resistance to commonly used antibiotics and disinfectants(22).These facts makes this species a major life-threatening agent that difficult to avoid in hospitals and was responsible for many outbreaks in different countries (23-25). The second most frequent bacterial type of the city hospital that represents (19%) is *Enterobacter* spp. According to (CDC), this species, have been considered opportunistic pathogens responsible for 8.6 % of nosocomial infections such as intravascular device-related, and surgical site infections.

In spite the fact of non highly pathogenic *E. coli* strains are common bacteria in human gastrointestinal tract, some of *E. coli* strains such as *E. coli* 0157:H7 are able to produce toxins that induce serious human infections (1). This species comprises 17% of contaminant isolates in Nasseriah.

It is not excluded that the isolated *E. coli* from city's hospitals is a highly pathogenic strain of species, but because of our poor possibility of such a routine survey to classify of isolated pathogenic bacteria into their serotypes.

In fact, *Staph. aureus* which consider as the most reliable indicator of hospital cleaning effectiveness, and known to be a predominant HAIs, because of their ubiquitous human carriage and frequent human traffic (26,27) , represented only 12% of all our isolated strains.

Acinetobacter spp.,that ranks among the top 10 most common pathogens associated with HAIs, which previously isolated from multiple surfaces and medical equipment (28),formed only 7% of isolated strains in this study.

The rest of the contaminant species (*Stenotrophomonas* spp, *Klebsiella* spp, *Burkholderia cepacia*,*Citrobacter* spp

and *Micrococcus* spp) were less likely to be present than those previously mentioned,(represented, %4.2, 1.4%, 0.93% , 0.46%, 0.46 % respectively), perhaps because of their susceptibility to disinfectantsthat used or due to short-term staying feature outside human body.

Private hospitals were less contamination than governmental ones, this finding was expected due to self-financing, limited number of patients and the socioeconomic situation of the patients hospitalized privately. The paying attention to cleanliness and sterilization to achieve good reputation and customer satisfaction, represent different aims in comparison with public hospitals.

Some of the hospitals included in the study are policlinic responsibility. In contrast to specialized hospitals (children and infants hospital), policlinics are often crowded with patients with different diseases, ages and gender, making the contamination more intensive and their unwanted consequences more frequent. Fortunately, four of eleven isolated bacterial species in this study (*Escherichia coli*, *Klebsiella*, *Acinetobacter*, *Pseudomonas* spp) are classified as conditional (not conventional) pathogens not inevitable by direct contact.

Although, some of isolated bacterial species though be harmless for healthy people, the presence of these pathogens make the hospital microbiologically not a safe environment for risky patients, such as immune-compromised patients or those who are often exposed to multiple procedures, invasive devices, those treated in surgical wards and ICUs.

In conclusion, we should recall the following recommendations to improve the level of sterilization and cleanliness in the hospitals of thegovernorate:

1. Following rules of universal and standard precautions.
2. Surfaces should be cleanbefore they are disinfected
3. Routineplace cleaning is carried out regularly each morning and in late afternoon, or especiallyduring peak work time.
4. Take precautions to protecthospital environment from airborne andwaterbornetransmission.
5. Use a registered quality of disinfectant that has the best activity against the pathogens, and according with manufacturer'sinstructions.
6. Minimize sharing of medical equipment betweenpatients,and maximize single patient use devices and equipment.
7. Proper disposal of needles and sharps.
8. Replacement medical devices, tools, and equipment they can be easily contaminated and hardly disinfected by others with opposite features.
9. Preparation sufficient educated and trained staff, ongoing monitoring, and constant upgrading of practice.
10. Establishment of two-way communication between those responsible for cleaning and those responsible for infection control (29).
11. Additional hygienerequirements,must be applied, such as extensive decontaminationof equipment and surfaces, hand hygiene,use of personal protective equipment,especially in invasive departments…

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تحليل نتائج تحري التلوث البكتيري الروتيني في مستشفيات مدينة الناصرية خلال عام 2016

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الخلاصة

تلوث المستشفيات هو سبب مهم للعدوى المتأصلة فيها. هدفت هذه الدراسة إلى تقييم حالة التلوث البكتيري في 70 مرفقا مختلفا في اثنتين من المستشفيات ا لخاصة وخمس مستشفيات عامة في مدينة الناصرية (جنوب العراق) خلال عام 2016. ما بين 50 إلى 200 مسحة تم جمعها أسبوعيا من كل مرفق، عزلت 213 سلالة زرع إيجابية، فالفت 11 نوعا بكتيريا تم الكشف عنها بواسطة الاختبارات البيو كيميائية والإنزيمية. تراوح التلوث بين جنس الزوائف *Pseudomonas* spp.الذي مثّل أكثر الأنواع الملوثة (30٪) وامتد إلى اجناس اخرى حتى المكورات الدقيقة *Micrococcus* spp. و*Citrobacter* spp. التي مثلت الاجناس الأقل تلويثا (0.46٪) من السلالات المعزولة. وعموما، كانت المستشفيات الخاصة أقل تلوثا من المستشفيات العامة، وكانت أشهر الصيف والشتاء أقل تلوثا من اشهر الربيع والخريفوالمستشفيات متعددة التخصصات اكثر تلوثا من تلك وحيدة التخصص.