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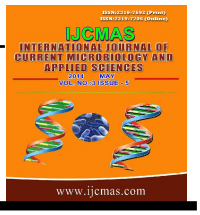

Original Research Article

Community-associated *Staphylococcus aureus* infections among children at the paediatric hospital in Benghazi city/ Libya (2008 - 2013)

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K e y w o r d s

Staphylococcus aureus; Community-associated diseases; excessive use to antibiotics

A B S T R A C T

Prevalence of *Staphylococcus aureus* infection is of the things that worries many countries, especially when it can be develop to become a human life threatening disease, currently this pathogen is endemic in many countries worldwide. Because of the excessive use to antibiotics and medicine non-fully prescribed by doctors in addition to the lack of awareness among families led to the emergence of many resistant strains as well as increase the spread of infection among Libyan community. This study carried out to determine the epidemiology of *S. aureus* among children at Benghazi paediatric hospital compare to the infections with other pathogenic bacteria. For six years (2008 - 2013) including sites of infection *S. aureus* samples were collected from all children hospital`s wards and outpatient department (OPD). The results were emerged 418 *S. aureus* isolates out of 968 (43.2 %) (Total Gram positive and Gram negative infected patients). in comparison with other bacterial infections there were two hundred and twenty three isolates (43 % of total *S. aureus* infections) from ear, one hundred and fifty eight isolates (48.9 %) are different skin infections, seventy one (19.7 %) are throat, thirty five (42.8%) are nose, and twenty one (38.1 %) from eye infections. This study has indicated that the prevalence rate of *S. aureus* was high among children community members and this represents risk factors.

Introduction

Staphylococcus aureus remarkably causes an extremely broad range disease from superficial skin lesions [boils or furuncles, pneumonia, mastitis, meningitis, urinary tract infections] to deep seated infections such as central nervous system infections, osteomyelitis, endocarditis, septicaemia, pneumonia and syndromes caused by exotoxins(Lowy, 1998). *S. aureus* causes the majority of hospital acquired infections

including bacteraemia, contaminated surgical site infections (SSIs) such as bone and joint infections, pneumonia and urinary tract infections (Livermore, 2000). *S. aureus* cause arthritis, toxic shock syndrome, toxic epidermal necrolysis and food poisoning.

S. aureus colonisation of the nares leads to hand carriage, and from the hands, the organisms are frequently spread to other areas of the body (Zimakoff *et al*., 1996) *S.aureus* causes skin infections, from where it can develop to be a source for more serious diseases such as bacteraemia, endocarditis or toxaemias. Moreover boils can develop into deep-seated infections of several hair follicles (Kauffman and Bradley, 1997). *S. aureus* is a significant cause of haemodialysis related bacteraemia (Lentino *et al*., 2000) and both native and replacement valve endocarditis (Mylonakis and Calderwood, 2001). It is responsible also for respiratory tract infections such as pneumonia (Coello, *et al*., 2003). In England *S. aureus* was responsible for 53 % of surgical infections between 1997 - 2005 (Casey *et al*., 2007). In the United States, infections with *S. aureus* annually constitute a high percentage of nosocomial infections (Emori and Gaynes 1993). Community-acquired *S. aureus* infection are growing health problem in many places around worldwide including the United States, Europe, Scandinavia and Japan (Farzana and Hameed 2006 and Rojo *et al*., 2010). The aim of this study to determine *S. aureus* infection distribution pattern among children at Children hospital in Benghazi city - Libya.

Materials and Methods

Samples collection

Between January 2008 and December 2013, bacterial samples were collected from patients from the out patients department (OPD) and from patients hospitalized with at least 72 hours stay in different wards in the children hospital in Benghazi city/ Libya and were diagnosed with *Staphylococcus aureus* and or other microbial infection. Samples were collected from the most likely site of infection *via* cotton swabs including wound secretions, ear, throat, nose, and eye then sent to the microbiology central laboratory for identification.

Growth conditions

S. aureus and other Gram positive isolates were grown aerobically and facultative anaerobically on blood agar, McConkey agar, and chocolate agar. Other Gram negative pathogens were grown aerobically on McConkey agar, Triple Sugar Iron agar (TSI), Hydrogen sulfide indole motility agar (SIM) and Urease agar.

Bacterial Identification

For accurate and rapid identification of clinically relevant gram positive and gram-negative bacteria a BD Phoenix™ Automated Microbiology System was used. For gram positive pathogens, samples were tested further for catalase, coagulase and DNase production, the samples were positive to these tests were identified as *S. aureus*. In order to identify gram negative bacteria some cases required additional tests including oxidase-reaction and using *Api 20 E* system for presence of *Enterobacteriaceae* pathogens.

Results and Discussion

Spreading of *S. aureus* infection among children at children hospital in Benghazi

city is not well characterized. Using cotton swabs microbial samples were collected from different body sites including ear, skin secretions, nose, throat, and eye. Among the patients who are visiting children hospital, there is around 2,498 cases have been forwarded for microbiological investigating, 968 (32%) are the total of bacterial infections which recorded.

