

Isolation of MRSA Strains from Hospital Environment in Benghazi City, Libya

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Abstract Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important cause of healthcare-associated infections, where healthcare workers (HCWs) are vectors of transmission. In addition to exposure to healthcare workers who may be as carriers, exposure to contaminated rooms can also be a risk factor. The hospital environment, especially surfaces, represents a secondary reservoir for pathogens such as *S. aureus*, and represent a challenge to infection control practices in most countries. This study aimed to explore the prevalence of MRSA in hospitals of Benghazi, Libya, Sounding the alarm of the presence of large hospitals infection in Benghazi and probably are in the grip of endemic problems with resistant organisms. **Methods:** The 395 swabs were collected from hospital surfaces such as surfaces of frequently handled items (beds, sinks, door handles, floors, and table surfaces). The surface swabs were collected at the different wards of the hospital Medical units, ICU and HCWs rooms. **Results:** Highest rate was in ICU followed by medical units and dialysis wards (9.5%, 7.8%, and 5% respectively). **Conclusion:** MRSA strains prevalence in Benghazi City. was high and this may be the case for other hospitals in Libya. A sound surveillance program of nosocomial infections is urgently needed to reduce the incidence of infections due to MRSA and other antimicrobial-resistant pathogens in Libyan hospitals.

Keywords: hospital environment, Nosocomial infection, MRSA strains

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1. Introduction

Nosocomial infections or hospital-acquired infections are one of the major problems in healthcare, undoubtedly hospital environments are a great source of potentially pathogenic microorganisms [1,2]. These may be transmitted from person to person, from hospital equipment, materials, and hospital environment to the patient, or may be from the endogenous flora of the patient [3,4,5]. One of the most common bacteria associated with nosocomial infections is *Staphylococcus*. Methicillin-resistant *Staphylococcus aureus* (MRSA) bacteria are more and more prevalent in the hospital environment and represent a challenge to infection control practices in most countries [6,7]. The main mechanism of transmission of infections within hospital is by direct contact, in particular with the hands of health professionals [6,8], which may both contaminate or be contaminated by hospital surfaces. The staphylococci can be spread by the infected person to someone else or to an object. Inanimate objects, such as clothing, bed linens, be associated to several biological materials in the hospital, environment such as floors, walls, ceiling, doors, windows electro-electronic equipment , sports equipment, personal items (soap or wash cloths) or furniture, may be a source of infection if they become soiled with wound drainage

and a non-infected person comes into contact with them [9,10]. If there is no break in the skin, contact with infected persons or contaminated objects may result in colonization [11,12,13]. Many previous studies have evaluated MRSA contamination of various items such as computers, pens, television sets, stethoscopes, tourniquets, uniforms and gowns, blood-pressure cuffs, and mattresses, pillows, chairs, bed frames, and over-bed tables [14,15,16]. Incidence and prevalence of MRSA varies widely between countries, geographical regions, hospitals and even wards in the same hospital. MRSA may spread from person to person and from one hospital to another, causing outbreaks [17]. Welsh's study evaluating hospital cleaning regimes and standards argues that there is "no doubt that environmental surfaces can act as a source of pathogens which can give rise to nosocomial [hospital-acquired] infections [18]. Health care settings are an environment where both infected persons and persons at increased risk of infection congregate. Patients with infections or carriers of pathogenic microorganisms admitted to hospital are potential sources of infection for patients and staff [18,19]. Patients who become infected in the hospital are a further source of infection. Crowded conditions within the hospital, frequent transfers of patients from one unit to another, and concentration of patients highly susceptible to infection in one area (e.g. newborn infants, burn patients, intensive care) all contribute to the development of nosocomial infections [20]. Microbial flora may

contaminate objects, devices, and materials which subsequently contact susceptible body sites of patients. In addition, new infections associated with bacteria such as waterborne bacteria (atypical mycobacterium) and/or viruses and parasites continue to be identified [20]. Methicillin-resistant *S. aureus* (MRSA) has been shown to have the ability to survive for long periods of time in healthcare environments. Hospital-acquired infections are increasing. There is a growing recognition of the relationship between the effective cleaning of hospitals and long-term care facilities and the health and safety of both patients and staff [21]. Thus, the quality of cleaning services is an important condition in the prevention and control of microbial spread, as well as the type of disinfectants used to diminish risks of cross infections during healthcare assistance [6,22].

2. Material and Methods

2.1. Sample Collection and Bacterial Isolates

Clinical samples were obtained from environments and equipment surfaces in ten public hospitals in Benghazi, Libya between April and August 2013. These hospitals (Psychiatric hospital and Al-Erada sanatorium, Benghazi Childrens hospital, Al- Jomhouria hospital, Nephrology Center and Al-Jala Hospital). The sites were determined by following the routines of each hospital. We selected sites with a greater possibility of contamination. The selected collection sites were: floors, hospital cots, hospital cot control panels, heart monitors, hospital ventilator control panels, infusion-pump control panels, blood-gas analyzer control panels, hospital incubators, telephones, scales, doors, tables, hospital beds, cabinets, emergency carts, medication carts, computers, air conditioners, faucets, handles, hospital countertops and prescription records. Samples were collected from each surface using sterile swabs. 395 hospital environment items) were collected for detection of MRSA.

