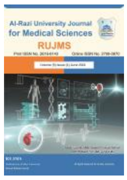
Original Research *Al-Razi Univ J Med Sci 2021; 5(1)*

RUJMS

Al-Razi University Journal of
Medical Sciences



DOI: https://doi.org/10.51610/rujms5.1.2021.99

Antibacterial Susceptibility of Isolated Bacteria from Wound Infection Patients Presenting at some Government Hospitals at Sana'a City, Yemen

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Abstract

Background: The rapid development of pathogenic bacteria resistant to a common antibiotic is becoming the most serious health problem for healthcare workers and the community. **Aims**: This study aimed to determine the antibacterial susceptibility profiles of isolated pathogenic bacteria from wound infections among patients attending some government hospitals in Sana'a City, Yemen. **Methods**: Two hundred and seventy-eight swab specimens were collected from patients' wound infections from November 2020 to February 2021. The required data were obtained by using the designed questionnaire. The identification of isolated pathogenic bacteria was performed by using standard microbiological methods. Also, antibiotic susceptibility tests were determined by using the Kirby-Bauer disc diffusion technique. **Results**: It was found that only 62.95% and 37.05% of cases, respectively, were positive and negative growth recorded in culture media. A higher rate of bacterial infection was found among the age group of 41-50 years (60.53%), males (37.87%), patients living in rural areas (40.62%), having wound infection in the foot (75.67%), hospitalized for two weeks (73.01%), from hospital inpatient (66.50%), with diabetic foot ulcers (73.68%), and not using antibiotics (65.71%). The most frequent bacteria were Staphylococcus aureus (42.45%) followed by Pseudomonas aeruginosa (17.14%), Escherichia coli (13.06%), Staphylococcus epidermidis (12.24%), Streptococcus pyogenes (8.57%), Klebsiella sp. (3.27%), Enterobacter sp. (1.63%), Acinetobacter sp. and P. mirabilis (0.82% for each). Most bacteria isolates were showed high resistance to common antibiotics. **Conclusion**: The prevalence of antibiotic-resistant bacteria among wound patients may be representing the health-threatening in upcoming years. Therefore, it is important to implementation periodic surveillance of antibacterial susceptibility profiles, and appropriate management of wound infection to avoid the rise and spread of antibiotic-resistant bacterial strains.

Keywords: Wound infection, Bacteria, Antibacterial susceptibility profile, Sana'a,, Yemen

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Introduction

A wound is a breach in the skin and the exposure of subcutaneous tissue following a loss of skin integrity providing a moist, warm, and nutritive environment that is conducive to microbial colonization and proliferation. Patients wound considers a favorite environment for the growth of pathogenic bacteria acquired from the hospital environment during hospitalizing. Wounds infections can be caused by different microorganisms that can exist in polymicrobial communities particularly in the wound margins and in chronic wounds[1] .

However, most of the pathogenic bacteria existing in infecting wounds are nosocomial bacteria that are responsible for causing morbidity and 70-80% of patients mortality[2,3]. Also, most of the nosocomial bacteria causing wound infections are antimicrobial-resistant which represents an increasing therapeutic challenge in wound controlling. The commonest pathogenic bacteria isolated from infected wounds are *Staphylococcus aureus*, *Escherichia* sp., *Pseudomonas* sp., *Klebsiella* sp., *Enterobacter* sp., *Enterococci* sp., *Proteus* sp., and *Acinetobacter* sp.[4,5,6].

The high prevalence of antimicrobial-resistance bacteria has become a major threat to reducing the effectiveness of antibiotics in low-income countries. The factors that contribute to antimicrobial-resistant bacteria maybe due to the over-the-counter antibiotic availability, extensive incorrect and misuse of these agents in hospitals as well as in the country as a whole [7,8].

However, very limited data are existing on the type of isolated bacteria from patient's wounds and their antibacterial susceptibility profiles in Sana'a Hospitals, Yemen. So, the present study was aimed to determine the antibacterial susceptibility profiles of isolated pathogenic bacteria from wound infections among patients attending some government hospitals in Sana'a City, Yemen.

Materials and Methods

Study area and period

This study was conducted during the period from November 2020 to February 2021 among patients with wounds infection attending some governorate hospitals in Sana'a city. Yemen.

Data collection

A designed questionnaire was subjected to collect information about the infected wounds' patients. In the questionnaire, questions such as gender, age, resident area, and duration of hospital stay were interviewed. Also, the clinical characteristics information gathered by the questionnaire was used to assess the location of a patient, wound location, type of wound, and antibiotics use among the infected wound patients.