Table (1) shows traditional microbiological analysis that identifying 418 *S. aureus* strains (43.2%) out of the other Gram positive and Gram negative bacteria. There are 223 (43.1%) from ear, 158 (48.8%) from skin secretions, 71(19.7%) from throat, 35 (42.8%) from nose, and 21 (38.1%) from eye. The distribution of other pathogenic bacteria compare to *S. aureus* are listed in table (1), here we found that, *S. aureus*is the most frequently isolated (43.2%), followed by *Pseudomonas aeruginosa* (15.9), *Klebsiella spp*. (12.7%)*Acinetobacterspp.* (2.9%) and *Proteus spp*. (2.7%). The remaining (3.7%) of isolates are *Enterobacter spp*., *Alcalegens spp*. *Serretia spp*., and *Citrobacter spp*.

In order to investigate the epidemiology of *S. aureus*, Figure (1) shows the infection with *S. aureus* at different site within six years, the results are indicating the most frequently sites infected with *S. aureus* are ear and skin and the highest number of ear infection was recorded in 2012 whereas the highest number of skin infection was recorded in 2010. Other sites including nose, throat, and eye showing less number of infections.

To gain further understanding of *S. aureus* prevalence a comparison with other pathogenic bacteria was carried out. The results in figure (2) show high *S. aureus* infection rates in all years.

Despite the advancement in many scientific fields and from which the understanding of the mechanisms that enable pathogens to cause diseases and to control it, however, there is an obvious contradiction with the constant increase in the incidence of *S. aureus* infection. Indeed, *S. aureus* are supper bugs, they have several pathogenic strategies enable them to survive and colonize into different human body sites (Naber, 2009).

Table.1 Distribution of Community-associated *S.aureus* infections vs other pathogens among children 2008 - 2013 (n = 968).

Infection sites	Tested*	Gram positive bacteria						Gram negative bacteria											
		Staphylococcus aureus		*Staphylococcus epidermidis*		*Streptococcus pneumonia*		*Pseudomonas aeruginosa*		*Klebsiella spp.*		*Escherichia coli*		*Acinetobacter*		*Proteus spp.*		Others	
		N0.	%	N0.	%	N0.	%	N0.	%	N0.	%	N0.	%	N0.	%	No.	%	No.	%
Ear	517	223	43.1	52	10	35	6.8	112	21.7	34	6.6	16	3.1	9	1.7	18	3.5	18	3.5
Wounds	324	158	48.8	3	0.9	5	1.5	26	8	70	21.6	29	9	15	4.6	7	2.2	11	3.4
Throat	71	14	19.7	2	2.8	22	31	10	14.1	11	15.5	3	4.2	3	4.2	0	0	6	8.5
Nose	35	15	42.8	9	25.7	0	0	3	8.6	5	14.3	2	5.7	0	0	0	0	1	2.9
Eye	21	8	38.1	2	9.5	0	0	3	14.3	3	14.3	1	4.7	3	14.3	1	4.8	0	0
Total	968	418	43.2	68	7	62	6.4	154	15.9	123	12.7	51	5.3	30	3.1	26	2.7	36	3.7

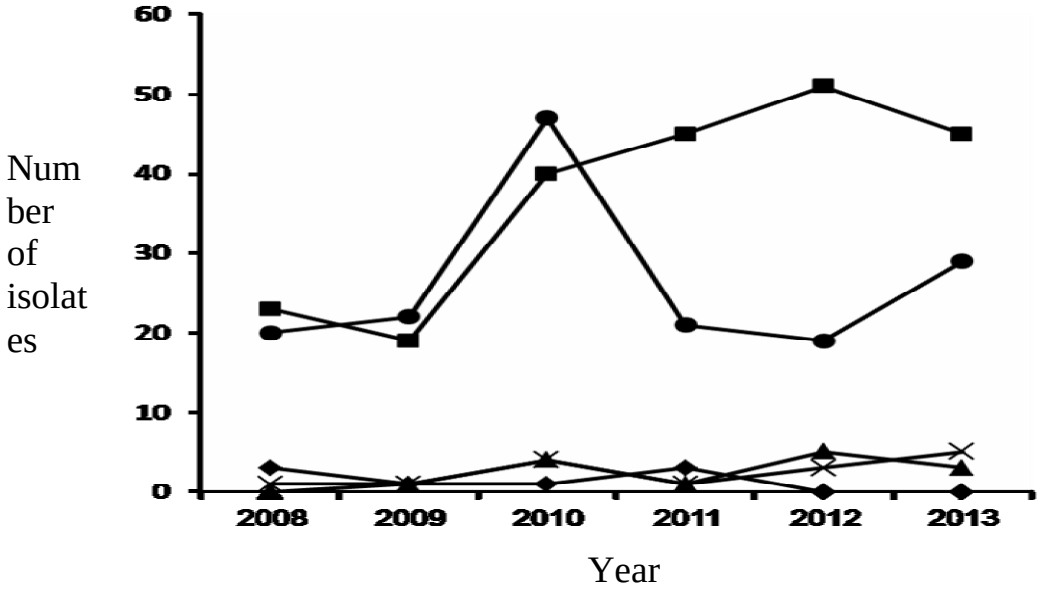

Figure.1 Prevalence of *S. aureus* infection by the sites of infections, 2008 - 2013

Presence of *S. aureus* infection at different sites including: (■) ear, (●)skin, (▲) throat, (×)nose, and (◆) eye.

