Original Article

Antibiotic Resistance of Staphylococcus aureus isolated from nasal cavity of Health Care Personnel.

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Summary:

Background: Staphylococcus aureus infections are growing problems worldwide with important implications in hospitals. The organism is normally present in the nasal vestibule of about 35% apparently healthy individuals and its carriage varies between different ethnic and age groups.

Objective: To study the antibiotic resistance of staphylococcus aureus isolated from nasal cavity of Health Care Personnel.

Patients and methods: A total of 180 samples were collected from the nose of the two groups (health care personnel, community control) at Baghdad Teaching Hospital. They were screened for nasal colonization with S.aureus during the period between April 2012 to September 2012, by using a sterile cotton swabs.

Results: Nasal swabs with Staphylococcus aureus which isolated from health care personnel was 40%, while in community control was 33.33%.

Conclusion: High prevalence rate of S. aureus nasal carriers was found among health care personnel of Baghdad Teaching Hospital. The highest rate was found in sub staff group. And among community control, high prevalence rate of S.aureus nasal carriers was found in the school students. All isolates of S. aureus were resistant to pencillin G, ampicillin, and erythromycin. Vancomycin was the most effective drugs against S.aureus, isolates and followed by rifampicin and fusidic acid.

Keywords: Staphylococcus aureus, Antibiotic resistance.

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Introduction:

Staphylococcus aureus remains the most important nosocomial pathogen because of both the diversity and severity of the infections caused by these organisms (1, 2, 3). Staphylococcus aureus can be responsible for a variety of serious diseases and host notably pneumonia, cellulites, supportive wound infections, abscesses and sepsis (4).

The original reservoirs for which patients acquired these isolates remain unclear, while some infected patients are colonized with S.aureus at the time of hospitalization, others likely become colonized, often with more widely antibiotic resistant isolates during their hospital stays (2, 5). Hospital personnel are among those implicated, as possible source of these potentially more antibiotic resistant pathogens. Transmission of these strains to patients is then likely to occur during routine patient care (6). Staphylococcus aureus is an important cause of nosocomial infections and has become endemic in hospital world wide as a major clinical problem, therapy has become cumbersome (7).Control of Staphylococcus aureus infection and colonization is difficult and may result in serious clinical and managerial problems (8, 9, 10, 11).

Several studies have documented that these staphylococcus infections are most commonly caused by the patient's own commensal flora, therefore; control of S.aureus in the hospital has now become more important than ever before (12, 13, 14, 15, 16).

Patients and methods:

This study was carried out during the period from April 2012 to September 2012. A total of 180 swabs were collected , 105 swabs were from health care personnel included (doctors, nurses, lab. workers, sub staff, food handlers and hospitalized patients) at Baghdad Teaching Hospital, and the remainder 75 swabs were from community control included (bakers, restaurants, shops workers and school students) from different areas of Baghdad . Nasal swabs from all groups were taken and cultured on Mannitol – Salt agar at 37°C for 24h. S.aureus colonies were yellow in color, shiny, convex, and had a diameter of approximately 2 mm. Gram stain was made, they were Gram positive cocci, grape like clusters. The identification of isolates was based on morphological and biochemical characteristics by (catalase test, coagulase test "both bound and free ", haemolysin production, tellurate reduction test, DNase test, TNase test) (17). The antimicrobial susceptility test of the isolated microorganisms by using the Kirby –Bauer disc diffusion method (18).

Result:

Distribution of S.aureus nasal isolates among health care personnel:

Table (1) showed that strains of S.aureus nasal carriage were isolated in 42 of 105 nasal swabs, which represented (40%). The high incidence of S. aureus nasal carries found in this study was 50% with sub staff followed by lab. workers ,food handlers, hospitalized patients, nurses and doctors (45.83%, 41.67% ,40%,35.71%, and 30%) respectively.

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Table (1): Distribution of Staphylococcus aureus nasal isolates among health care personnel:

Source	No. of samples		%
	Examined	Positive	
Doctors	20	6	30
Nurses	28	10	35.71
Substaff	16	8	50
Lab.workers	24	11	45.83
Food handlers	12	5	41.67
Patients*	5	2	40
Total	105	42	40

Non significant X^2=4.289, P=0.75

*Hospitalized patients for 72h.post admission.