Ethical approval

The protocol of this work was approved by the Ethics Research Committee of the Medicinal College, Al-Razi University. All participants were informed in the Arabic language of the purpose of this investigation before the information was collected and written informed consent was obtained from them.

Specimens collection and culturing

A total of two hundred and seventy-eight (278) specimens were collected from wound patients hospitalize at three governorate hospitals (Al-Gmohori, Typical Police, and Al-Thourah) in Sana'a City of Yemen. By using a sterile cotton swab, the wound samples were swabbed gently from the superficial, medium, or deep of the infected area and the samples were immediately transported to the laboratory.

Bactria identification

The collected specimen was streaked independently on the surface of McConkey agar, Chocolate agar, and Blood agar. The McConkey agar and Blood agar plates were incubated aerobically while the Chocolate agar plates were incubated anaerobically for 24 hrs 37°C. bacteria isolates were identified based on colony morphological characterization on culture media and other typical growth characteristics on non-selective, selective, and differential culture media and complemented with gram staining as well as biochemical tests to confirm their identity/purity [9].

Antimicrobial susceptibility testing

Antimicrobial susceptibility testing of isolates bacteria was performed by the modified Kirby-Bauer disks diffusion method on Mueller-Hinton agar according to the Clinical and Laboratory Standards Institute (CLSI) protocol [10]. The using 9 antibiotic discs were used that include; Vancomycin (VA, 30µg), Erythromycin (E, 15µg), Imipenem (IPM, 10µg), Ciprofloxacin (CIP, 5µg), Ceftriaxone (CTR, 30µg), Gentamicin (GEN, 10µg), Ceftazidime (CAZ, 30µg), Tetracycline (TE, 30µg), and Amikacin (AK, 30µg) discs (HiMedia Labs, India). The plates of Muller Hinton agar were incubated overnight, and the inhibition zone of bacterial growth was measured and interpreted according to CLSI[10].

Results

Table 1 shows the distribution of sample collection from patients' wounds infection. The most specimens collected were 30.58% from age group 31-40 years old from males (87.41%) who come from rural areas (58.27%) and were hospitalized in hospitals within one week (30.58%). Also, it was noticed that the high samples were sampled from inpatients (75.18%) have wound in the leg (39.21%) with abscess forms of wounds (50.72%).

Table 1: Socio-demographic of participated infected wounds

Variables	Examined No. (%)	Variables	Examined No. (%)
Age group(in years)		**Location of patient**	
<10	**11 (3.96)**	Preadmission	**12 (4.32)**
11-20	**31 (11.15)**	Inpatient	**209 (75.18)**
21-30	**61 (21.94)**	Outpatient	**34 (12.23)**
31-40	**85 (30.58)**	Operating Room	**23 (8.27)**
41-50	**38 (13.67)**	**Wound location**	
>50	**52 (18.70)**	Leg	**109 (39.21)**
Gender		Abdomen	**42 (15.11)**
Male	**243 (87.41)**	Hand	**23 (8.27)**
Female	**35 (12.59)**	Head neck	**29 (10.43)**
Resident area		Foot	**37 (13.31)**
Rural	**162 (58.27)**	Arm	**24 (8.63)**
Urban	**116 (41.73)**	Chest	**14 (5.04)**
Duration of hospital stay		**Type of wound**	
1 week	**85 (30.58)**	Trauma	**16 (5.76)**
2 week	**63 (22.66)**	Postoperative wound	**102(36.69)**
3 week	**50 (17.98)**	Abscess	**141 (50.72)**
4 week	**80 (28.78)**	Diabetic foot ulcers	**19 (6.83)**
Antibacterial use			
Yes	243 (87.41)		
No	35 (12.59)		

From the results, only 175 cases (62.95%) showed positive growth in culture media and 103 cases (37.05%) were reported as negative growth in culture media, as shown in Table (2).

Table 2: Specimens growth in culture media		
Type of growth	**Number of specimens**	**Percentage %**
Positive growth	175	62.95
Negative growth	103	37.05
Total	**278**	**100**

Figure (1) reveals that the higher rate of wound infection was (60.53%) documented among the participants in the age group of 41-50 years while the lowest rate was (32.25%) observed among the age group of 11-20 years.

