



Methacillin resistant staphylococcus aureus (MRSA) in superficial bacterial skin infections

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Abstract

Background: Methacillin resistant staphylococcus aureus (MRSA) is any strain of staphylococci that has resistance to beta lactam antibiotics including the penicillins (methicillin, dicloxacillin, nafcillin, oxacillin, etc). Our aim in this study is assess methacillin resistant staphylococcus aureus among (MRSA) Libyan patients with superficial skin bacterial infections, to screen patients with MRSA skin infections for staphylococcus aureus nasal carriage.

Patients and Methods: The study include 151 Libyan patients attending OPD clinic of dermatology department - Jomhoria hospital - Benghazi – Libya with the clinical diagnosis of superficial skin bacterial. All the patients were exposed to detailed disease history and complete dermatological examination according to the prepared proforma. Samples were taken from patient nares and infection sites and send directly to microbiology laboratory for detection of organisms. Oxacillin disc and other different antibiotic discs were fixed on Muller Hinton agar and incubated at 37c for 24-48hr (Disk diffusion test) according to the guidelines of the clinical and laboratory standards institute (CLSI).

Results: Out of 151studed patients, 72 patients (47.7%) were males and 79 patients (52.3 %) were females with mean (25.9 years). Regarding the age groups, the highest percentage of patients was seen in age group 0-10 years and (28.5 %) of cases followed by age group 11-20 years and 21-30 years. Lower and upper extremities were involved in 29.1% and 17.9% respectively followed by the face and seen in 13% of the patients. Regarding the clinical diagnosis, furuncle (boil) was seen in 31 patients (20.5 %) followed by impetigo in 20 patients (13.2%), eczema with secondary bacterial infection in 16 patients (10.6), Approximately 70.9% of patients were not received antibiotics in last 12 months. Positive pus cultures were found in 82.1% of patients. Staphylococcus aureus was isolated from 77.4% of patients followed by streptococcus pyogenes. Regarding swab cultures of nasal area for carrier, 116 patients (76.8%) were had positive cultures. In 97 patients (83.6%), the type of bacteria in nasal swab culture was staphylococcus aureus followed by staphylococcus albus and constitute 8.6%. Out of the staphylococcus aureus isolates examined from infection site, 40.7% were methacillin resistant staphylococcus aureus (MRSA) and approximately 59 % of them were staphylococcus aureus nasal carriage.

Conclusions: Superficial bacterial skin infections constitutes a major health problem in Benghazi – Libya and majority of patients affected by these diseases was aged ≤ 30 years. Resistance of staphylococcus aureus to methacillin was seen in 40.6 % whereas sensitivity was high to amikacin and clindamycin.

Keywords: methacillin resistant staphylococcus aeraus (MRSA), superficial bacterial skin infections, nasal carriers, disc diffusion test

Introduction

Staphylococcus are facultative anaerobic, nonmotile, non-spore forming gram-positive cocci, which appears as grape-like clusters under the microscope [1]. *S. aureus* is a catalase-positive that is in many instances distinguishes from streptococcus and from most strain of staph aureus from other staphylococcus species [1,2,3]. *S. aureus* is found as part of normal flora on the skin and the nose [4] and approximately 35% of the normal people are nasal carriers of staph aureus as a resident [2,5]. A skin and soft tissue infections (SSTIs) are inflammatory bacterial invasions of the epidermis, dermis and subcutaneous tissues [6,7]. The skin bacterial infection divided into two categories according to U.S. Food and Drug Administration (FDA); the minor and uncomplicated skin infections such as simple abscesses, impetigo, furuncles, and cellulitis [8]. The complicated skin infections include infection involving deeper soft tissue such as infected ulcer, major

abscesses, and burns [8]. The occurrence of secondary bacterial infection that complicates skin lesions is the one of the common causes of SSTIs [9].Methacillin Resistant Staphylococcus aureus (MRSA) is any strain of staphylococci that has resistance to beta lactam antibiotics which include the penicillin (methacillin, oxacillin, dicloxacillin, nafcillin, etc) and the cephalosporin [10]. it may also be called as multidrug-resistant *S. aureus* or Oxacillin-resistant Staph aureus (ORSA) [10]. Identification of risk factors for MRSA is important and people at risk including young children, elderly people, HIV infection, intravenous drug users according to previous studies, nasal carriage of staph aureus [11, 12]. MRSA infections can be classified into two groups: Health care acquired- MRSA (HA-MRSA) and community acquired-MRSA (CA-MRSA). HA-MRSA has been a problem in hospital setting, and the patients are older and have immune compromised

diseases [13]. The aim of the study is to assess methicillin-resistant staphylococcus aureus (MRSA) in patients with skin and soft tissue infection and to screen their nasal carriage.

