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Original Article

Bacteriological study of wound infections and their antimicrobial susceptibility pattern of isolates from patients at shaafi hospital Mogadishu, Somalia

Shafie Abdulkadir Hassan[1,2], Fatima Hassan Ali[1], Najma Dahir Mohamud[1], Asma Hassan Ali[1], Layla Abdi Igal[1]

[1] *Department of Medical Laboratory Sciences, Faculty of Medicine and Health Sciences, Jamhuriya University of Science and Technology, Mogadishu, Somalia*
[2] *Advance Medical Research, Jamhuriya Research Center, Jamhuriya University of Science and Technology, Mogadishu, Somalia*

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Abstract

Background: Wound infection is one of the public health problems worldwide associated with the colonization of bacterial pathogens and resistance to commonly used antibiotics. The study aimed to identify the most common bacterial pathogens that cause wound infections and their antimicrobial susceptibility of isolates from patients at shaafi Hospital in Mogadishu, Somalia.

Methods: This study was a descriptive cross-sectional design conducted from January to June - 2020 at shaafi Hospital in Mogadishu –Somalia. A total of 80 patients were taken from wound swab; all specimens were directly cultured on standard media, then Gram stain and Biochemical tests were also done antimicrobial susceptibility test was performed following Standards guidelines and procedures of (CLSI).

Results: A total of 80 patients were taken from the wound swab; of these, 25 samples shown significant growth, isolating 38 bacteria strains. The most bacteria that isolated was *Staphylococcus aureus* 15 (39.47%), followed by *Escherichia coli* 12 (32%), *Klebsiella pneumonia* 8 (21%), *Proteus Vulgaris* 2 (5%), and *Pseudomonas aeruginosa* 1(3%). *Staphylococcus aureus* was entirely resistant to penicillin G, Ampicillin, and Methicillin, less sensitive to amoxicillin, and strongly sensitive to gentamicin. Moreover, All isolates of *Escherichia coli*, *Klebsiella pneumonia*, *Proteus Vulgaris* were sensitive to gentamicin and norfloxacin. In contrast, all isolates of *Pseudomonas aeruginosa* were resistant to gentamicin and norfloxacin.

Conclusions: The study revealed that bacterial pathogens of wound infection were resistant to commonly used antibiotics in Mogadishu, Somalia, showing an increasing trend of antibiotic-resistant. The study suggested that timely diagnosis with antimicrobial susceptibility is necessary before prescribing appropriate antibiotics.

Keywords: Antimicrobial susceptibility test; Antibiotic resistance, Wound infection; Bacteria, Somalia.

Introduction

Millions of people are burned, have non-healing wounds, or have acute wounds complicated by infections, dehiscence, or problematic scarring every year. Effective wound treatment generally requires well-considered interventions, which often necessitate multiple clinics or hospital visits, with incredibly high wound-care costs. [1] In developing countries like Ethiopia, wound infections are major health problems; many people die from preventable and curable wound infections. This is a significant health problem in hospitals, particularly in surgical techniques, where otherwise clean operations might get contaminated with virulent organisms and gets infected. Antibiotics are frequently purchased without a prescription by the community in developing countries. [2] This public misuse of antibiotics contributed to the emergence and spread of antimicrobial resistance. [3]

Subcutaneous tissue exposure following a loss of skin integrity during wound infection provides a moist, warm, and nutritious condition conducive to colonization and proliferation of microbial. [4]

Address for correspondence: Shafie abdulkadir hassan, Department of medical laboratory sciences, Faculty of medicine and Health Sciences, Jamhuriya University of Science and Technology, Mogadishu, Somalia. Email: Shafie@just.edu.so

Among high-risk bacterial pathogens, staphylococcal infections continue to be a significant cause of death and morbidity worldwide. [5] It has a remarkable ability to evolve various resistance mechanisms to most antimicrobial drugs. [6]

The most common microorganisms that induce wound infection include Staphylococcus aureus, Streptococcus pyogenes, Enterococci, Escherichia coli, Klebsiella pneumoniae, Proteus species, and Pseudomonas aeruginosa. [7] The continuous use of systemic and topical antimicrobials for wound infections has created drug pressure, resulting in the emerging of antibacterial-resistant strains, which have prompted novel antibiotics for these emerging strains. [8] Therefore, this study aimed to identify the most common bacterial pathogens that cause wound infections and their antimicrobial susceptibility of isolates from patients at shaafi Hospital in Mogadishu, Somalia.