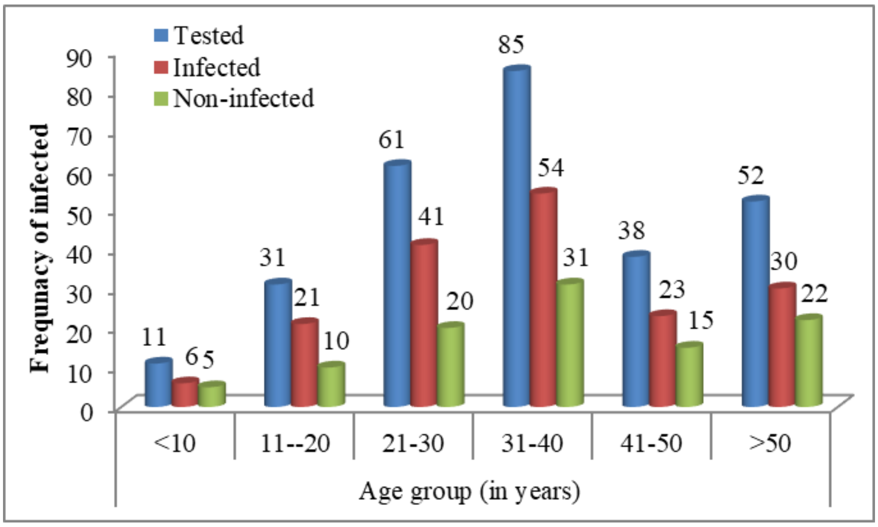

Figure 1: The frequency of infected wounds according to age

The current result showed the males had (67.49%) the highest rate of wounds infection compared to females (31.42%) as showed in Figure (2).

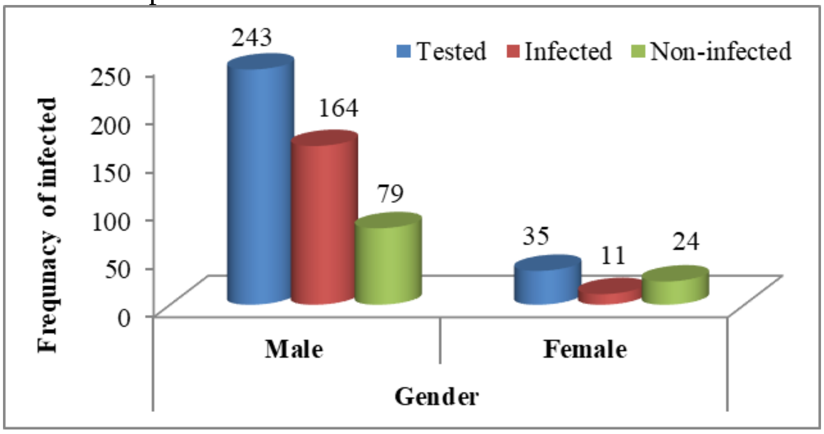

Figure 2: The frequency of infected wounds according to gender

This result showed that the high rate of wounds infection was among participants coming from rural 105(64.81%) compared to patients from urban 70(60.34%) areas as shown in Figure (3).

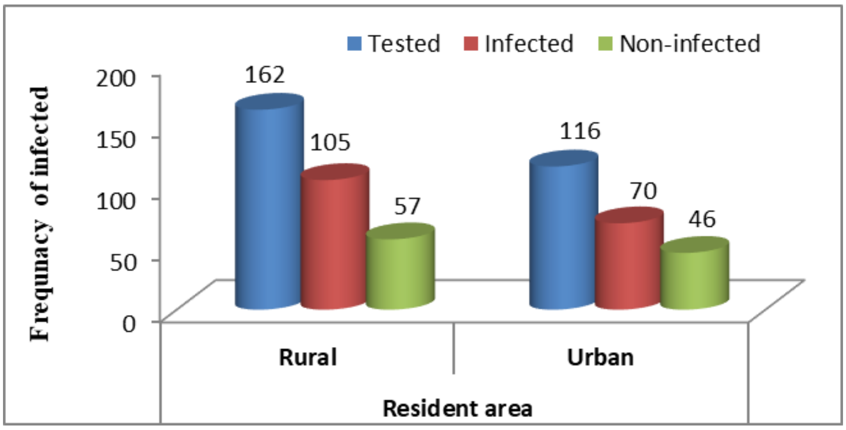

Figure 3: Distribution of wound infection in relation to the area

Table 3 shows that the higher rate of wound infection was among specimens collected from foot (75.67%) followed by leg (70.64%), hand (65.22%), arm (54.17%), and the lowest rate was (42.86%) recorded in chest specimens as listed in Table (3).

