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The resistance patterns of multi –Drug resistant *Staphylococcus aureus* isolated from different clinical samples

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Abstract

A total number of 283 *Staphylococcus aureus* isolates isolated from different clinical samples obtained from outpatients and hospitalized patients attending the Elbatnan Medical Center Tobruk and their sensitivity to antimicrobial drugs were tested. High incidence of resistant strains and high degree of association between resistance, and complex resistance patterns are seen. The strains were resistant to all Antibiotics tested and 10 resistance patterns occurred three times and more these, distinguished patterns could be used as an additional typing system for local *Staphylococcus aureus strains.*

Key-Words: *Staphylococcus aureus*, Multi-drug Resistant, Resistant Ptterns

Introduction

Staphylococcus aureus is a major Gram-positive pathogen *that is* capable of causing several kinds of infectious diseases, such as skin and soft tissue infection Pneumonia and sepsis. *S.aureus* is one of the commonest causes of both endemic and epidemic nosocomial infection, with substantial morbidity and mortality (Grosserod and Wenzal, 1999). *S.aureus* strains have been isolated s dramatically worldwide in hospitals such as the study of [Gordan,1993] which found that 18% of nosocomial infections were due to *S.aureus* whereas,[Archer,1996] reported that 14% Of nosocomial infections were *S.aureus.*

Staphylococcus aureus infection dramatically decreased after the introduction of penicillin ,which was followed by the introduction of penicillinase-stable penicillin(Park *et al*., 2007).More than 80% of *S.aureus* strains produce penicillinase and therefore, Penicillinase-stable beta lactam such as methicillin,cloxacillin and flucloxacillin, have been mainstay of treatment of *S.aureus* for over35 years (Segreti *et al*., 1996) .However, the introduction of these antibiotics has also contributed to the Emergence of methicillin resistant *S.aureus*[MRSA] strains and increasing number Of MRSA have been isolated worldwide,[Lynette et al., 2008). In addition in hospitals, hospital associated-MRSA (HA-MRSA) have been reported (Ma *et al*., 2000; Okuma *et al*., 2000) .

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In recent years infections with MRSA in children and adults who have Little or no access to the healthcare system, commonly referred to as community-associated MRSA(CA- MRSA),have been reported with increasing frequency and the characteristics of CA-MRS Aare district from HA- MRSA (Eady and Cove,2003; Ko *et al*., 2005; Diep *et al*., 2006 ; Scott *et al*., 2011). Strains of MRSA may be epidemic (EMRSA) or multidrug –resistant with variable resistance to clindamycin erythromycin tetracycline, trimethobrims / sulfamethoxazole, Fluoroquinoiones, aminoglycosides and rifampicin. In the present study the resistance patterns of multi- drug resistant strain of *S.aureus* were reported and the correlations of resistance between pairs of antibiotics were suited.

Experimental

283 *S.aureus* strains were isolated from different clinical samples from patients hospitalized and out patients attending Al-batnan medical center between January 2005 and June2005 the strains were isolated and identified according to (Baron and Finegold,1990) and API system for *Staphylococcus aureus* (Lioflchem, Italy).The antimicrobial susceptibility test was perform using the agar dilution method according to the guidelines of the national committee for clinical laboratory standard Nccls2003 the antimicrobial agents used were ampicillin (P) ,Ampicillin (AMP) , Amoxicillin (AMX), Erythromycin (E), Co-Trimoxazole (SXT), Cephalexin (CLX), Doxycylin (DO), Nalidixic Acid (NA), Chloroamphenicol (C), Glavalanic acid Amoxicillin (AMC), Cloxacylln (OB), Clindomycin CN , Ceftriaxone CR.

Results and Discussion

283 *S.aureus* strains were isolated from different clinical samples(table-1).These isolates were collectively tested for sensitivity and resistance against 13 antibiotics. The antimicrobial susceptibility test of the isolates showed that *S aureus* strains were sensitive to clavulanic acid/Amoxicillin, chloroamphenicol , cloxycylin ,doxycyclin and cephalexin((table-2).

The result of this study showed that *S.aureus* strains were sensitive to Clindamycin agreed with the result of (Carmeli et al., 1999) Clindomycin a lincosamide antibiotic has long been considered to be an optional drug in the treatment of infections caused by both the aim is that demands that and it is MSSA and MRSA strains (Park *et al*., 2007).

