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Bacterial Contamination in Some Hospitals in Thamar

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ABSTRACT

Contamination of hospital departments is a major cause of hospital acquired infections (nosocomial infection). Multi reservoirs have been reported as being responsible for hospital contamination, particularly delivery theaters, intensive care units (I.C.U), instruments, canuola, stethoscopes, etc. This study was carried out in 2010, and aimed to evaluate the incidence of bacterial contamination of Thamar hospital and Alwehda teaching hospital in Thamar city/Yemen. 263 swabs collected from instruments, equipments, devices, mobiles, blankets, gowns, and others, of different hospital departments, and examined for bacterial contamination. Resistance to commonly used antimicrobials is evaluated in positive cultures. This study showed that the rate of positive cultures in Thamar hospital is 28% (44 were positive out of 156 examined). Of the 44 positive cultures: 77.2% were Gram positive and 22.7% were Gram negative. Staphylococcus aureus (S. aureus) was the most common isolate, represent 41% and present in almost all items examined, whereas non-coagulase staphylococcus, which is the predominant in second place, represent 18.2%. The rate of positive cultures in Alwehda teaching hospital is 7.5% (8 were positive out of 107 examined). Of the 8 positive cultures: 87.5% were gram positive and 12.5% were Gram negative. Non-coagulase staphylococcus was the most common isolate represent 50%, whereas S. aureus came second, represent 37.5%. The resistance rate to commonly used antimicrobials in isolated bacteria from hospitals departments and instruments varied and no clear pattern was found except that all isolates showed a high resistance rate to Ampicilin. S. aureus showed a high resistance rate to Ampicilin (85% resistant), while it showed a low resistance rate to vancomycin (4.8%).

INTRODUCTION

Nosocomial infections are infections which are a result of treatment in a hospital or a healthcare service unit. Infections are considered nosocomial if they first appear 48 hours or more after hospital admission or within 30 days

after discharge. This type of infection is also known as a hospital-acquired infection (HAI) (or more generically healthcare-associated infection) [1, 15, 2].

Nosocomial infections occur worldwide and affect both developed and resource-poor countries.

A prevalence survey conducted under the auspices of WHO in 55 hospitals of 14 countries representing 4 WHO regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had nosocomial infections at any time and over 1.4 million people worldwide suffer from infectious complications acquired in hospitals [4]. The so-called hospital infections are among the main causes of morbidity and mortality in hospitals. Also, they increase hospital stays and costs [10]. The hospital acquired infection is estimated to more than double mortality, and morbidity risk of any admitted patient [9], and probably result in as many as 70,000 death per year, in the United States [17].

Nosocomial infections can cause severe pneumonia and infections of the urinary tract, bloodstream and other parts of the body[1].

Hospital contamination is the most probable cause of nosocomial infection. Contaminations of hospital equipments, hands of staff , and improper use of detergent, disinfectant, and antibiotics, affect patient directly, and may result in nosocomial infection [7, 14].

20% of hospital patients suffer from infection: half of them are admitted with, and often because of, their infection (community acquired); the other half develop their infection during their hospital stay (hospital acquired)[18, 19].

Multi reservoirs have been reported as being responsible for hospital contamination, particularly delivery theater, instruments, intensive care units (I.C.U), canola, and stethoscope, operating theaters, purified water systems, personal phones and hospital air [6, 13, 14, 16, 17, 18].

Some patients are at greater risk than others for acquiring HAIs due to the presence of certain risk factors which alter their susceptibility to infection. These risk factors may be roughly divided into 2 groups: intrinsic and extrinsic. Intrinsic risk factors are factors inherent to the patient and include the presence of acute medical/surgical disease, and severity of illness. Extrinsic risk factors relate to the types of medical practice performed at individual staff or hospital level and the mix of patients within hospitals. For example, urinary catheterisation, parenteral nutrition, mechanical ventilation, tracheostomy, and surgical contamination are significantly associated with HAIs [7].