Materials and Methods

The study include 151 Libyan patients attending outpatients OPD of dermatology department -Jomhoria hospital, Benghazi- Libya with the clinical diagnosis of superficial bacterial skin infection. All the patients were exposed to detailed disease history and complete dermatological examination according to the prepared proforma. Fasting blood sugar test and serology test including HIV, HBsAg, and HCV examination was done. Samples were taken from nares and infection sites and send directly to microbiology laboratory for culture onto blood and Mac Conkey agar then incubated at 37c for 24-48 hrs. Staphylococcus aureus was identified by morphology, catalase test, Gram-stain, and DNAase to be differentiated it from other bacteria. Acolony of isolated staphylococcus aureus was taken by sterile loop then emulsify in normal saline putted in tube for 10 minute, then spread on Muller-Hinton agar by sterile cotton swab immersed in this tube. Oxacillin disc and other different antibiotic discs were fixed on Muller Hinton agar plates and incubated at 37c for 24-48hr (Disk diffusion test) according to the guidelines of the clinical and laboratory standards institute (CLSI). The oxacillin disc (1µg) was used to detect methacillin resistant staphylococcus aureus, where resistant of staphylococcus aureus to oxacillin disc will reported as MRSA, and sensitivity of staph aureus to oxacillin will reported as MSSA. The different antibiotics were used to test sensitivity in this study including oxacillin (oxi) (1µg), ampicillin (amp) (10µg), penicillin (p)(10µg), amoxy/clav (amc)(30µg), vancomycin (VA) (5µg), amikacin (Ak) (30µg), ciprofloxacin (cip) (5µg), ceftriaxol (CFR) (30µg), chloramphenicol (C) (10µg), gentamycin (CN) (10µg), erythromycin (E) (15µg), clindamycin (DA) (2µg). Statistical analysis, data were analyzed using statistical package for social science(SPSS) version 18. Descriptive statistics, as mean, standard deviation, median and mode were used. Inferential statistics were used when needed, as Chi-square (x2) to find the difference in the distribution of the variables between the two groups, P-value were considered significant when ≤ 0.05. Data were presented in form of tables and figures, were the figures done by Microsoft Excel 2007.

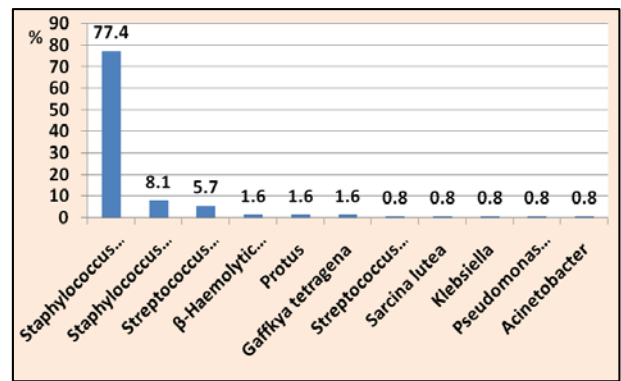


Fig 2: Distribution of patient pus cultures where S. Aereus isolated in 77.4% followed by S. Albus in 8.1%.

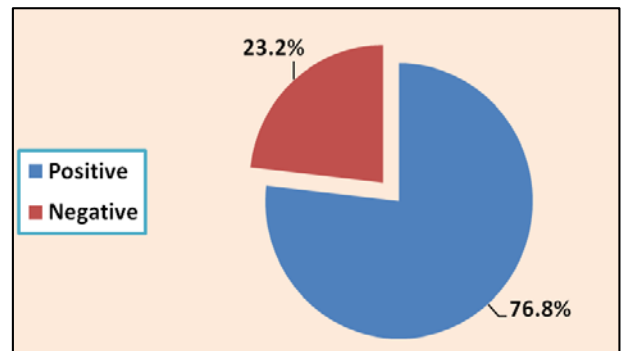


Fig 3: The percentage of positive nasal carrier cultures.