The expression of inducible clindamycin resistance, however could limit the effectiveness of this drug. Phenotypically, inducible clindamycin resistance strains appeared to be resistance to erythromycin and susceptible to clindamycin on routine antimicrobial susceptibility testing. This result is agreed with (Weisblum, 1985). Inducible resistance however can be expressed during double disk diffusion D-test (Leclerq, 2002 ; Lewis and Jorgenen, 2005) in which an erythromycin disk will induce clindamycin resistance.

The sensitivity of the isolates to clavulanic acid/amoxicillin, clocycillin in the present study is similar to the result of (Segre *et al.,* 1996), however it is different from the result of (Al-Kalidy, 2002) in which the Isolates were resistant to chloroamphenicol, cloxycylin and clavulanic acid/Amoxicillin.

The result of the present study showed that the isolates were resistant to all antibiotics used in a ratio of 8-82% [table-3].These strains were high resistant to amoxicillin, ampicillin, erythromycin, co-trimoxazole, penicillin, cephalexin, doxycylin and nalidixic acid. Multi-drug resistance strains, especially to the B-lactam antibiotics develop from the production of penicillin binding protein [PBP2a] which which has low affinity to beta – lactams, allowing cell wall synthesis to continue in their presence, this protein therefore confers resistance to the beta–lactamase resistant, penicillin and cephalosporin (Keiichi , 2004). Matrix and triangle matrix were conducted for the resistance of the strains to antibiotics (table-4),(table-5). Almost all these strains were resistant to one or more antibiotics (table-6) .The high incidence of resistant strains, high degree of association between resistance, and complex resistance pattern of the same strain were noticed .Most strains revealed multiple resistance and the resistance pattern were so different and complex. These results indicate that the resistance of most *S .saureus* to a number of antibiotics is common, this agreed with the results of others (Palumbi, 2001; Levy and Marshall, 2004 and Lynette *et al*., 2008).

The result of present study showed that there were 10 resistance patterns to antibiotics and the resistance patterns to beta-lactam antibiotics were the most frequented e .g the resistance pattern to ampicillin, amoxicillin frequency was 22times and the resistance pattern to ampicillin, amoxicillin and penicillin frequency was 16 times .The results of this study recommend that therapy should account for local resistance patterns.

Conclusion

Staphylococcus aureus strains were tested against 13 antibiotics. Almost all strains were resistant to one or more antibiotics, there were high incidence of resistant strains, high degree of association between resistance, and complex resistance patterns were obtained.

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Table 1: The different source of *Staphylococcus aureus* strains

Clinical samples	No of *S.aureus* strains	%
Throat swabs	29	10.25
Ear swabs	41	14 5
Wound and burns swabs	81	28.6
Urine samples	97	34.3
Vaginal swabs	8	2.83
Semen samples	10	3.5
Sputum	12	4.24

Table 2: Sensitivity and resistance of *S.aureus* to antibiotic

antibiotics	**Urine 97**	**PUS 81**	**Sputum 12**	**T \ S 29**	**Ear 14**	**Semen 10**	**Vagina 8**	**Skin 5**	**Total**	**%**
P	S R 78 19	S R 24 57	S R 3 9	S R 5 24	S R 11 30	S R 3 7	S R 4 4	S R 2 3	S \ R 130\ 153	S \ R 46\54
AMP	24 73	18 53	2 10	5 24	9 32	3 7	4 4	1 4	76 \207	17\83
AMX	23 74	14 67	1 11	3 26	4 37	1 9	4 4	- 5	50 \233	18\82
E	33 64	58 23	6 6	23 6	23 18	- 10	2 6	3 2	148\135	25\48
SXT	46 51	57 24	9 3	21 8	23 18	4 6	3 5	4 1	167\116	59\41
CLX	54 43	64 17	6 6	18 11	29 12	7 3	5 3	4 1	187\69	66\34
DO	55 42	63 19	11 1	25 4	28 13	6 4	3 5	5 -	195\88	69\31
NA	34 63	77 4	12 -	29 -	39 2	5 5	7 1	5 -	208\75	74\26
C	74 23	77 4	12 -	29 -	39 2	10 -	8 -	5 -	254\29	90\10
AMC	86 11	77 4	12 -	15 4	37 4	10 -	7 1	5 -	259\24	92\8
OP	88 9	71 10	9 3	22 7	31 10	6 4	6 2	4 1	237\46	84\16
CN	90 7	69 12	11 1	27 2	35 6	6 4	7 1	4 1	249\34	88\12
C	74 23	78 3	9 3	28 1	33 8	10 -	7 1	5 -	244\39	86\14

Table 3: Resistance of *S.aureus* strains isolated fro different clinical samples