Many factors promote infection among hospitalized patients such as: decreased immunity among patients, the increasing variety of medical procedures, invasive techniques creating potential routes of infection and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission frequency of infection [7,8] . Infection rates are higher among patients with increased susceptibility because of old age, underlying disease, or chemotherapy.

The majority of hospital acquired infections are due to common organisms, example; urinary infections due to coliform, wound infection due to S. aureus, pneumonia due to Streptococcus pneumonia, septicaemia is the most serious infection, and is associated with significant mortality: most often due to coliforms, S. aureus, S. epidermidis[18].

Many reports worldwide have indicated the strong involvement of bacteria in hospital contamination and consequently in nosocomial infection [3, 4, 5, 6, 11, 16].

In Baghdad/Iraq (2001-2002), a study [6] on "Microbial contamination in the operating theaters", showed that in 2001 the rate of positive cultures were 3.7%, and 4% in 2002. In 2001 S. epidermidis was the most common isolate in 39%, followed by P. aeurginosa that was 30.4%, whereas in 2002 coliform bacteria where the highest 62.5%, followed by P. aeruginosa 25%. In Kerman, Iran in 2009, a study[16] showed that nearly 40% of health care worker's dominant hands, and 32% of their mobile phones were contaminated with S. epidermidis (77% of bacterial contamination), followed by 12.5% contaminated with S. aureus, the percentage of contamination in all mobile phones is about 32.5% and , 59% of hands. Bernard, et al (1999) found that 85% of hospital physicians ' stethoscope were contaminated, of which 9% showed the common isolated pathogen, S. aureus [4].

The microbiota from the uniforms of 31 professionals from the general intensive care unit was analyzed [11]. 39% of pathogenes were Gram negative and 61% were Gram positive. S. aureus, was among the isolated pathogens. Some of these isolates were multi-resistant to antibiotics. Bacterial Distribution Analysis in the Atmosphere of two Hospitals in Ibb/Yemen was studied by Al-shahwani [13]. and revealed a high level of bacterial counts.

Nosocomial infections caused by multi-drugs resistance Gram positive organism, such as, S. aureus, MRSA, VERSA and Enterococcaus species are a growing problem in many health care institutions [5, 12].

Intensive use of broad spectrum antibiotics has likewise facilitated the emergence of resistance among gram-negative bacteria. Enterobacteriaceae, Pseudomonas species, and other gram-negative bacteria have become increasingly resistant to most first-line antibiotics, including third-generation cephalosporins, monobactams, aminoglycosides, and quinolones [8].

This study aimed to evaluate the incidence of bacterial contamination in Thamar and Alwehda teaching hospitals in Thamar city/Yemen, to identify contaminating agent and their distribution within different theaters and to identify the resistance rate of isolated bacteria to some of commonly used antibiotics.

MATERIAL & METHODS

Material
263 swabs were collected from different departments of Thamar hospital and Alwehda teaching hospital in Thamar city,Yemen .
The samples were as follow:
a.   156 samples from Thamar hospital; 50 samples from Operation rooms, 52 samples from the nursery, 8 samples from the doctor's mobiles, 15 samples from the blankets of the patients, 8 samples from the doctor's stethoscopes, 23 samples from others (Lock of door, floor, gowns (hospital staff uniforms), Medicine table, sink).
b.   107 samples from Alwehda teaching hospital: 50 samples from Operation rooms, 9 samples from intensive care unit (ICU), 10 samples from the doctor's mobiles, 15 samples from the blankets of the patients, 7 samples from the doctor's stethoscopes, 16 samples from others (Lock of door, floor, gowns, Medicine table, sink).
c.   Controls included in this study were as follows: sterile swabs were selected randomly and cultured on Blood, Chocolate and MacConkey agar.

