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Original article

The Prevalence of *Staphylococcus Aureus* Isolated from Skin and Soft Tissue Infections and Its Antibiotic Susceptibility Patterns

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ABSTRACT

Objectives: *The current study was aimed to evaluate the frequency and antibiotic susceptibility pattern of S. aureus isolated from various clinical specimens of patients admitted to Al Jala hospital during 2017 and 2018, and to figure out the prevalence of S. aureus strains among clinical specimens.* ***Methods****. A cross sectional study conducted in AL jala hospital during 2017-2018. About 226 clinical specimens were collected and inoculated in sheep blood agar, chocolate, and mannitol salt agar. Then incubated at 35 c for 18-24 hours in aerobic atomosphere. The Kirby-bauer disc diffusion method was performed to determine antibiotic susceptibility.* ***Results****. Most of staph aureus isolate were from ages 21-30 years, followed by ages 31-50 years, while in 2018, the most of staph aureus isolate were from ages 31-50 year followed by 17-30 years. The highest isolate of staph aureus from clinical specimens was in males than in females in both years. The highest specimen found in the swab was staph aureus followed by tips and pus. The highest susceptibility level of Staph aureus during 2017 was recorded towards Vancomycin, followed by Ciprofloxacin (70%), Septrin (66%), Erythromycin and Amikacin 85(60) equally. While, the highest resistance level recorded was towards Amoxicillin (46%) followed by Tetracycline (32%), Gentamycin 34 (24%). In 2018, S. aureus strains recorded high sensitivity to Ciprofloxacin and Erythromycin 83 (81%) equally. The most common drug resistance was colistin 101 (99%), Augmentin 93 (91%) and ceftazidime 77 (75%).* ***Conclusion****. Vancomycin, Ciprofloxacin and Erythromycin were the most antibiotics found to give constant sensitivity. The determination of prevalence and antibiotic sensitivity pattern of staph aureus will assist clinicians to establish antibiotic treatment approaches.*

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INTRODUCTION

Annually, nosocomial infections account for ill health and death between millions of patients, worldwide. S. aureus are Gram-positive cocci, usually appearing as clusters on a Gram's stain [1,2]. S. aureus is a common cause of skin and soft tissue infections [3,4]. Some strains have the ability to produce enterotoxins that cause foodborne illness. Thus, in addition to causing skin infections, S. aureus is a major cause of gastroenteritis [5]. Shortly after hospitals started using penicillin, S. aureus resistant to the antimicrobial agent appeared, and by the 1970s, multidrug-resistant S. aureus (MRSA) had appeared [6]. Strains of Staphylococcus aureus that are

resistant to the penicillinase-resistant penicillin have been isolated principally from hospitalized patients, particularly in Europe [7-9]. In England, the mean incidence of MRSA bacteremia is about 40% of Staph aureus bacteremia [10-12]. MRSA were first reported in 1961 and have since become a major nosocomial pathogen worldwide [13,14]. Various tests can be used to identify S. aureus, including production of protein A, cell-bound clumping factor, extracellular coagulase and heat-stable nuclease [15,16]. Daptomycin, linezolid and tigecycline are alternative agents which can be selected [17]. Other newer agents to consider are ceftaroline, dalbavancin, oritavancin, telavancin, or tedizolid [18-21]. Before long after hospitals started using penicillin, S. aureus resistant to the antimicrobial agent seemed, and by the 1970s, multidrug-resistant S. aureus had appeared [18]. Methicillin-resistant S. aureus (MRSA) specifically was first encountered in the 1960s; it is predictable that almost 100,000 severe MRSA infections arose in 2005, with nearly 19,000 deaths linked to MRSA, matched with 17,000 deaths from human immune deficiency virus and AIDS.9 Between 1999 and 2005, hospitalizations due to MRSA doubled [15]. The objectives of the study were to compare the susceptibility pattern of S. aureus isolates against various types of commonly used antibiotics in Al- Jala hospital during two years, and to determine the prevalence of staph aureus among clinical specimens.