Antibiotics	Urine 97	PUS 81	Sputum 12	T \ S 29	Ear 14	Semen 10	Vagina 8	Skin 5	Total
P	NO % 19 19.5	NO % 57 70.4	NO % 9 75	NO % 24 82.8	NO % 30 73	NO % 7 70	NO % 4 50	NO % 3 60	NO % 153 54
AMP	73 75.3	53 65.4	10 83.3	24 82.8	32 78	7 70	4 50	4 80	207 73
AMX	74 76.3	67 82.7	11 91.7	26 89.7	37 90.2	9 90	4 50	5 100	233 82
E	64 65.9	23 28.3	6 50	6 20.7	18 43.9	10 100	6 75	2 40	135 48
SXT	51 52.5	24 29.6	3 25	8 27.6	18 43.9	6 60	5 62.5	1 20	116 59
CLX	43 44.3	17 20.9	6 50	11 37.9	12 29.3	3 30	3 37.5	1 20	69 34
DO	42 43.3	19 23.5	1 8.3	4 13.8	13 31.7	4 40	5 62.5	- -	88 31
NA	63 64.9	4 4.9	- -	- -	2 4.9	5 50	1 12.5	- -	75 27
C	23 23.7	4 4.9	- -	- -	2 4.9	- -	- -	- -	29 10
AMC	11 11.4	4 4.9	- -	4 13.8	4 9.8	- -	1 12.5	- -	24 8
OP	9 9.2	10 12.4	3 25	7 24.1	10 24.4	4 40	2 25	1 20	46 16
CN	7 7.2	12 14.8	1 8.3	2 6.9	6 14.6	4 40	1 12.5	1 20	34 12
C	23 23.7	3 3.7	3 25	1 3.4	8 19.5	- -	1 12.5	- -	39 14

Table 4: Matrix of the frequency of co-resistance between pairs of antibiotics

	P	AMP	AMX	E	SXT	CLX	DO	NA	C	AMC	OB	CN	CR
P	-	98	122	59	50	39	38	17	7	10	26	22	12
AMP	98	-	194	104	88	91	64	38	25	22	37	24	35
AMX	122	194	-	102	78	84	66	16	24	20	30	17	35
E	59	104	102	-	65	54	52	51	17	11	22	20	25
SXT	50	88	78	65	-	49	53	38	18	8	19	21	24
CLX	39	91	84	54	49	-	35	32	15	10	23	9	22
DO	38	64	66	52	53	35	-	30	14	10	17	10	21
NA	17	38	16	51	38	32	30	-	19	5	11	7	14
C	7	25	24	17	18	15	14	19	-	5	1	3	9
AMC	10	22	20	11	8	10	10	5	5	-	7	4	7
OB	26	37	30	22	19	23	17	11	1	7	-	11	11
CN	22	24	17	20	21	9	10	7	3	4	11	-	9
CR	12	35	35	25	24	22	21	14	9	7	11	9	-

Table 5: Matrix indicating number of *S.aureus* strains resistant to two antibiotics at the same time

AMP	98										
AMX	122	194									
E	59	104	102								
SXT	50	88	78	65							
CLX	39	91	84	54	49						
DO	38	64	66	52	53	35					
NA	17	38	16	51	38	32	30				
C	7	25	24	17	18	15	14	19			
AMC	10	22	20	11	8	10	10	5	5		
OB	26	37	30	22	19	23	17	11	1	7	
CN	22	24	17	20	21	9	10	7	3	4	11	
CR	12	35	35	25	24	22	21	14	9	7	11	9
	P	AMP	AMX	E	SXT	CLX	DO	NA	C	AMC	OB	CN

Table 6: resistance pattern of *S.aureus* strains to antibiotics

Resistance patterns	Number	%
One antibiotic	4	1.4
Two antibiotics	36	12.7
Three antibiotics	46	16.2
Four antibiotics	64	22.6
Five antibiotics	42	14.8
Six antibiotics	30	10.6
Seven antibiotics	25	8.38
Eight antibiotics	15	5.35
Nine antibiotics	6	2.12
Twelve antibiotics	1	0.35

Table 7: The frequency of resistance patterns *of S. aureus*

Antibiotics	Frequency number
Amp – AMX	21
AMP – AMX – P	16
AMP – AMX – E	3
SXT – E – P	3
AN – AMX – P	3
AMP – AMX – E – P	11
AMP – AMX – SXT – P	6
AMP – AMX – CL – P	5
AMP – AMX – E – NA	3
AMP – AMX – E – NA – SXT – DO – CLX	5