Methods

Samples were collected by taking a smear of selected devices, instruments, mobiles and others, using a moist sterile swabs. Samples were then returned to the laboratory and Agar plates were marked according to the sites. Swabs obtained were cultured directly on prepared Blood, Chocolate and MacConkey agar. by streaking method, and standard method of inoculation. The inoculated plates were incubated aerobically overnight at 37 °C, for 24 hours while chocolate agar plates were incubated anaerobically at 37 °C for 24-48 hours.

All bacterial growths were then subjected to identification: Morphology of colony on culture media, appearance of colony, such as : hemolytic pigmentation, mucous production, swarming phenomena and lactose fermentation. Further identifications were done by biochemical tests, including: the oxidase ,catalase , gelatinase , KIA, MIU, and citrate tests.

Bacterial isolates were inoculated in Muller Hinton Agar , and several antimicrobial were added to observe inhibition zones. The following types of antibiotics were used in this study: Cephotaxime , Ampicillin , Augmentin , Gentamicin ,Vancomycin. 52 positive cultures were subjected to sensitivity tests

RESULTS

Culture results

The total number of swabs cultured were 263 ; 156 from Thamar hospital and 107 from Alwehda teaching hospital.

All control samples were negative. Out of 156 samples cultures, 44 samples were positive (showing bacterial growth), making the percentage of contamination in Thamar hospital 28%.

The distribution of positive cultures in Thamar hospital is presented in table; 1

Table (1): Distribution of positive samples cultures in Thamar hospital.

Department.	No. of samples examined			Type of bacteria
	Total	+ve	-ve	
Operation room	50	6 (12%)	44 (88%)	S. aureus , Proteus spp., Bacillus cereus, Non-coagulase stapylococcus
I.C.U	-	-	-	
Nursery	52	18 (34.6%)	34 (65.4%)	Proteus spp., K. pneumonia, Pseudomonas spp., streptococcus, S. aureus , non-Coagulase staphylococcus., Streptococcus spp., Bacillus cereus, E. coli
Mobiles	8	1 (12.5%)	7 (87.5%)	S. aureus
Blankets	15	10 (66.7%)	5 (33.3%)	S. aureus ,non-Coagulase staphylococcus., Streptococcus spp., Bacillus cereus
Stethoscopes	8	1 (12.5%)	7 (87.5%)	S. aureus.
Gowns	12	2 (16.7%)	10 (83.3%)	S. aureus
Others	11	6 (54.5%)	5 (45.5%)	S. aureus , Proteus spp., Pseudomonas spp.
Total	156	44 (28%)	112 (72%)	

Of the 44 positive cultures: *S. aureus* was isolated in 18 samples (41%), *non-coagulase staphylococcus* in 8 (18.2%), *Bacillus cereus* in 6 (13.6%), *Proteus* spp. in 5 (11.4%), *Pseudomonas* spp. in 3 (6.8%), *Streptococcus* spp. in 2 (4.5%), *K. pneumonia* in one culture, and *E. coli* is also isolated in just one culture (2.3% for each) (table; 2)

Table (2): Distribution of bacterial contamination in Thamar hospital

Types of bacteria	Hospital departments.								
	Operation room	I.C.U	mobiles	blankets	Stethoscopes	gowns	Others	nursery	Total
S. aureus	2 (33.3 %)	-	1 (100%)	6 (60%)	1 (100%)	2 (100%)	2 (33.3%)	4 (22.2 %)	18 (41%)
Proteus spp.	1 (16.7%)	-	-	-	-	-	2 (33.3%)	2 (11.1%)	5 (11.4 %)
Non-coagulase stapylococcus.	1 (16.7%)	-	-	1 (10%)	-	-	1 (16.7%)	5 (27.8%)	8 (18.2 %)
Pseudomonas spp.	-	-	-	-	-	-	1 (16.7%)	2 (11.1%)	3 (6.8%)
Streptococcus spp.	-	-	-	1 (10%)	-	-	-	1 (5.6%)	2 (4.5%)
K .pneumonia	-	-	-	-	-	-	-	1 (5.6%)	1 (2.3%)
Bacillus cereus	2 (33.3%)	-	-	2 (20%)	-	-	-	2 (11.1%)	6 (13.6%)
E.coli	-	-	-	-	-	-	-	1 (5.6%)	1 (2.3%)
Total	6	-	1	10	1	2	6	18	44 (100%)

In Alwehda teaching hospital, out of 107 cultures, 8 were positive, making the percentage of contamination 7 .5%. The distribution of positive cultures in Alwehda teaching hospital is presented in table; 3.

