

Investigation the role of Medical devices and hospital objects in transmission of nosocomial infections.

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Abstract:-

A total of 515 swabs were collected from different medical devices and hospital objects in Al-Sader teaching hospital and Al-Hakeem hospital, and tested to investigate the role of those in transmission of nosocomial infections. The samples were cultured on suitable media and identified. The results indicated that 384 samples (74.5%) gave positive results for pathogenic bacterial growth, versus 131 samples (25.5%) gave negative results. The results revealed that 48 isolates were isolated from ventilator, and 38 isolates from sucker, while 26 and 42 isolates were recovered from anesthesia and aeroscopy respectively, versus 34 isolates were obtained from neonat incubator. In addition 69 isolates obtained from patients bed, and 35 isolates from patient transmission beds, with 36 and 26 isolates isolated from patient tables and surgical set respectively, versus 30 isolates from hand of hospital staff. From the results appear that predominant of *E.coli* in 114 isolates (29.7%) mainly associated with neonat incubator and patients bed respectively. followed by *Staphylococcus aureus* in 95 isolated (24.7%). while *Pseudomonas aeruginosa* appear in 80 isolates (20.8%). *Klebsiella pneumoniae* and *Enterobacter spp.* appear in 52 isolated (13.5%) and 20 isolated (5.2%) respectively. The gram positive *Bacillus sp.* appear in 23 isolates (5.7%).

الخلاصة

جمعت 515 مسحة من مختلف الاجهزة الطبية ومواد المستشفيات في مستشفى الصدر التعليمي ومستشفى الحكيم العام في النجف وفحصت للتحري عن دورها في نقل الاصابة بين المرضى في المستشفيات, زرعت العينات على اوساط مناسبة وشخصت مختبريا. بينت النتائج ان 384 عينة (74.5%) اعطت نتيجة موجبة لنمو البكتريا المرضية مقابل 131 عينة (25.5%) اعطت نتيجة سالبة. كشفت النتائج ان 48 عذلة بكتيرية عزلت من جهاز عطاء الاوكسجين و38 عذلة من جهاز سحب السوائل, بينما حصل على 26 و42 عذلة بكتيرية من جهاز التخدير وجهاز تنظيف الاذن, مقابل 34 عذلة حصل عليه امن حاضنات الاطفال, بالاضافة الى 69 عذلة حصل عليها من فراش رقاد المرضى و35 عذلة من سرير نقل المرضى. فضلا عن 36 و26 عذلة عزلت من منضدة مريض وسيت الجراحة على التوالي, مقابل 30 عذلة من ايادي الكادر الطبي في المستشفى. تبين من النتائج سيادة بكتريا لاشريشيا القولونية (*E coli*) ب 114 عذلة (29.7%) ارتبط معظمها مع حاضنات الاطفال وسرير رقاد المرضى. تليها بكتريا المكورات العنقودية الذهبية (*Staphylococcus aureus*) ب 95 عذلة (24.7%) بينما ظهرت بكتريا الزوائف الزنجارية (*Pseudomonas aeruginosa*) ب 80 عذلة (20.8%). اما بكتريا الكبسيلا الرئوية (*Klebsilla pneumoniae*) و الاتيبروباكتز (*Enterobacter sp.*) فقد ظهرت ب 52 عذلة (13.5%) و 20 عذلة (5.2%) على التوالي, بينما ظهرت البكتريا العصوية الموجبة (*Bacillus sp.*) في 23 عذلة (5.7%).

Introduction :-

Nosocomial infections or hospital acquired infections are infections result from treatment patients in hospital, when they appear after 48 hours of patient admission. In spite of the advance in control of hospital infections the nosocomial infections remain one of the most important problems in hospital settings. Gram-negative aerobic bacteria are the most important causative agents in those infections (Bogdanovitch *et al*, 2006).

The contaminated bacteria are found on the surface of medical devices such as intubation tubes, catheters, artificial heart valves, water line ventilating oxygen, the surface of all these medical and dental devices are normal target for occurring of microbial communities which have been implicated as the route of transmission in some of our break (Tomaras *et al.*, 2003).

Different nonbiotic dry environmental source and various components of hospital environment such as mattress and pillows , gloves , tables , chairs dors ,windows and hospital bed themselves have been observed to be contaminated with different pathogenic bacteria ,which served as a route of transmission infections (Jawad *et al.*, 1996).