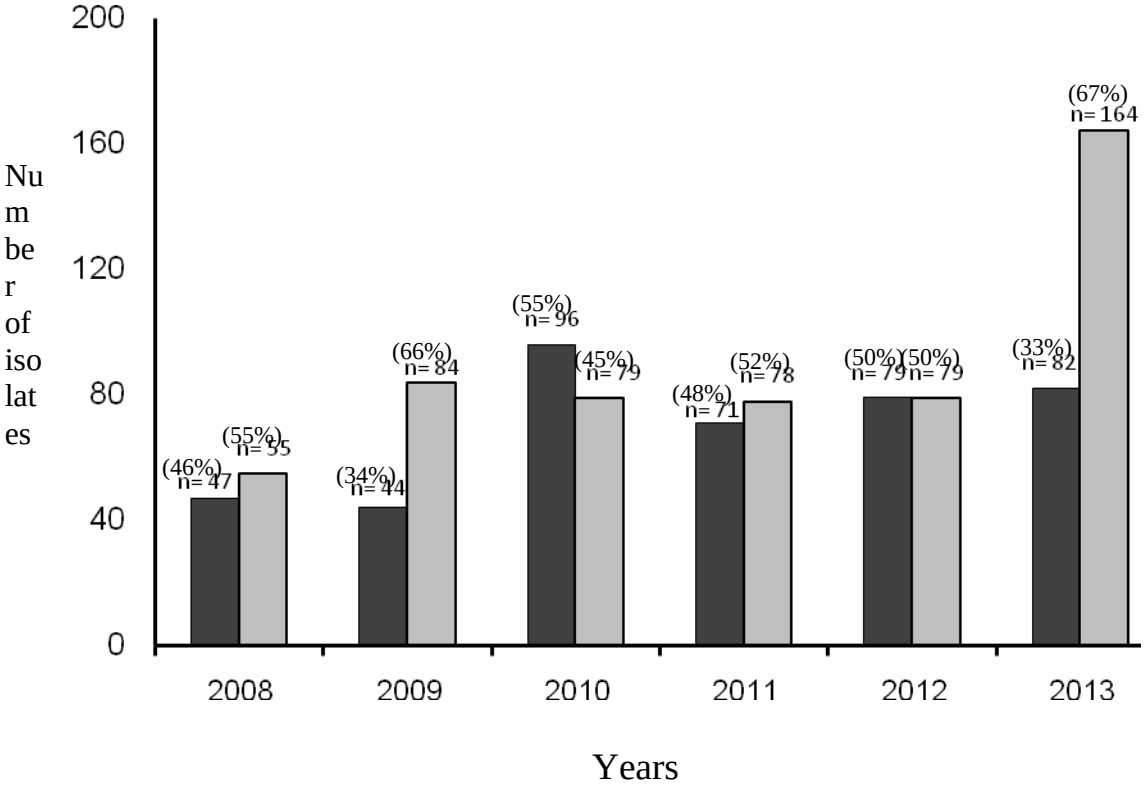

Figure.2 Emergence of *S. aureus* infection among children within 2008 - 2013

Determination the rates of *S. aureus* infection (■) compare with the infection with other pathogens (■), 2008 - 2013.

In this study, *S. aureus* has represented the highest infection rate among children compare to the infection with the other pathogens. The infections with *S. aureus* into the ear and throat are high compare with the other body sites. Strains *S. aureus*, *P. aeruginosa*, *Klebsiellaspp.* and *E. coli* were the most frequently pathogens isolated from wounds. This is an agreement with several studies that represented the prevalence of aerobes such as *S. aureus*, *E. coli* and *Klebsiella spp.* into the burn wound infections, such opinion has been formed on the bases of skin contamination (Mayhall, 1993; Revathi *et al*., 1998 and Khalili *et al*., 2012). In contrast a study by Khalili *et al*. (2012) has reported *E. coli* was the most frequent pathogen from wound (Khalili *et al*., 2012). Also in this study the most the frequent pathogens isolated from the ear were *S. aureus*, *P. aeruginosa and Klebsiella spp.* This is slightly different result from another study has showed just *S. aureus* and *P. aeruginosa* are leading pathogens from ear specimens (Tahiri and Mustafa, 2008).

S. pneumonia and *S. aureus* were the most frequent gram positive pathogens from throat, whereas gram negative pathogens including *Klebsiella spp. P. aeruginosa* were the leading pathogens from throat site. A study has reported *S. pneumonia* is not representing the most common gram positive pathogen infecting throat but *S. aureus* (Tahiri and Mustafa, 2008). On the other hand, our study was identical with a study has shown *P. aeruginosa and Klebsiella spp*. were the most frequently pathogens isolated from respiratory tract (Hadadi *et al*., 2008 and Khalili *et al*., 2012).

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