Table (3): Distribution of positive samples cultures in Alwehda teaching hospital.

Deparment.	No. of samples examined			Type of bacteria
	Total	+ve	-ve	
Operation room	50	2 (4%)	48 (96%)	S. aureus, proteus spp.
I.C.U	9	1 (11%)	8 (89%)	Non-coagulase staphylococcus
Mobiles	10	-	10 100%	-
Nusery	-	-	-	-
Blankets	15	4 (26.7%)	11 (73.3%)	S. aureus ,non-coagulase staphylococcus
Stethoscopes	7	-	7 (100%)	-
Gowns	8	-	8 (100%)	-
Others	8	1 (12.5%)	7 (87.5%)	S. aureus
Total	107	8 (7.5%)	99 (92.5%)	-

Of the 8 positive cultures, <u>*S. aureus*</u> was isolated in 3 cultures (37.5%), *non-coagulase staphylococcus* in 4 cultures (50%) and <u>*Proteus* spp</u>. in just one culture (12.5%) (table;4)

Table (4): Distribution of bacterial contamination in Alwehda teaching hospital.

| Types of bacteria	Hospital departments.								
	Operation room	I.C.U	mobiles	blankets	Stetho-scopes	Gowns	Others	nursery	Total
S. aureus	1 50%	-	-	1 (25%)	-	-	1 (100%)	-	3 (37.5%)
Proteus spp.	1 50%	-	-	-	-	-	-	-	1 (12.5%)
Non-coagulase stapylococcus	-	1 100%	-	3 (75%)	-	-	-	-	4 (50%)
Total	2	1	-	4	-	-	1	-	8 (100%)

Sensitivity results
The resistance rate of the isolated bacteria to the antibiotics in this study was: 25% for Vancomycin, 25.5% for Augmenten, 33% for Cephotaxime, 53% for Gentamicin and 81% for Ampicillin (table;5)

Table (5): Bacterial resistance to antibiotics

Type of antibiotics	Sensitive %	Resistant %
Ampicillin	19%	81%
Cephotaxime	67%	33%
Augmenten	74.5%	25.5%
Gentamicin	47%	53%
Vancomycin	75%	25%

The resistance rate of *S. aureus* to the antibiotics used in this study was as follow: 85.7% resistant to Ampicilin, 57% to Gentamicin, 47% to Cephotaxime, 33.3% to Augmentin and 4.8% to Vancomycin (Figure 1)
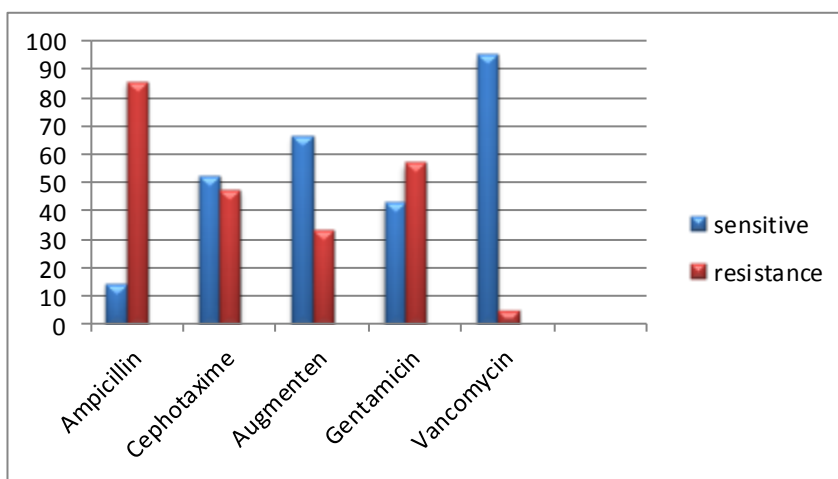
Figure (1): S. aureus resistance to antibiotics

DISCUSSION.