Table 3: Distribution of wound infection according to wound location

Wound location	Tested sample	Infected (%)	Non -infected (%)
Leg	109	77 (70.64)	32(29.36)
Abdomen	42	22(52.38)	20(47.62)
Hand	23	15 (65.22)	8(34.78)
Head neck	29	14(48.27)	15(51.73)
Foot	37	28 (75.67)	9 (24.33)
Arm	24	13 (54.17)	11 (45.33)
Chest	14	6(42.86)	8 (57.14)
Total	**278**	**175(62.95)**	**103(37.05)**

Most of the wound infection was reported among the patients hospitalized for two weeks (73.01%) while the lower rate was recorded among patients staying for three weeks in hospitals (Figure 4).

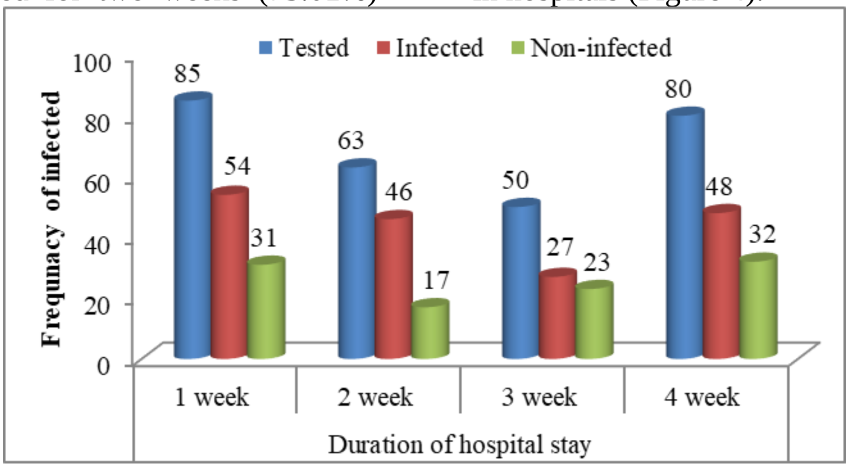

Figure 4: Distribution of wound infection in relation to duration period

Figure 5 shows the most of the participants were from hospital inpatient with an infection rate of 139(66.50%) and in contrast the preadmission and outpatient had a lower rate of participants.

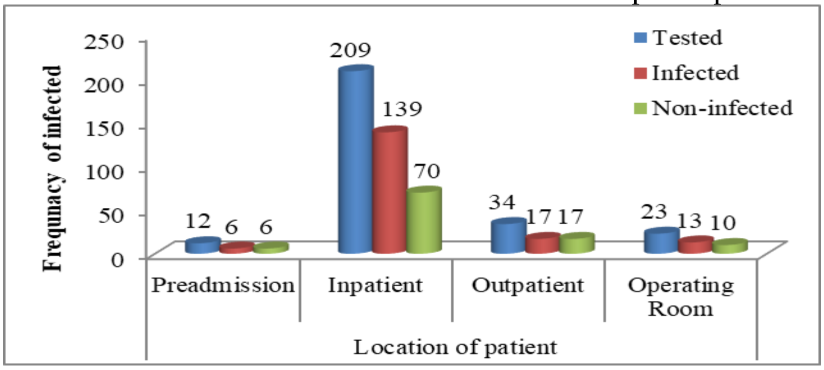

Figure 5: Distribution of wound infection in relation to patient location

This result observed that the high prevalence rate of wound infection was (73.68%) among patients with diabetic foot ulcers followed by patients with abscesses (65.96%). Whereas the lower rate was 37.50% among trauma patients (Figure 6).