The most important pathogens isolated from hospital environment and medical devices are gram-negative bacteria , such as *Pseudomonas aeruginosa* , *Klebsiella pneumonia* , *E coli* , *Enterobacter spp.* *Proteus spp.* , and *Acinetobacter spp.* , and gram positive bacteria such as *Staphylococcus aureus* (Bogdanovitch *et al.* ;Wendt *et al.*, 1997).For this purpose the aim of the study included investigate the role of the medical devices and hospital objects in transmission of pathogenic bacteria between patients in Al-Najef hospital.

Materials and Methods :-

1-Specimens collections:

A total of 515 swabs were collected from medical device and hospital objects in Al-Sader Teaching hospital and Al -Hakeen hospital for testing and investigate the role of those device and objects in transmission of bacterial infections among patients in those hospitals during eleven months from January to November 2007.

The specimens included 56 samples from ventilator, 54 from anaesthesia , 50 from each of sucker and earoscopy , and 40 samples from neonat incubator, while 80 samples were collected from patient beds , versus 50 samples from patient transmission beds, 40 and 48 samples from patient tables and surgical sets respectively ,with 47 sample from hand of hospital staff (Doctors , medical assistances ,nurses and workers).

2- Specimens culture:

The specimens cultured by streaking on suitable media including Blood agar, MacConky agar, Manitol salt agar , and incubated at 37C for 18-24 hours.

3-Laboratory identification :-

The bacterial isolates identified according to (MacFadin,2000) with the following criteria .

A- cultural and morphological characters.

B- Biochemical test, which occurring as in a table below :

Charac ters Test	Gra m stain	Growt h on MaCc onky	Growth on Manitol	Heamolysi n on blood agar	Ind ol	Methy l red	Vogas prosquer	Citrat test	TSI	Motili ty	Oxida stest
Staphy lococ cus aureus	G+v e	-	+	Alpha heamolysi n	non	non	non	non	non	-	-
E coli	G- ve	+	-	alpha	+	-	+-	+-	A\K	-	-
Pseud omona s aurogi nosa	G- ve	+	-	Beta	-	+-	+-	+	K\K	+	+
Klibse illa Penum oniae	G- ve	+	-	alpha	-	+	+-	+-	A\A	-	-
Entero bacter sp.	G- ve	+	-	alpha	-	+-	+-	+-	A\A	+	-
Bacill us sp.	G+v e	+	-	Beta	non	non	non	non	non	+	-

Results and discussion :

Nosocomial infections are one of the most important problem in hospital setting(Bogdauovitch *et al.* ,2006) .

Different nonbiotic dry environment sources have been implicated as routes of transmission, including reusable medical equipment used for the management of severely ill patients and various component of hospital environment(Doglas and Leung ,1999). In addition, a wide variety of medical devices such as ventilator,Catheters,intubation tube,and dry environmental objects such as patients bed,pillows,televisions ,door knobs,tables,chairs,and windows have contaminated with bacteria and may serve as reservoirs during nosocomial outbreak (Jawad *et al.*,1998).

For this reasons, a total of 515 swabs were collected from different medical devices and hospital objects to investigate the role of them in transmission of hospital acquired infections among patients in Al-Sader teaching hospital and Al-Hakeem hospital,during eleven months from January to November 2007 The Samples cultured on suitable media and identification according to criteria previous.The results indicated that 384 (74.5%) samples gave positive results for pathogenic bacterial growth,versus 131(25.5%) gave negative results (Tab.1).

The positive results including 48 isolates (12.5%) from ventilator , 38 isolate (9.9%)from sucker and 26 isolates (7.3%) from anesthesia while 42 isolates (10.9%) were isolated from aroscopy, and 34(8.9%) isolates from neonat incubater.

The positive results for patient beds accounted 69 isolates (17.8%),versus 35 isolates(9.2%) were collected from patient transmission beds ,with 26 isolates (6.8%)obtained from patient tables.

The samples were collected from surgical sets gave 26 (9.4%)positive results for bacterial growth ,while the bacterial growth were appear in 30 sample (7.8%)from hand of hospital staff, this results were expected because the skin of patients and medical devices as well as dry inanimate objects in hospital wards contaminated with pathogenic bacteria, are able to facilitate transmission of strains and may serve as unrecognized reservoirs in prolonged nosocomial outbreaks(Jawad *et al.*, 1998).

The results revealed that the ventilator was the most contaminated device in 48 isolates from 56 samples ,versus 26 isolates obtained from anesthesia device (Table-1). Mostly associated with nosocomial pneumonia .