This study was carried out in the year 2010, to evaluate the incidence of bacterial contamination of two largest hospitals in Thamar city/Yemen.

In this study the percent of bacterial contamination in Thamar hospital and Al-Wehda teaching hospitals was: 28% & 7.5% respectively.

The contamination percentage differ from one theater to another, the highest contaminated department in this study was the nursery in Thamar hospital (34.6%).

The results of this study regarding types of bacteria isolated are similar to other studies published[4, 6, 16], but the percent of hospital contamination in this study is higher, especially than that of Ensayef et al,[6] who reported a low contamination rate compared to this study (3.7% in 2001 and 4% in 2002).

This might be due to the level of hygiene in different countries. In this study, 12.5% (1 out of 8 examined) of doctor's mobiles in Thamar hospital found to be contaminated with

S. *aureus*. The results of this study is lower than that reported by Sephehri et al,[16] in Iran who isolated the same bacteria but reported high rate of contamination (32.5%).

Regarding physicians' stethoscopes, *S*. *aureus* was isolated from one out of 8 swabs examined (12.5%) in Thamar hospital. The rate of contamination of this study is much lower than that of Bernard, et al [4] who reported 85% of physicians ' stethoscope were contaminated with bacteria, of which 9% showed the common isolated pathogen, *S*. *aureus*).

The isolation of *Bacillus* cereus in this study has not been reported before in hospital theatres except in an investigation [3] into two cases of post-operative *Bacillus cereus* meningitis which revealed that hospital linen was heavily contaminated by *Bacillus cereus* spores. Spores of *Bacillus cereus* can be found widely in nature, including samples of dust[23]. The bacteria isolated in this study may be from the dust as Thamar city is known for its dusty weather.

In this study 16.7% (2 out of 10) of professional uniforms in Thamar hospital were found to be contaminated with *S*. *aureus*. These results are, in part, in agreement with those related in other reports [11, 20, 22], which detected certain pathogens, e.g. *S*. *aureus* which was the only Gram-positive pathogen isolated.

The isolation of pathogens from uniforms of hospital staff reinforces the need for more care with clothing.

In this study, 10 out of 15 blankets examined for bacterial contamination in Thamar hospital were culture positive. In Alwehda teaching hospital, only 4 blankets out of 15 examined were positive. *S*. *aureus*, non-Coagulase *Staphylococcus*, *Streptococcus* species and *Bacillus cereus* were isolated. In any environment, blankets can become a haven for bacteria. These bacteria usually represent a spectrum of Gram positive and Gram negative organisms capable of producing infections. In a hospital environment, fever and sweat are common and an excellent source of bacterial contamination [21].

This study also aimed to identify the resistance rate of contaminating bacteria to some antibiotics. The following types of antibiotics were used in this study as they are commonly given by doctors for bacterial infections: Cephotaxime, Ampicillin, Augmenten, Gentamicin, and Vancomycin.

S. *aureus* showed a high resistance rate to Ampicilin (85% resistant), while showed a low resistance rate to vancomycin (4.8%).