METHODS

Study design and setting

It was a cross - sectional study conducted at department of bacteriology in Al-Jala Hospital- Benghazi between 2017 to 2018. About 226 clinical specimens were collected from CSF, urine, catheter tip, pus, pus swabs, sputum and surgical site infections. Specimens were inoculation on sheep blood agar, chocolate and mannitol salt agar. The plates were then incubated at 35 °C for 18–24 hours in aerobic atmosphere. The identification of S. aureus was made on the basis of colony morphology, gram's staining, catalase and coagulase tests. The Kirby-Bauer disk diffusion method was performed to determine the antibiotic susceptibility. The antibiotics tested were AK-Amikacin (30µg), Amoxicillin (30 µg), Doxycillin 30 (30 µg), Levofloxacin (30 µg), Erythromycin (15 µg), pencillin (10 µg), ceftazidime (30mcg), gentamicin (10 mcg), Piperacillin (30 µg), ciprofloxacin (5µg), Imipenem (30 µg), Vancomycin (25 µg), SXT-Sulfamethoxazole (25µg), Nalidixic acid (30 µg), Nitrofurantoin (300 µg), tetracycline (30mcg), tobramycin (10 mcg), Colistin (10Fg), Augumentin (30ug). Results of disk diffusion method were interpreted in accordance to the Clinical and Laboratory Standards Institute (CLSI, 2009). All ethical considerations for the studies on patients were considered carefully and the experimental protocol was approved by the Ethics Committee for research on the hospital infection control unit.

Statistical analysis

Following data collection, clinical specimens were coded and placed in numerical sequence. A Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA) spread sheet database was built to collate, quantify and analyses the data which was subsequently inputted by the investigator in order to estimate distribution of the Staph aureus growth in specimens, susceptibility and resistance patterns of staph aureus to antibiotics. The excel programme spread sheet was used with the appropriate formulas to compile tables of summary statistics and to create frequency tables, charts of counts and percentages.

RESULTS

Distribution of staph aureus growth in clinical specimens according to the age group (2017).

The highest isolate of staph aureus was recorded in ages 21-30 (23%), followed by ages 31-50 years (33%), while the lowest was recorded in ages between1-10 (17%).

Table 1: Distribution of staph aureus growth in clinical specimens according to age group 2017

Age group 2017	1-10	12-20	21-30	31-50	51-70
%	12%	18%	29%	23%	18%
Number	17	26	41	33	25

Distribution of staph aureus growth in clinical specimens according to the age group (2018).

Most of staph aureus isolate was from ages 31-50 year followed by 17-30 years, while the lowest reported in ages 1-16 year.

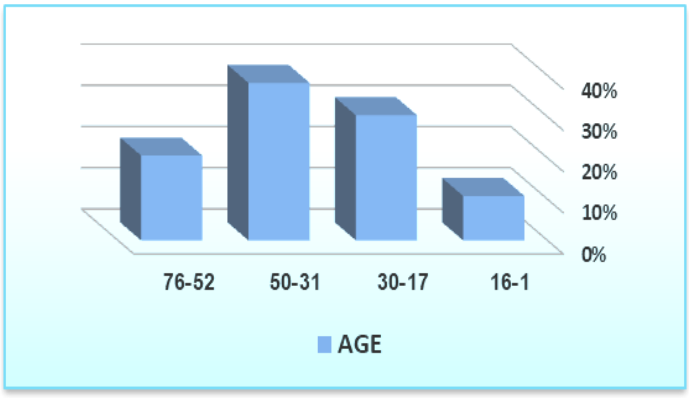

Figure 1. Distribution of staph aureus growth in clinical specimens according to the age group (2018).

Distribution of the specimens according to gender 2017

According to gender, the highest isolate of staph aureus from clinical specimens was more in males than in females.

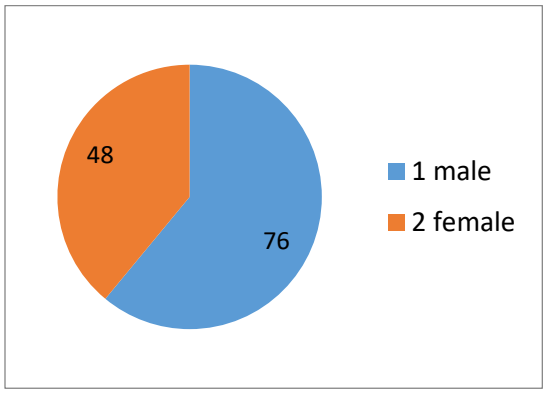

Figure 2. Distribution of the specimens according to gender (2017).

Distribution of the specimens according to gender (2018)

Also, the highest isolated of staph aureus from the clinical specimens was (61%) males and (39%) females.