The incidence of hospital –acquired pneumonia in ventilated patients is high as 20` in some series, as well as many as 60` of mechanically ventilated patients have nosocomial pneumonia can obtained in the intensive care units (Merck,2006),gram negative bacilli are frequently cause hospital acquired pneumonia particularly in ventilator patients (Mireille *et al.*, 1994).Community acquired pneumonia with ventilation equipment have been recorded in many hospital setting (Jawad *et al.* ,1996).

The results indicated that 38 isolates were recovered from 50 samples of sucker device this result was expected because the surface of many medical devices such as catheters , sucker and intubation tubes are colonize with different type of bacterial cells may serve as route for spreading of bacterial infections (Tomaras *et al.*,2003).

From the results ,off 50 sample were collected from aroscopy , 42 samples appear positive results for bacterial growth ,the important risk factors for ear infection include sex ,age, race , socio-economic , genetic factors , nutritional factors and environmental factors , as well as using contaminated aroscopy during ear testing (Correspondence,2003) .

The results revealed that 34 isolates were recovered from neonat incubater , this device always contaminated with feces of new born ,that may carrying pathogenic bacteria,serve as route for transmission of infections among neonats(Jawad *et al.*,1998).

From the results (Table-1) 69, 35 , 36 and 26 isolates were obtained from patients beds, patients transmission beds, patient tables and surgical sets respectively, this results were true ,because a wide variety of dry hospital environmental objects such as hospital beds, pillows, televisions, windows, tables and door knobs have been found to be contaminated with different types of opportunistic bacteria and may serve as reservoirs during nosocomial outbreaks and implicated as route of transmission of infections(Jawad *et al.*,1998;Wendt *et al.*,1997).

In addition, 30 isolates were recovered from hand of hospital staff with or without gloves. Jawad *et al* (1996) reported that the bacterial cell found on both of the gloves and on the hands of hospital staff themselves. that may be serve as a route of transmission bacterial infections during outbreak.

The results revealed the predominance of *E. coli* in 114 isolates (24.7%) from the total number of positive samples, mainly associated with neonate incubator and patient beds in 20 isolates for each one, the *E. coli* mostly associated with diarrhea of neonate and some cases of adults that may be contaminated the neonate incubator and patient bed, Bogdanovitch *et al.* (2006) found that the *E. coli* was the second most frequently isolated nosocomial pathogen after *Pseudomonas aeruginosa*. The gram positive cocci *Staphylococcus aureus* accounted in 95 isolates (24.7%), mainly associated with ventilator, patients beds and patient tables in 17, 15 and 14 isolates respectively. Parakash (2006) reported that the *Staphylococcus aureus* remains the dominant species in hospital infection, especially in wound infections, and the bacteria appear to be patients own body flora (endogenous infection). *Pseudomonas aeruginosa* accounted 80 isolates (20.8%) mainly distributed with sucker in 12 isolates and 10 isolated for each of ventilator, anesthesia, patients bed, patient transmission beds and patient tables respectively. *P. aeruginosa* and other members of this group are opportunistic pathogens that frequently cause hospital-acquired infections, particularly in ventilator patient, burn patients and those with chronic debility (Mirrille *et al*, 1994). In addition *Pseudomonas aeruginosa* is ubiquitous, frequently found in hospital environment, and colonized various medical devices involved the ventilator, catheter, and different type of nonbiotic materials, and transmission of this bacteria to new patients may occur especially in burn and neonatal patients (Merck, 2006). The enterobacteriaceae members *Klebsiella pneumoniae* and *Enterobacter sp.*, were found in 52 (13.5%) and 20 (5.2%) isolates respectively. *Klebsiella pneumoniae* mainly associated with patient beds and patient transmission beds in 14 and 10 isolates respectively, while *Enterobacter sp.* mainly associated with endoscopy and patient beds in 5 and 6 isolates respectively. Both of the bacteria have polysaccharide capsule on the surface of the cell, and the capsule may promote the adherence of bacteria to surface of medical device or other nonbiotic of hospital materials, and there may be facilitate the transmission of these bacteria during nosocomial outbreak (Jan, 1996). In addition, the mucoid isolates of bacteria appear to be more able to formation of biofilm and colonized various ecological niches, may serve as a route to transmission of bacterial infections and more resistance to drying and environmental factors than of nonmucoid isolates (Mireille *et al*, 1994).