Methodology

The study is descriptive and cross-sectional conducted from 23 January to 31 June - 2020 at shaafi Hospital in Mogadishu –Somalia. Eighty patients were obtained from the wound swab; then, all specimens were directly cultured in Blood agar and McConkey agar. [9] The gram stain and biochemical tests were performed with antimicrobial susceptibility testing following the Standards guidelines and procedures of CLSI. [10]

Sample procedure and culture specimen

The wound was cleaned with normal saline, and a swab of wound secretion/pus, purulent exudates, or wound discharge was aseptically obtained using a sterile cotton swab from each study participant. The specimen was collected on moistened cotton swab without contaminating with skin commensals, and the swab was immersed in a container of Brain Heart Infusion (BHI) transport medium. [11] Soon after collection, each sample was transported to the Microbiology laboratory at the department of medical laboratory science of Jamhuriya University of science and technology.

The collected swab samples were inoculated onto MacConkey agar and blood agar (Himedia laboratory Pvt ltd in India) and incubated at 37°C for 18–24. All the plates were incubated aerobically and initially examined for growth after 24 hrs. [12]

Antimicrobial Susceptibility testing

After obtaining pure colonies, further identifications were made by using the standard microbiological technique, which includes Gram stain, colony morphology, and biochemical tests (Himedia, Ltd.) (13). Species identification of the isolates was performed from pure colonies using classical biochemical tests according to the standard guidelines. [14]

Antimicrobial susceptibility testing was carried out on each identified organism by the disc diffusion method on Muller Hinton agar (MHA) as recommended by the Clinical and Laboratory Standards Institute (CLSI). [15] The isolates were tested against Penicillin G, Methicillin, Amoxicillin, Ampicillin, Gentamycin, and Norfloxacin. The zones of inhibition were measured and compared with the guidelines.

Statistical data analysis

All data collected were processed and analyzed using the statistical package for the Social Science technique (SPSS) program (version 20.0). Descriptive statistics were used to present data using frequency, percentage, and graphs.

Ethical consideration of the study

The study obtained ethical approval from the research ethics committee of Jamhuriya University of Science and Technology. The hospital administration of Shaafi hospital granted permission to conduct this study in the hospital. All inpatients and outpatients at shaafi Hospital included in this study after accepting verbal consent, respecting the ethical values, confidentiality, and moral expectations.

Results

The majority of the respondents were females, accounting for 16 (64%), and males represented 9 (36%). The highest frequency of wound infections

occurred in the age group (40 and above), while the minor infected age groups were between (10-20) years. Out of 25 total samples collected, 14 (56%) were inpatients, 11(44%) were outpatients, as shown in **Table 1**. Eighty-three isolates of bacterial pathogens were identified from wound swabs; Of these, *Staphylococcus aureus* was predominant, accounting for 15 (39.47%) of the isolates, followed by *Escherichia coli* 12 (31.58), *k. pneumonia* 8 (21.5), *proteus vulgaris* 2 (5.3), and *pseudomonas aeruginosa* 1 (2.6) as shown **Table 2**.

All *Staphylococcus aureus* isolates from the patients were entirely resistant to Methicillin, penicillin G, and ampicillin. Whereas all isolates of *Staphylococcus aureus* showed 2 (13%) sensitivity to amoxicillin and 9 (60%) sensitivity to gentamicin. All isolates of *E. coli* 12 (32%), *k. pneumonia* 8 (21%), *Proteus Vulgaris* 2 (5%) were sensitive to gentamicin and Norfloxacin. In contrast, all isolates of Pseudomonas aeruginosa 1 (3%) were resistant (100%) to Gentamicin and Norfloxacin, as shown in Table 2.

Table 1. Characteristics of study respondents (N = 25) of inpatients and outpatients suspected with wound infections at Shaafi hospital, Mogadishu, Somalia

Characteristics	Total (%)
Sex	
Male	9 (36)
Female	16 (64)
Age	
Below 10	2 (8)
10-20	1 (4)
21-30	2 (8)
31-40	8 (32)
Above 40	12 (48)
Patient type	
Inpatient	11 (44)
Outpatient	14 (56)

Table 2. The antimicrobial susceptibility pattern of Staphylococcus aureus isolates of gram-positive strains from patients (N = 15) with wound infection at shaaafi Hospital, Mogadishu, Somalia

Antimicrobials	Sensitive		Resistance	
	N	100%	N	100%
Methicillin	0	0	15	100
Gentamicin	9	60	6	40
Amoxicillin	2	13	13	87
Ampicillin	0	0	15	100
Penicillin G	0	0	15	100

Discussion

From the total of 80 patients with found infections, isolates of 25 patients showed growth. The overall prevalence of bacterial isolates was 38 (48%).