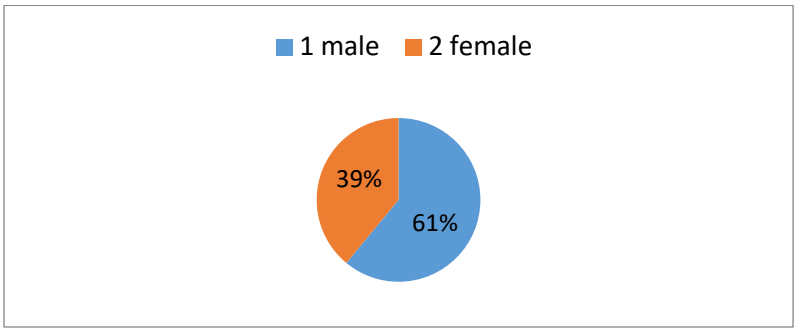

Figure 3. Distribution of the specimens according to gender (2018).

Distribution of the Staph aureus growth in specimens 2017

The highest specimen found in the swab was staph aureus followed by tips and pus.

Table. 2: Distribution of the Staph aureus growth in specimens (2017)

SAMPLE	swab	urine	pus	Catheter tip	csf	sputum	
%	53%	7%	12%	16.9%	4%	6%	100%
NUMBER	66	9	15	21	5	8	

Distribution of the Staph aureus growth in specimens 2018.

The prevalence of *staph aureus* was significantly different among various clinical specimens and was found that 58% of these isolates were from swab followed by pus (25%) and Tips (12%).

Table 3. Distribution of the Staph aureus growth in specimens 2018

SAMPLE	Swab	Urine	Pus	Catheter tip	CSF	Sputum	Total
%	58%	2%	25%	12%	3%	1%	100%
NUMBERS	59	2	25	12	3	1	102

Susceptibility and resistance patterns of Staph aureus to antibiotics 2017.

The highest susceptibility level of Staph aureus was recorded towards Vancomycin, followed by Ciprofloxacin (70%), Septrin (66%) Erythromycin and Amikacin 85(60) equally. While the highest resistance level recorded was towards Amoxicillin (46%) followed by Tetracycline (32%), Gentamycin 34 (24%).

Table. 4: Susceptibility and resistance patterns of Staph aureus to antibiotics 2017

Susceptibility Patterns	Amik	AMOX	DO	levo	E	P	ceft	GN	Bip	Cip	Imip	Van	SXT	NA	F	Te	Tob	Coli
Intermediate Susceptibility	4 3%	2 1%	5 4%	0 0%	0 0%	0 0%	1 1%	4 3%	5 4%	6 4%	1 1%	1 1%	2 1%	1 1%	1 1%	5 4%	0 0%	0 0%
High Susceptibility	85 60%	69 49%	51 36%	79 56%	85 60%	6 4%	1 1%	20 14%	14 10%	99 70%	111 78%	111 78%	94 66%	1 1%	24 17%	56 39%	7 5%	10 7%
Resistant	28 20%	65 46%	17 12%	20 14%	28 20%	18 13%	2 1%	34 24%	20 14%	29 20%	8 6%	8 6%	27 19%	0 0%	3 2%	46 32%	15 11%	4 3%
NA	25 18%	6 4%	69 49%	43 30%	29 20%	118 83%	138 97%	84 59%	103 73%	8 6%	22 15%	22 15%	19 13%	140 99%	114 80%	35 25%	120 85%	128 90%
%	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

AK-Amikacin (30µg), Amoxicillin (30 µg), Doxycillin 30 (30 µg), Levofloxacin (30 µg), Erythromycin (15 µg), pencillin (10 µg), ceftazidime (30mcg), gentamicin (10 mcg), Piperacillin (30 µg), ciprofloxacin (5µg), Imipenem (30 µg), Vancomycin (25 µg), SXT-Sulfamethoxazole (25µg), Nalidixic acid (30 µg), Nitrofurantoin (300 µg), tetracycline (30mcg), tobramycin (10 mcg), Colistin (10Fg)

Susceptibility and resistance patterns of *Staph aureus* to antibiotics 2018

S. aureus strains recorded high sensitivity to Ciprofloxacin and Erythromycin 83 (81%) equally. The most common drug resistance was toward colistin 101 (99%), Augmentin 93 (91%) and ceftazidime 77 (75%).