2.2. Cultivation, Identification and Antibiotic Susceptibility

All swabs were inoculated on Mannitol salt agar plates (MSA-HiMedia, India) and were incubated at 37°C for 24-48 hours. Suspect colonies, which revealed acidification of mannitol, were subjected to identification procedures. Colonies with coagulase-positive, Gram-positive cocci, DNase and catalase positive [23]. were selected as possible *S. aureus* and identified by BD Phoenix Automated Microbiology System. Also antimicrobial resistance of sampled colonies was evaluated *in vitro* by BD Phoenix Automated Microbiology System; *S. aureus* is tested against various concentrations of antimicrobics. A maximum of 100 identification and antimicrobial susceptibility tests can be performed in the Phoenix instrument at a time using Phoenix ID/AST combination panels; bacterial layer was resuspended and then inoculated drop wise into Phoenix panels ID broth in order to obtain a suspension matching a McFarland 0.5 standard. The remaining of the panels setup and loading was performed according to the manufacturer's instructions, determining the *S. aureus* resistance (ineffective) or susceptibility (effective) to the antimicrobics; Phoenix

panels are read only by the instrument. Phoenix panels cannot be read manually.

3. Results

Out of 395 samples from environment swabs 100 (25.3%) were identified as *S. aureus*. The incidence of MRSA at Benghazi Hospitals environment was approximately 8.1 %. The high incidence of MRSA isolates was evident in both ICU (9.5%) and medical units (7.8%). A similar incidence was seen in HCWs rooms (7.5%) and the dialysis wards (5%) of MRSA (Table 1).

Table 1. The distribution of MRSA in different hospital wards

Wards	No	<i>S. aureus</i>	MRSA
ICU	105	25 (23.8%)	10 (9.5%)
Medical units	230	64 (27.8%)	18 (7.8%)
Dialysis	20	2 (10%)	1 (5%)
HCWs room	40	8 (20%)	3 (7.5%)
Total	395	100 (25.3%)	32 (8.1%)

Most MRSA strains isolated from this study were multidrug- resistant (MDR) (Table 2).

Table 2. Resistance patterns of MRSA strains isolated from hospitals environment

Antibiotics	MRSA of hospitals environment =32
	Resist
Penicillin	32 (100%)
Cefoxitin	32 (100%)
Oxacillin	32 (100%)
Augmentin	32 (100%)
Gentamycin	8 (25%)
Erythromycin	14 (43.8%)
Vancomycin	0 (0.0%)
Rifampicin	0 (0.0%)
Clindamycin	7 (21.9%)
Cotrimoxazole	2 (6.25%)
Ciprofloxacin	2 (6.25%)
Tetracycline	8 (25%)
Nitrofurantoin	0 (0.0%)
Mupirocin	0 (0.0%)

4. Discussion

Out of total 395 samples from environment swabs, about (25.3%) of the investigated were contaminated with *S. aureus*, irrespective of whether they had infected patients or not. The present study disclosed staphylococci in various sites within the hospital environment. Similar results were reported by Masaki [24]. An another study [25,26] obtained 25 MRSA isolates from hospital beds. In this study MRSA prevalence was (8.1%) among all the samples from environment, which is less than that reported in other studies [29,30,31]. The present study disclosed the presence of MRSA in various sites within the hospital environment, in surfaces in ICU, medical units, HCWs rooms and dialysis wards, the high incidence of MRSA isolates was evident in ICU(9.5%). Similar results were reported by [26,32,33]. As observed most of the isolates obtained in the present study were showing growth of multi drug resistant organisms as compared to those isolated from non clinical sections. The effectiveness of

environmental cleaning is an important factor in strategies to prevent the nosocomial transmission of MRSA [27,28]. A study conducted reported that health professionals re-contaminate their hands during interruptions of patient care by touching objects such as a computer mouse, control panels, phones, alarm buttons, electrical switches and pens before caring for patients [32]. Moreover, many other microorganisms are transmitted to health professionals' hands through inanimate objects such as soap dispensers, tables, telephones, sphygmomanometers, monitors and bedside bars [33]. This transmission may render the health professionals' hands permanently colonized with pathogenic microorganisms acquired in a hospital environment [34, 35].

5. Conclusion

Hospitals provide reservoirs of multi resistant microorganisms borne by patients and staff. Preventing the spread of relevant bacteria depends on the quality of hospital routine cleaning services. Monitoring bacterial susceptibility to antimicrobials and disinfectants may help the management of nosocomial infections.

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