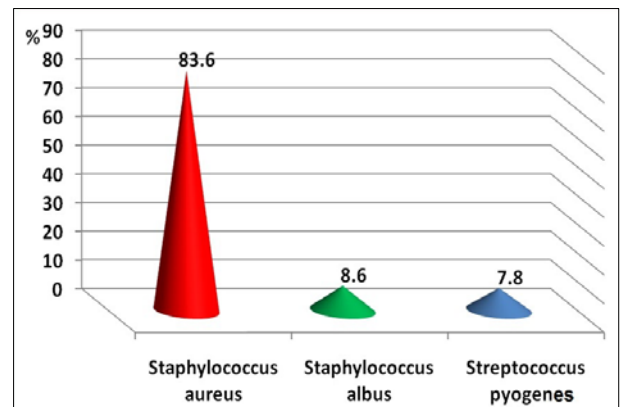


Fig 4: Distribution of bacteria among patient nasal carrier cultures.

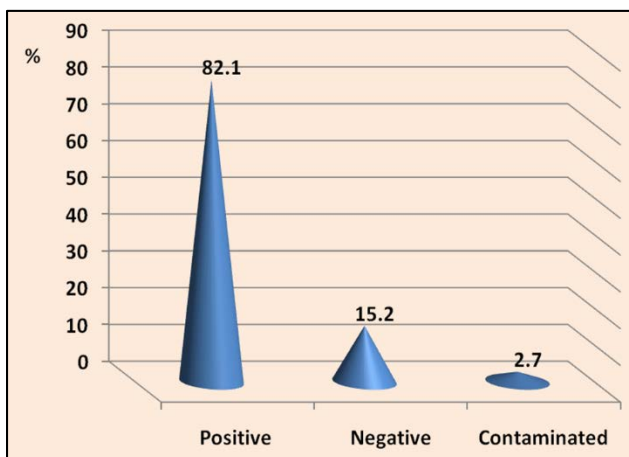


Fig 1: Patients pus culture results.

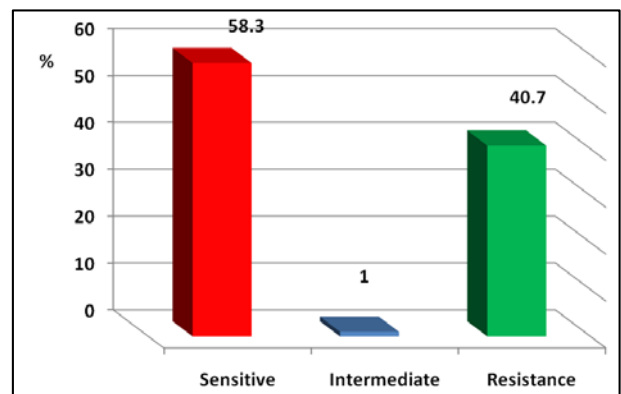


Fig 5: Percentage of methacillin for S. aureus resistance

Table 1: MRSA positive rate among different age group.

Age	Total	MRSA(n)	%	P value
<30	63	23	36.5	0.683(not significant)
30 - 50	25	11	44	
>50	8	5	62.5	0.683(not significant)
Total	96	39	40.6	

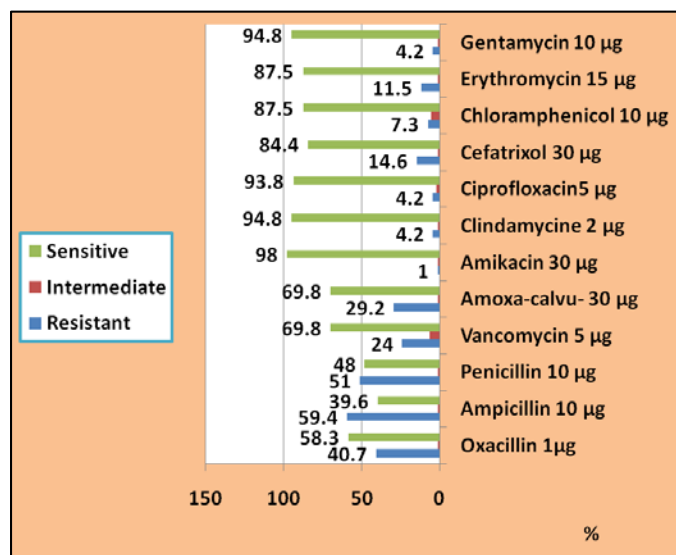


Fig 6: Sensitivity of *S. aureus* to different antibiotic.