Distribution of S.aureus nasal isolates among communitycontrol: Table (2) showed that strains of S.aureus were isolated in 25 of 75 nasal swabs that represented (33.33%). Among community control groups, 16 of 40 (40%) had positive nasal cultures with school students followed by workers in shops, restaurants, and bakery which represented (33.33%, 25%, 18.18%) respectively. There was no significant difference among community control groups.

Table (2): Distribution of Staphylococcus aureus nasal isolates among community control:

Source	No. of samples		%
	Examined	Positive	
Bakery workers	11	2	18.18
Restaurants =	12	3	25
Shops =	12	4	33.33
School students	40	16	40
Total	75	25	33.33

Non significant X^2=6.401, P=0.10

Identification of S. aureus: Data in Table (3) showed the comparison between the percentages of the tests of S.aureus according to the various groups of health care personnel & community control, these results found that the percentage of free coagulase among health care personnel was higher than community control; this indicated that these isolates were more virulent than those obtained among community control. And this would provide useful information to differentiate these two groups or at least act as screening test in identification.

Table (3): Comparison between the percentage of presumptive tests of S.aureus among health care personnel and community control:

	No. of Isolates	Mannitol Fermentation	Coagulase slide	Coagulase tube	Tellurite reduction	DNase	TNase	Hemolysis
Health care Personnel	42	42(100%)	33(78.57%)	40(95.24%)	39(92.86%)	37(88.09%)	39(92.86%)	20(47.62%)
Community control	25	25(100%)	18(72%)	22(88%)	24(96%)	21(84%)	23(92%)	6(24%)
Total	67	67(100%)	51(76.12%)	62(92.54%)	63(94.03%)	58(86.57%)	62(92.54%)	26(38.81)

Antimicrobial Susceptibility Tests:

Clinical microbiology laboratories on most bacterial isolates routinely perform antimicrobial susceptibility testing. The identification of new or unusual patterns of antibiotic resistance among bacteria isolated from various patients may raise the suspicion of an outbreak or the presence of a new strain (19). Sixty seven isolates were enrolled in this study. 42 isolates from health care personnel and 25 isolates from community control were examined for 20 antibiotics susceptibility test Table (4).

Table (4): Comparison between antibiotic susceptibilities of S. aureus nasal isolates obtained from health care personnel and community control:

Antibiotic	Health care personnel (n=42)	Community control (n=25)
	No.(%)of isolates resistant	No.(%)of isolates resistant
Penicillin	42 (100)	25 (100)
Ampicillin	42 (100)	25 (100)
Amoxicillin	19 (45.24)	14 (56)
Methicillin	27 (64.29)	10 (40)
Cloxacillin	15 (35.71)	8 (32)
Cephaloxcin	9 (21.49)	8 (32)
Cefazidime	13 (30.95)	9 (36)
Gentamycin	8 (19.05)	12 (48)
Neomycin	11 (26.19)	10 (40)
Amikacin	16 (38.09)	7 (28)
Ciprofloxcin	13 (30.95)	9 (36)
Tetracycline	17 (40.48)	10 (40)
Doxcycline	10 (23.81)	9 (36)
Chloramphenicol	17 (40.48)	12(48)
Erythromycin	42 (100)	25 (100)
Licomycin	15 (35.71)	10 (40)
Vancomycin	0))0	0))0
Rifampicin	1 (2.38)	1 (4)
Fusidic acid	1 (2.38)	0))0
Trimthoprim-sulfonamide	17 (40.48)	12 (48)

Discussion:

Staphylococcus aureus is one of the most frequently isolates pathogen in clinical specimens. In facts, S .aureus is currently the most common cause of infection in hospitalized patients (4). It causes a variety of serious diseases associated with a high mortality (20). The anterior nares have proven to be the primary reservoir of S. aureus in humans and S. aureus nasal carriage has been established as major risk factor for the development of both community – acquired and nosocomial infections (21). The human can be the source of infection with S.aureus and its prevalence. The nasal carriers can be also the source of infections; it can survive in their body without notes the symptoms (22). The nasal carriage rate in adults is estimated at about 20-40%, depending on seasonal and local epidemiological factors. Some groups of individuals seem to be colonized with S.aureus: physicians, nurses, and hospital ward attendants may be nasopharyngeal carriers in a higher percentage of cases (70%) than the general population (30%) (23). The high incidence of S.aureus nasal carriers found in this study in table one was (50%) with sub staff, this result was higher than result of another study who had (39%) of S.aureus nasal carriage rate of hospital staff (24). Many suggestions of this highly susceptible group may be related to intensive chemotherapy and antibiotic usage, which alter the normal flora of the nose, and may eradicate the other organisms i.e.: -the colonization resistance factors. Clearly, other factors, such as changes in the normal nasal flora and bacterial interaction may have a part to play in the pathogenesis of S.aureus syndrome. In intensive care unit, 2 of 5 (40%) hospitalized patients were examined daily after 72h. of admission to the hospital who were negative at admission. It appears that S.aureus which is spread in the environment of the hospital; can be acquired by susceptible patients, especially those who lack resistance to colonization by S.aureus. So far, a typing scheme is not available to distinguish the different strains of S.aureus and to trace their spread in hospital environment but extensive antibiograms may be helpful. High incidence of nasal carriage of S .aureus had appeared in schools students who represented (40%) where as low incidence had appeared in bakers group (18.18%) (Table two). This may be indicated to poor education and personnel hygiene of the school students in comparison with bakers who had always exposed to heat because of their jobs. By contrast, my results were in fair disagreement with results of another study that reported the incidence rate was (8%) of isolates in healthy people (24).

Rapid isolation and identification of S.aureus in clinical samples are essential for appropriate patient care and control of this microorganism in hospital. In clinical laboratory routine S.aureus is usually isolated on specific media and then presumptively identified before definitive overnight characterization (25, 26). Selective media have been developed to achieve isolation and presumptive identification in single step. Mannitol Salt agar is one of the most widely selective media for isolation of S.aureus (27) . All the isolates of health care personal were completely positive to fermentation of Mannitol, while (95.24%) of isolates were positive for free coagulase and (78.57%) of isolates gave a positive result in possessing bound coagulase, therefore, the tube method was adopted as a standard method and a firm clot was taken as a positive result for coagulase test. Metallo proteinase with coagulase – like activity is produced by some coagulase negative strains and may interfere with their identification (28), this may explain the high percentage of coagulase production obtained in this study. (92.86%) of all isolates were positive in TNase production these results could be argued for that mutation of some kinds may happen to the population of S.aureus included in this study. The hemolysin production was in low percentage of the above groups, it was (47.62%). In general, the total production of TNase and DNase were (94.05%) and (89.29%) respectively of S.aureus isolated from health care personnel groups. Some strains of S.aureus gave negative results in DNase, so it must depend on TNase, and this agreed with another study (29) which found that TNase is more reliable than DNase. All isolates of community control were positive in acid production of mannitol .The percentages of positivity followed by Tellurite reduction, TNase production, free coagulase, DNase production, bound coagulase, and hemolysin production were (96%, 92%, 88%, 84%, 72%, 24%) respectively. These findings were confirmed during the course of our study, it was therefore decided to include a fermentation of Mannitol, TNase production, and free coagulation production in identification of S.aureus. Table (4) showed the differences of antibiotics resistance between health care personnel and community control, there were significant differences between these two groups, this may be due to the different mechanisms selected by the bacteria that change the pathway of antibiotic resistance by β-lactamase and tolerance the lethal effect of the antibiotic.The appearance of multi drug resistance antibiotics was appeared in the hospital isolates than in the open community that may be affected by the place, the time of collection, seasonal, geographic distributions and the important cause is that due to contact with the patient who carry these strains or from the wards, and theater in the hospital. Also the genetic variation of these strains, mutation, and changing in the genetic material may be effect on type of these strains. The antibiotic susceptibility testing has relatively limited use in epidemiological studies because of phenotypic variation, and antibiotic resistance is affected by selective pressure in hospitals (30,31). The antibiotic abuse in both hospital and community may increase the rate of resistance to antibiotic. It was blamed that genetics and plasmid carrying resistant genes and its transfer from one generation to another, that may be the cause of the high resistance rate to penicillin G, ampicillin in S.aureus isolates (32, 33, 34).

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