Table 3. Antimicrobial susceptibility pattern of gram negative strains isolates from patients (N=25) with wound infection at Shaafi hospital, Mogadishu, Somalia

Organism Isolated	Total (%)	Gentamicin		Norfloxacin	
		S	R	S	R
Escherichia coli	12 (32)	12	0	12	0
Klebsiella pneumonia	8 (21)	8	0	8	0
Proteus vulgaris	2 (5)	2	0	2	0
Pseudomonas aeruginosa	1 (3)	0	1	0	1

However, the rate of resistant organisms was high, particularly staphylococcus auras, which are considered to be the most frequent pathogen isolated from wound infections likely. [16]

The high prevalence of bacterial pathogens found in this study was lower than a previous study done at the same hospital. [6] The highest frequency of wound infections occurred in the age group (40 and above), while the minor infected age groups were between (10-20) years. This finding is similar to that reported by another study, documenting that the majority (46.2%) of the respondents were the age 41 years and elder while the less infected age groups were 20 years. [6]

The current findings demonstrate that Gram-negative bacteria were isolated at higher rates (61%) than Gram-positive bacteria (39%). This could be related to the fact that the current study included a significant number of cases from outpatients than inpatients. In this study, *Staph. Aureus* was the most common bacteria in this investigation (39%). This result is lower than the 46% reported by Moussa et al., 2021 from different samples isolated from patients in public hospitals in Mogadishu. [17] The disparity of the findings could be; the earlier study used different specimens other than wound swabs from different hospitals, while the current study only used swabs from wound infection and a single large hospital. Whereas the rate of *Staph. Aureus* reported in this study was significantly higher than that reported by other studies conducted in Mogadishu Somali Turkish Training and Research Hospital and Shaafi Hospital in Mogadishu, Somalia. [17] The *Staph. Aureus* from earlier studies was from urine isolates. Mohamed et al.(2020) conducted a study in Mogadishu Somali Turkish Training and Research Hospital reported only 13 (3.6%) *Staph. Aureus* from urine isolates. On the other hand, the study by Mohamed *et al*.(2020) conducted in Shaafi hospital reported only 22 (26.5%) *Staph. Aureus* from urine isolates. [15] Moreover, the common bacterial pathogen of wound infection in Somalia was reported to be *Staph. Aureus* accounting for 13 (26%) of total isolates reported by Hussein et al., 2018. These studies revealed that *Staph. Aureus* was the predominant pathogen in wound infection; in contrast, *Escherichia coli w*as the predominant uropathogen in urinary tract infection (UTI).

The results of antibiotic resistance patterns reveal *Staph. Aureus* isolates were entirely resistant to Methicillin. This result agrees with that reported in a previous study conducted in shaafi hospital. [6][18] The present study demonstrated that amoxicillin was resistant to 87% of *Staph. Aureus isolates*, which was lower than a study done by Moussa et al., 2021, which reported amoxicillin had the highest resistance rate (92%). [17] This study reports that all isolates of *Escherichia coli* and *Klebsiella pneumonia* were sensitive to gentamicin and norfloxacin. This is similar to a recent study that indicated all isolates of *Escherichia coli were* sensitive to gentamycin, but it was different to *Klebsiella pneumonia* which was less sensitive (83.3%) to gentamycin. [17]

The limitation of this study was the use of a single hospital, which may not be an accurate representation of a general population in the study area. Also, the selection of specific antibiotics for the antimicrobial susceptibility testing was based on the commonly prescribed antibiotics by the clinician in the selected hospital for wound infection. The small number of patient samples was due to the scarcity of patients with wound infection due to the covid-19 epidemics as the hospital was unwilling to accept more patients to prevent further spread of Covid19-infection.

Conclusion

This study indicated that *Staph. Aureus* and *E. coli* were significant bacterial pathogen causing wound infection. Staphylococcus aureus was almost entirely resistant to penicillin G, Methicillin, and ampicillin, less sensitive to amoxicillin, and strongly sensitive to gentamicin. The gram-negative strains of *E. coli*, *k. pneumonia* and *Proteus Vulgaris* were highly sensitive to gentamicin and norfloxacin. Almost all isolates of pseudomonas were resistant to the former two drugs.

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Conflict of interests: No conflict of interests is declared.

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