Table. 5: Susceptibility and resistance patterns of Staph aureus to antibiotics 2018

Susceptibility Patterns	E	F	GN	Cip	Imep	Te	Dapt	Levo	Sep	Van	Amik	AMC	Coli	Ceft
Low Susceptibility	0 0%	0 0%	0 0%	0 0%	0 0%	1 1%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Intermediate Susceptibility	5 5%	0 0%	2 2%	0 0%	0 0%	1 1%	3 3%	1 2%	1 1%	0 0%	3 3%	1 1%	0 0%	2 2%
High Susceptibility	83 81%	56 55%	36 35%	83 81%	49 48%	55 54%	74 73%	75 47%	75 74%	49 48%	49 48%	8 8%	1 1%	23 23%
Resistant	1 4%	46 45%	64 63%	19 19%	53 52%	45 44%	25 25%	52 51%	26 25%	12 12%	50 49%	93 91%	101 99%	77 75%
%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Erythromycin (15 µg), Nitrofurantoin (300 µg), gentamicin (10 mcg), ciprofloxacin (5µg), Imipenem (30 µg), tetracycline (30mcg), Augumentin (30ug), Colistin (10Fg). ceftazidime (30mcg)

DISCUSSION

S. aureus is a highest nosocomial pathogen causing significant disease and mortality [16]. The major way for patient-to-patient spread s. aureus infected or colonized patients and transient hand carriage on the hands of health care staff. This cross-sectional study reported that isolated of staphylococcus aureus from clinical specimens was more in male specimens than female. In agreement with our observation, there was a study

done by Loreen mentioned that "male gender was identified as risk factor for s. aureus nasal carriage"[22]. Judyta et al., indicated that "Risk factors for *S aureus* carriage were sex dependent"[23].

The current study found that a high staphylococcus aureus isolate during the two years was obtained from swab, tips and pus. On the other hand, previous studies carried out by Metha and Rajaduraipandi, found a high isolation rates from pus and wound swab [21,24]. While, Qureshi et al., recorded high isolation rate from pus [25].

The prevalence and antibiotic susceptibility patterns of various *Staph aureus* isolates gained from various clinical subjects were determined. The present study documented high sensitivity of staphylococcus aureus was to vancomycin, which was similar to studies performed by Mehta and Rajaduraipandi [21,24]. The most common drug resistance of S. aureus during 2017 was recorded toward Amoxicillin (46%) followed by Tetracycline (32%), Gentamycin 34 (24%), while in 2018 the resistant was recorded toward colistin 101 (99%), Augmentin 93 (91%) and ceftazidime 77 (75%). Dissimilarly, Qureshi et al., had reported 97.8% staph aureus recorded resistant to Gentamicin [25]. Furthermore, Unaezuoke et al., documented a high resistance of 95.8% to penicillin, 89.6% to ampicillin, 87.5% to tetracycline and 75.0% to chloramphenicol by staphylococcus aureus strains [26].

CONCLUSION

Vancomycin, Ciprofloxacin and Erythromycin were the most antibiotics found to give constant sensitivity toward S. aureus isolates. These findings could assist epidemiologists to understand the nature of S. aureus isolates in this hospital of Libya.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

REFERENCES

1. James J, Michael A, Karen C, Guido F, Marie L, Sandra S, et al. Manual of Clinical Microbiology. 11th edition, Washington. DC: ASM Press ed. 2015.
2. Amy L. Clinical Microbiology Procedures Handbook. 4th Edition. Washington. DC: ASM Press. 2016.
3. David S. Clinical Infectious Disease. Cambridge. United Kingdom: Cambridge University Press. 2015.
4. Catherine L, Arnold B, Sara E, Robert S, Scott K, Rachel J, et al. Clinical practice guidelines by the infectious disease's society of America for the treatment of methicillin-resistant Staphylococcus aureus infections in adults and children. Clin Infect Dis. 2011; 1;52(3):285-92.
5. Hajo G, Marta A, John B, Eidne T. Emergence and resurgence of methicillin-resistant Staphylococcus aureus as a public-health threat. Lancet. 2006; 2;368(9538):874-85.
6. Yves L, Florence B, Michel G. Staphylococcus aureus and food poisoning. Genet. Mol. Res. 2003; 31;2(1):63-76.
7. Acar F, Courvalin P, Chabbert P. Methicillin-resistant staphylococcemia. bacteriological failure of treatment with cephalosporins. Antimicrob Agents Chemother (Bethesda). 1970; 10:280-5.
8. Barber M. Naturally occurring methicillin-resistant, staphylococci. J. Gen. Microbiol, 1964; 35:183-90.
9. Benner J and Kayser H.Growing clinical significance of methicillin-resistant Staphylococcus aureus. Lancet. 1968; 5;2(7571):741-4.