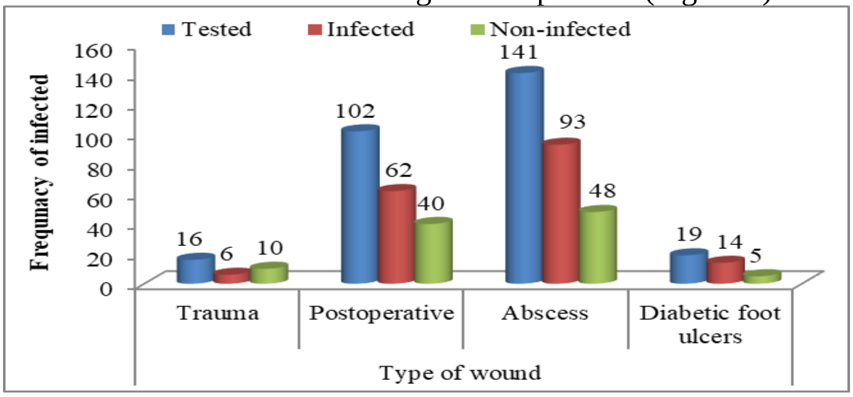

Figure 6: Distribution of wound infection concerning the type of wound

Most of the patients who participated in this study are using antibiotics. The patients who are not using the antibiotics showed a more rate of wound infection (65.71%) compared to patients using antibiotics (62.55%) as figured in Figure (7).

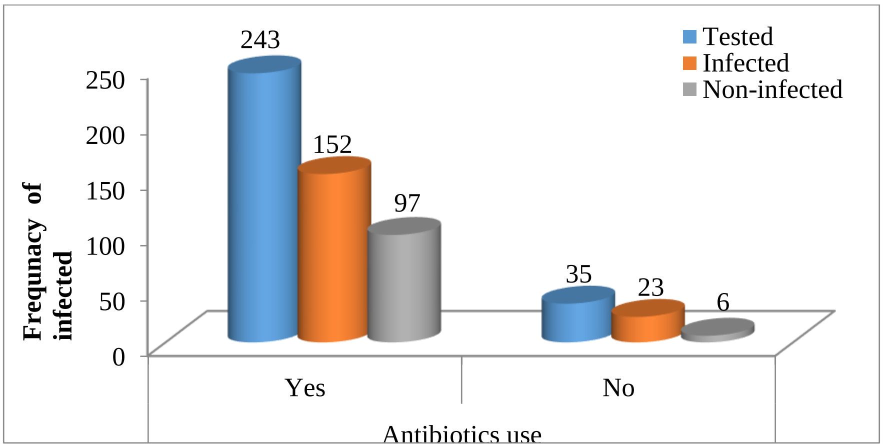

Figure 7: Distribution of wound infection in relation to antibiotics use

The present results revealed that the *Staph. aureus* was the predominant bacteria species isolated from wound infection (42.45%) followed by *P. aeruginosa* (17.14%), *E. coli* (13.06%), *S. epidermidis* (12.24%), *S. pyogenes* (8.57%), *Klebsiella* sp. (3.27%), *Enterobacter* sp. (1.63%), *Acinetobacter* sp. and *P. mirabilis* (0.82% for each) as summarized in Table (4).

Table 4: Frequency of bacteria isolates from wound infection

Bacterial species	Frequency	Percentage %
S. aureus	104	42.45
P. aeruginosa	42	17.14
E. coli	32	13.06
S. epidermidis	30	12.24
S. pyogenes	21	8.57
Klebsiella sp.	8	3.27
Enterobacter sp.	4	1.63
Acinetobacter sp.	2	0.82
P. mirabilis.	2	0.82
Total	**245**	**100**

The single of isolates bacteria was 117(66.86%) whereas the frequency of mixed isolates of bacteria from the infected wound was 58 (33.14%) as indicated in Table (5).

Table (5): Frequency of single and mixed bacterial isolates

Bacterial isolates	Frequency of isolation (%)
Single isolate	117 (66.86)
Mixed isolates	58 (33.14)
S. aureus + *P. aeruginosa*	16
S. aureus + *S. epidermidis*	8
E. coli + *S. aureus*	8
E. coli + *S. pyogenes*	4
S. aureus + *S. pyogenes*	4
P. aeruginosa + *S. epidermidis*	3
E. coli + *S. epidermidis*	3
S. epidermidis + *S. pyogenes*	3
S. aureus + *Klebsiella* sp.	3
P. aeruginosa + *S. pyogenes*	2
Klebsiella sp.+ *P. aeruginosa*	2
S. epidermidis + *Klebsiella* sp.	2
Total	**58 (33.14)**

Table 6 reveals the antibacterial susceptibility results for isolated bacteria from the infected wounds. *S. aureus* showed high sensitivity to imipenem (82.8%) and erythromycin (71.2%) and moderate sensitivity to amikacin (68.6%) and 65.7% for each of ciprofloxacin and tetracycline. Also, it showed resistance to ceftriaxone at 74.3%. The imipenem, amikacin, and ciprofloxacin showed high effectiveness against *P. aeruginosa* at 92%, 84%, and 72%, respectively. In contrast, the isolates of this bacteria showed resistance to erythromycin and tetracycline at 76% for each.