Results

Among the 151 patients included in this study, 72 patients (47.7 %) were males and 79 patients (52.3 %) were females, with age ranging from 7 months to 73 years (Mean : 25.9 years). Majority of the patients (94.7%) were Libyans.

Regarding the age groups, the highest percentage of patients was seen in age group 0-10 years and constitute 28.5 % of cases followed by age group 11-20 years. Lower and upper extremities were involved in 29.1% and 17.9% respectively followed by the face. Regarding the diagnosis of skin infections, furuncle (boil) was seen in 31 patients and constitute 20.5 % followed by impetigo in 20 patients, eczema with secondary bacterial infection in 16 patients, and abscess patients, and constitute 13.2 %, 10.6 %, and 9.9 % respectively.

According of history of chronic diseases such as Diabetes mellitus, hypertension, *et al*, most of our cases (90%) was not had chronic illness, while 11 patients (7.3%) was had Diabetes mellitus. Most of our cases, about 139 patients was not received drugs by injection and constitute 92.1 %, In approximately 70.9% (107 patients) of patients were not received antibiotics in last 12 months. About 140 patients (92.7%) had no history of contact with family any skin infections. All our patients had negative serology for results HBV, HIV and HCV. About 144 patients (95.4 %) had normal fasting blood sugar.

Positive pus cultures were found in 82.1% of our study patients (Fig.1). *Staphylococcus aureus* was isolated from 77.4% followed by *S.albus* in 8.1% (Fig.2). Regarding the swab of nasal area for carrier, 116 patients (76.8%) had positive cultures for bacteria (Fig.3). In 97 patients (83.6%), nasal swab culture was *staphylococcus aureus* followed by *staphylococcus albus* (8.6%) (Fig.4).

Out of *staphylococcus aureus* isolates, 40.7% were methacillin

resistant *staphylococcus aureus* (MRSA) and 58.3% were methacillin sensitive *staphylococcus aureus* (MSSA) (Fig.5).

Among different ages groups, MRSA was found in 36.5 % of patients aged < 30 years old, 44 % of patients aged between 30-50 years old, and 62.5 % of patients aged >50 years old (*p value* 0.683) (Tab.1). *Staphylococcus aureus* isolates were exposed to various antibiotics and were found more sensitivity to amikacin, clindamycin as well as gentamycin and constitutes 98% and 94.8% respectively. *Staphylococcus aureus* resistance was greatest to ampicillin (59.4%) followed by penicillin (51%) and oxacillin (40.6%) (Fig.6).

Discussion

Staphylococcus aureus (*S. aureus*) is the cause of the most common skin and soft tissue and systemic infections in the world (13,14). *Staph. aureus* infections are associated with a higher morbidity and mortality in children and adults despite antibiotic therapy (15). The human body is a natural reservoir for this bacterium and the nasal nares are the main site for *staph aureus* [16, 17]. Carriers can be divided into three groups: persistent, intermittent, and non-carriers. Approximately 20% of individuals are persistent nasal carriers, 60% are intermittent carriers and 20% are resistant to nasal colonization [2, 17]. If examined microscopically, *S. aureus* appears as a gram- positive cocci in clusters. It can differentiated from other staphylococcal species by gold pigmentation of colonies. The skin bacterial infections resulting from microbial invasion of the skin layers and subcutaneous tissues [6,7] due to cutting or abrasion [3,7], and range from mild infection, such as folliculitis, impetigo to serious life-threatening infections, such as necrotizing fasciitis [7]. Although *S. aureus* were historically treatable with common antibiotics, emergence of the drug- resistant organisms in now a major concern [14].