Today, *S*. *aureus* has become resistant to many commonly used antibiotics. In the UK, only 2% of all *S*. *aureus* isolates are sensitive to penicillin with a similar picture in the rest of the world[26] The most effective defense used today against methicillin-resistant *S*. *aureus* (called MRSA) is vancomycin. However, the increasing use of vancomycin has set the stage for the evolution of vancomycin-resistant *S*. *aureus* (called VRSA). Scientists expect strains of the bacterium *S*. *aureus* that are fully resistant to the antibiotic vancomycin to evolve soon[25]. All types of bacteria isolated in this study showed a high resistance rate to Ampicilin and most of the isolated bacteria had some resistance to other antibiotics commonly used in therapy. The similar resistance profile of some microorganisms of the same species isolated from different items suggests that these could have had a common source of contamination. Also, the widespread use of antibiotic for these organisms might cause the resistance. Careful use of anti-microbial agents, such as antibiotics, is vital.

CONCLUSION

In summary the result of this study showed that there is bacterial contamination in both Thamar and Alwehda teaching hospitals, which may cause nosocomial infection to patients who stay in hospitals, and to medical staff and visitors.

The percent of bacterial contamination in Thamar hospital and Al-Wehda teaching hospitals was: 28% & 7.5% respectively. *S. aureus* & non-Coagulase *Staphylococcus* were the most common isolates. All bacterial isolates showed high resistance rate to Ampicilin. *S. aureus* was highly sensitive to Vancomycin.

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REFERENCES

[1] Abert B, Max S,(2002).Microbiology and microbial infection, 9th edition, Volume III:13:191-195.

[2] Ayliffe Gaj, (2008).Hospital hygiene and infection control,chapter14:pp148-158

[3] Barrie D, Hoffman PN, Wilson JA, Kramer JM (1994) Contamination of hospital linen by Bacillus cereus. Epidemiol Infect. ;113(2):297-306

[4] Bernard L, Kereveur A, Durand D, et al. (1999). Bacterial contamination of hospital stethoscope, Infection Control and Hospital Epidemiology 20 (9): 274-276.

[5] El-Mishad M. Abla,(2005).Manual of medical microbiology and immunity, 5th dition, Vol. II:2; 6-7

[6] Ensayef E, Shalchi S, Sabber M. (2009).Microbial contamination in the operating theater: a study in hospital in Baghdad. Eastern Mediterranean Health Journal, 15 (1):219-223.

[7] Grady O,(2002). Guidelines for the prevention of intravascular catheter related infection. Pediatrics ;110: 51-51.

[8] Lautenbach E (2001). "Chapter 14. Impact of Changes in Antibiotic Use Practices on Nosocomial Infections and Antimicrobial Resistance—Clostridium difficile and Vancomycin-resistant Enterococcus (VRE)". in Markowitz AJ. Making Health Care Safer: A Critical Analysis of Patient Safety Practices. Agency for Healthcare Research and Quality. 2005. 10th Epiet Scientific Seminar. Mahon, Menorca, Spain, 13-15 October 2005 [Poster].

[9] Madigan M; Martinko J (2005). Brock Biology of Microorganisms, 11th edition. Prentice Hall.

[10] Mangram A.J., Horan T.C., Pearson M.L., et al. (1999) Guideline for prevention of surgical site infection. Am J Infect Control; 27:97-134.

[11] Marcelo Pilonetto; Edvaldo Antonio Ribeiro Rosa; Paulo Roberto Slud Brofman; Daniela Baggio; Francine Calvário; Cristiane Schelp; Aguinaldo Nascimento; Iara Messias-Reason (2004): Hospital gowns as a vehicle for bacterial dissemination in an intensive care unit. Braz J Infect Dis ; 8 (3)

[12] McBryde ES, Bradley LC, Whitby M, McElwain DL (2004). "An investigation of contact transmission of methicillin-resistant Staphylococcus aureus". J. Hosp. Infect.; 58 (2): 104–8.

[13] Muhammad F. Al-Shahwani (2004):Bacterial Distribution Analysis in the Atmosphere of Two Hospitals at Ibb City, Yemen. J. King Saud Univ.;17 (1): 9-15

[14] Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV.(1999)   Bacterial contamination of the hand of hospital staff during routine patient care. Arch Inter. Med.; 159 (8):821:826.