10. Centers for Disease Control and Prevention (CDC). Staphylococcus aureus resistant to vancomycin. JAMA, 2002 Jul 5;51(26):565-7.
11. Hiramatsu K, Hanaki H, Ino T, Yabuta K, Oguri T, Tenover C.Methicillin-resistant Staphylococcus aureus clinical strain with reduced vancomycin susceptibility. J Antimicrob Chemother. 1997; 40(1):135-6.
12. Thauvin-Eliopoulos C, Rice L, Eliopoulos G, Moellering R. Efficacy of oxacillin and ampicillin-sulbactam combination in experimental endocarditis caused by b-lactamase-hyper producing Staphylococcus aureus. Antimicrob Agents Chemother, 1990;34(5):728-32.
13. Diekema D, Pfaller M, Turnidge J, Verhoef J, Fluit A, GDoern G, et al. Genetic relatedness of multidrug-resistant, methicillin (oxacillin)-resistant Staphylococcus aureus bloodstream isolates from SENTRY Antimicrobial Resistance Surveillance Centers worldwide. 1998. Microb Drug Resist, 2000;6(3):213-21.
14. Michael C, Stephanie D, Giles E, Donald M, stuart C. European Antimicrobial Resistance Surveillance System (EARSS). Annual Report EARSS-2003. Bilthoven. The Netherlands. RIVM, 2004.
15. Betty A, Daniel F, Alice S. Staphylococcus, Micrococcus and Similar Organisms, Chapter 19. In: Baily and Scott's Diagnostic Microbiology. ed. 11 edition. Mosby Inc: St. Louis, 2002.
16. Sachdev D, Amladi S, Nataraj G, Baveja S, Kharkar V, Mahajan S, et al. An Outbreak of Methicillin–resistant Staphylococus aureus (MRSA) infection in dermatology indoor patients. Indian J Dermatol Venereol Leprol, 2003:69:6;377-380
17. Gilbert M, David N, Henry F, Chamber M, George M, Michael M, et al. The Sanford Guide to Antimicrobial Therapy 2016. 46th edition. Antimicrobial Therapy. Inc. 2016.
18. Gould I, David M, Esposito S, Garau J, Lina G, Mazzei T, et al. New insights into methicillin resistant Staphylococcus aureus (MRSA) pathogenesis. treatment and resistance. Int J Antimicrob Agents. 2012; 39(2):96-104.
19. Andrew W, Rupali J, David H. New approaches to antibiotic use and review of recently approved antimicrobial agents. Med Clin North Am. 2016 Jul;100(4):911-26.
20. Mendes R, Sader H, Smart J, Castanheira M, Flamm R. Update of the activity of telavancin against a global collection of Staphylococcus aureus causing bacteremia. including endocarditis (2011-2014). Eur J Cli Microbiol Infect Dis. 2017; 36(6):1013-1017.
21. Mehta A, Rodrigues C, Sheth K, Jani S, Hakimiyan A, Fazalbhoy N. Control of methicillin resistant Staphylococcus aureus in a tertiary care Centre–A five–year study. J Med Microbiol. 1998; 16, 31-34.
22. Loreen A, Josseph J, Pamela F, Jianfang H, Michael A, Richard P, et al. preoperative risk factors for nasal carriage of staphylococcus aureus. Cambridge university press. 2015; 25(6).
23. Judyta E. and Barbara A. Sex differences in the risk factors for Staphylococcus aureus throat carriage. American Journal of Infection Control. 2017; 29-33.
24. Rajaduraipandi K, Mani K, Panneerselvam K, Mani M, Bhaskar M, Manikandan P. Prevalence and antimicrobial susceptibility pattern of Methicillin resistant Staphylococcus aureus: a multicenter study. Indian Journal of Medical Microbiology, 2006; 24 -34.
25. Qureshi H, Rafi S, Qureshi S, Ali A. The current susceptibility patterns of methicillin resistant Staphylococcus aureus to conventional anti Staphylococcus antimicrobials at Rawalpindi. Pak J Med Sci. 2004; 20:361–4.
26. Unaezuoke J and Aririatu L. A survey of Antibiotic Resistant Staphylococcus Aureus Strains from clinical sources in Owerri. Journal of applied sciences and environmental management. 2004; 8(1).