MRSA is the a primary cause of a wide range of the infections in the hospital and community. MRSA is especially troublesome in hospitals where patients with open wounds, invasive devices and weakened immune systems are at greater risk of infection than the general public. In this study, 151 patients with skin and soft tissue infections, 52.3% of them were females and 47.7% were males. Similar results study were reported by Nikolas AF *et al* in 10 medical clinics in Texas(18), while in other study males constitute 68% of patients [11]. Mean age of our patients with SSTIs was 25.9 ± 18.9 years and about 28.5% was in age group ≤10 years and only 10% was >50years which is not consistent with a study which reported that age group > 50 was seen in 58% of their patients [11], while other studies reported those aged < 5 years and young males had high rate of skin infection than patients aged 65 years old (19, 20). The lower extremities are the commonest site affected (29.1%) followed by upper extremities (17.9%) and face (13.9%). A similar results were seen in one study (18) while in other study, the highest site affected was upper extremities (42%) followed by lower extremities (30%) and face was affected in 6% of cases [11]. Furuncle (boil) was the most common skin infection reported in our data (20.5%), followed by impetigo and eczema with secondary bacterial infection (13.2% and 10.6%, respectively). Ray G T *et al* reported that cellulitis and abscess were the major skin infections and seen in 63% of their patients [20]. Pus culture was positive in 82.1% of the patients, 15.2% were negative (no growth), and 2.7% was contaminated. In our study we found *staphylococcus aureus* is the predominant

isolates in pus cultures and accounted 77.4%. Similar results was seen in other studies.^[20, 21, 22] MRSA rate in our study was reported 40.6% of patients. A similar finding found in other study^[23]. In other recent study in Libya reported high prevalence rate of MRSA in 54.2% of *S. aureus* isolated from burn patients in the burn and plastic surgery center in Tripoli^[24]. Also in other studies, the rate of MRSA was higher than our study and this might be due to hospital based specimens^[11, 22, 25]. In previous study in Benghazi the rate of MRSA in their patients was lower than our result and seen in 31% of patients^[26]. In a review study they found that the proportion of MRSA was ranged between less than 1% and 24%^[27]. There is no statistically differences between ages in our study (p 0.683) although an increase in the prevalence of MRSA was observed to correlate with increased age of patients, and a similar finding was seen in study carried out by Najat Buzaid where as another study, the MRSA rate was higher in ages above 30 years (88.1%) than ages below 30 years^[25]. Other study reported that the extremes of ages were more affected^[28]. Rate of nasal carriage of staphylococcus aureus in patients with skin infections in our study were high and seen in 83.6%. According to studies on different population, the prevalence and incidence of nasal carriage of staph-aureus varies, where rate of nasal carriage was in range (19.0-55.1%) in general population and high rate in patients with staph- aureus skin infections and accounts 65.9%^[17]. Also there is increase in nasal carriage in old studies^[17]. Other study found that 29% of patients was staph aureus nasal carriage, while 70% was MRSA nasal carriage^[22]. Out of 96 of patients with staph aureus skin infections, 63.5 % of cases were staph aureus nasal carriage. In review study they found a similar results^[17]. So, the high rate of staph-aureus colonization in our patients with skin infection demonstrating that nasal colonization is a predisposing factor for skin infections. Also out of 39 (40.7 %) patients with MRSA skin infections, approximately 59 % of patients were staph aureus nasal carriage. Other older studies, approximately 80% of their patients were *S aureus* nasal carriers and 65% of them had the same phage type in the nose and skin lesion^[30]. In our study patients with MRSA had multi-resistant to drugs including ampicillin, penicillin, amox/clav, vancomycin and seen in 59.4%, 51%, 29.2%, and 24%, respectively. Less resistant was to Amikacin and seen in 1% of cases. The sensitivity of staph aureus to clindamycin and gentamycin were equally high (94.8 %). A similar results were seen in other study^[17]. In another study reported that penicillin resistant was 97.3% followed by cotrimoxazole and chloramphenicol^[25]. In another study in Benghazi, Libya reported by Najat Buzaid *et al* found increasing resistant of staph aureus to vancomycin, erythromycin, ciprofloxacin, fucidic acid, and chloramphenicol^[26].

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