[15] Pollack, Andrew. (2010) "Rising Threat of Infections Unfazed by Antibiotics" New York Times, Feb. 27

[16] Sephehri G., Talebizadeh N., Mirzazadeh A., et al(2007).Bacterial contamination and resistence to commonly used antimicrobial at healthcare worker"s "mobile phone in teaching hospital., kerman, Iran. Amirican Journal of Applied Science; 6(5):806-810

[17] Singh D, Kaur H, Gardner G, et al.(2002).Bacterial contamination of hospital pager"s, Infection Control Hospital Epidemiology; 23:274-276

[18] Sleigh J, Timbury M, (1998). Notes on medical bacteriology, fifth edition, infection in hospital; 43:357-358.

[19] Vnguyen Q.   (2009). hospital acquired infection, http://emedicine.medscape. com/article/7022_overview

[20] Wong D., Nye K., Hollis P. (1991) Microbial flora on doctors' white coats. Br Med J;303:1602-4,

[21] Reducing Microbial Contamination in Hospital Blankets http://www.aegisasia.com

[22] Loh W., Ng V.V., Holton J. (2000) Bacterial flora on the white coats of medical students. J Hosp Infect;45:65-8

[23] Hobbs, B.C. and Gilbert, R. J. 1974. 'Microbiological Counts in relation to food poisoning', Proceedings of the IV international Congress of Food Science Technology 3:159.

[24] Chambers HF (2001). The changing epidemiology of Staphylococcus aureus? Emerg Infect Dis 7 (2): 178–82.

[25] Menichetti F (2005). "Current and emerging serious Gram-positive infections". Clin Microbiol Infect 11 Suppl 3: 22–8.

[26] Wikipedia. Staphylococcus aureus

التلوث البكتيري لبعض مستشفيات محافظه ذمار،اليمن

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ملخص

يعتبر التلوث البكتيري للمستشفيات هو السبب الرئيس للعدوى المكتسبة للمرضى من المستشفيات. أجريت هذه الدراسة في عام 2010 حيث هدفت إلى تقييم التلوث البكتيري في مستشفيات محافظه ذمار في اليمن: مستشفى ذمار العام ومستشفى الوحدة التعليمي.

تم جمع 263 مسحة من أدوات ومعدات وأجهزة هواتف نقالة وبطانيات المرضى وبالطو الأطباء والممرضات وأشياء أخرى مختلفة وتم تقييم التلوث الجرثومي والتعرف على نوع البكتيريا المعزولة من العينات وكذلك تم تقييم حساسية هذه الجراثيم لعدد من المضادات البكتيرية التي تستخدم بشكل واسع لمعالجه الالتهابات البكتيرية للمرضى المترددين.

أظهرت هذه الدراسة أن معدل العينات التي وجدت فيها تلوث بكتيري كانت 28% (44 موجبة من 156 عينة تم فحصها) في مستشفى ذمار العام وكان من ال44 عينة موجبة 77.2% جرام موجب و22.7% جرام سالب و كانت البكتريا الأكثر شيوعا هي الستافيلوكوكاس اوريوس (41%) والنانكواوكيوليس ستافيلوكوكاس (18.2%)

أن معدل العينات التي وجدت فيها تلوث بكتيري في مستشفى الوحدة التعليمي كانت 7.5% (8 موجبة من 107 عينة تم فحصها) وكان من ال8 عينات موجبة 87.5% جرام موجب و12.5% جرام سالب وكانت البكتريا الاكثر شيوعا هي النانكواوكيوليس ستافيلوكوكاس (50%) و الستافيلوكوكاس اوريوس (37.5%) وأظهرت جميع أنواع البكتريا المعزولة في هذه الدراسة مقاومة عالية لمضاد الامبيسيلين وأظهرت بكتريا الستافيلوكوكاس اوريوس مقاومة عالية للامبيسيلين (85%) بينما أظهرت مقاومة قليلة للفانكومايسين (4.8%).