The aerobic gram positive bacilli *Bacillus sp.* accounted 23 isolates (5.7%), This bacteria is widely distributed in nature and in soil, that may be contaminated the skin and cloth of many individuals and serve as a route for transmission of this bacteria to hospital environment and colonized many hospital niches (Mireille *et al*, 1994).

Table-1 distribution of samples from device and hospital objects

Type of device and objects	Total Number of samples	Positive samples	Negative samples
Ventilator	56	48	8
Anesthesia	54	26	28
Sucker	50	38	12
Endoscopy	50	42	8
Neonate incubator	40	34	6
Patient's bed	80	69	11
Patients transmission bed	50	35	15
Patient tables	40	36	4
Surgical set	48	26	22
Hand of hospital staff	47	30	17
Total	515	384	131

Table -2- Distribution of bacteria isolates with medical device and hospital objects

Type of device and hospital objects	<i>Staphylococcus aureus</i>	<i>E coli</i>	<i>Pseudeomonas aeruginosa</i>	<i>Klebsiella pneumoneae</i>	<i>Eimterobacter sp.</i>	<i>Bacillus sp.</i>	Total
Ventilater	17	13	10	4	2	2	48
Sucker	10	10	12	5	-	1	38
Ansthesia	4	8	10	2	-	2	26
Earosceopy	10	11	7	5	5	U	42
Neonat Incubater	5	20	5	1	1	2	34
Patient s Bed	15	20	10	14	6	4	69
Patient transmitting Bed	5	5	10	10	2	3	35
Patient s Table	14	7	10	5	-	-	36
Surgicl set	5	10	4	4	1	2	26
Hand of Staff	10	10	2	2	3	3	30
Total (%)	95 (24.7 %)	114 (24.7%)	80 (20.8 %)	52 (13 . 5%)	20 (5.2)	23 (5 .7%)	384

References

- Bogdauovitch , T . , Stetsiouk ,O . , Reshedko , G . and sekhin ,S .(2006): Antimicrobial resistance in nosocomial strain of *Acinetobacter spp* . isolated in ICUs in Russia . *J . clin . pharma.and Antimicrobiol. Chemothera.*, 37 (5):133_139.
- Correspondence (2003) :Bacterial isolated from patients with ear infection . *Indian J.Med.Microbial* .,21 (4):294_296.
- Doglas ,S.K.and leung ,A.N.(1999): Radiology of pneumonia *Clin .Chest Med* .,20 (3): 549_562.
- Ian .S.Robert (1996) .The Biochemistry and genetics of capsular polysaccharid production in bacteria .*Annu. Rev. Microbial* ,50: 285_ 315.
- Jawad-a ; A.; Heritage J.; Snelling A.M.; Gascoyne_Bimzi and Hawkey p.M. (1996): Influence of relative Humidity and suspending meustrua on surviva of gram_negative bacteria on dry surfaces .*J.clin .Microbiol* .,34 (12):2001_2007.
- Jawad-b .A.; Seifert .H.; Snelling A.M.;Heritage, J. And Hawkey P.M (1998): Survival *Acinotobacter* on dry surfaces: comparison of outbreak and sporadic isolates.*J.Clin Microbial* ., 36 (7): 1938_1941.
- MacFadin ,J.F (2000) :Biochemical test for identification medical *Bacteriology*.3th ed.,Lippincott Williams Co.Baltimore London
- Merck. M(2006) : *Psedomanas* and related infection .*J.Infec Dis* .,24(6) :131_137.
- Mireille C.;Eric A., Emmanuel G.; Michel B.and Michel S.(1994) :Investigation of hospital aquired Infection due to *Alcaligenes denitrificans* sub sp. *Xylosoxydaus* by DNA restriction fragment lenght *poly morphism* *J.clin Microbiol* ., 32 (4):1023_ 1026 .
- Parakash K.,S .(2006) : Nosocomial infections An overview for The surgeon proceeding of The xvll national countinuing medical education programme in surgery. *J. Clin microbiol* .,4: 139_ 136.

- Tomaras ,P. Andrew ; Caleb ,W.Dorsey; Richard E. Edelman and Luis ,A. Actis (2003): Attachment to and biofilm formation on abiotic surface by *Acinetobacter baumannii* involvement of an oval chaperoneusher pili assembly system *J. Microbiol .*, 149:3473_ 3484.
- Wendt C.; Dietze B.; Dieze E K. and Ruden H.(1997): Survival of *Acinetobacter* on dry surface .*J .Clin Microbiol .*, 35(6) :1394_ 1397.
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