However, *E. coli* showed high sensitivity to ceftriaxone at 73.35% and moderate sensitivity to erythromycin, imipenem, and amikacin whereas it showed moderate resistance to ciprofloxacin. Similarly, *S. epidermidis* revealed higher sensitivity to vancomycin amikacin, imipenem gentamicin, and ciprofloxacin and moderately to ceftriaxone, ceftazidime, and tetracycline. Also, the *S. pyogenes* showed high sensitivity to erythromycin, ceftriaxone, and gentamicin at 80% for each and moderate sensitivity and resistance to ciprofloxacin. The *Klebsiella* sp. showed complete sensitivity to amikacin and highly to ceftazidime and tetracycline at 83.3% for each. Also, it showed moderate resistance to ciprofloxacin and erythromycin (Table 6).

Enterobacter sp. showed highly sensitivity to ceftazidime and ceftriaxone and moderate to imipenem and gentamicin as well as highly resistant to ciprofloxacin. *Acinetobacter* sp. showed completely resistance to gentamicin and amikacin and moderate to imipenem and ciprofloxacin. The imipenem, ceftazidime, and amikacin were effective against *P. mirabilis* which is completely resistant to gentamicin summarized in Table (6).

Table 6: Antibacterial susceptibility profile of isolated bacteria

Bacterial species		**VA**	**E**	**IPM**	**CIP**	**CTR**	**GEN**	**CAZ**	**TE**	**AK**
S. aureus	S(%)	18(51.4)	25(71.2)	29(82.8)	23(65.7)	9(25.7)	17(48.6)	ND	23(65.7)	24(68.6)
	R(%)	17(48.6)	10(28.8)	6(17.2)	12(34.3)	26(74.3)	18(51.4)	ND	12(34.3)	11(31.4)
P. aeruginosa	S(%)	0(0)	6(24)	23(92)	18(72)	16(64)	8(32)	10(40)	6(24)	21(84)
	R(%)	25(100)	19(76)	2(8)	7(28)	9(36)	17(68)	15(60)	19(76)	4(16)
E. coli	S(%)	0(0)	10(66.7)	8(53.3)	6(34)	11(73.3)	9(66)	7(46.7)	ND	8(53.3)
	R(%)	25(100)	5(33.3)	7(46.7)	9(66)	4(26.7)	6(34)	8(53.3)	ND	7(46.7)
S. epidermidis	S(%)	10(100)	7 (70)	9(90)	8(80)	6(60)	9(90)	5(50)	5(50)	10(100)
	R(%)	0(0)	3(30)	1(10)	1(20)	4(40)	1(10)	5(50)	5(50)	0(0)
S. pyogenes	S(%)	0(0)	8(80)	7(70)	5 (50)	8(80)	8(80)	ND	7(70)	ND
	R(%)	10(100)	2(20)	3(30)	5 (50)	2(20)	2(20)	ND	3(30)	ND
Klebsiella sp.	S(%)	0(0)	3(50)	4(66.7)	2(33.3)	ND	3(50)	5(83.3)	5(83.3)	6(100)
	R(%)	25(100)	3(50)	2(33.3)	4(66.7)	ND	3(50)	1(16.7)	1(16.7)	0(0)
Enterobacter sp.	S(%)	ND	ND	2(50)	1(25)	3(75)	2(50)	4(100)	ND	ND
	R(%)	ND	ND	2(50)	3(75)	1(25)	2(50)	0(0)	ND	ND
Acinetobacter sp.	S(%)	0(0)	ND	1(50)	1(50)	ND	0(0)	ND	ND	0(0)
	R(%)	25(100)	ND	1(50)	1(50)	ND	2(100)	ND	ND	2(100)
P. mirabilis	S(%)	0(0)	1(50)	2(100)	1(50)	1(50)	0(0)	2(100)	1(50)	2(100)
	R(%)	25(100)	1(50)	0(0)	1(50)	1(50)	2(100)	0(0)	1(50)	0(0)

VA= Vancomycin; **E**= Erythromycin; **IPM**=Imipenem; **CIP**; Ciprofloxacin; **CTR**=Ceftriaxone; **GEN**= Gentamicin; **CAZ**= Ceftazidime; **TE**=Tetracycline; **AK**= Amikacin. **ND:** Not done

Discussion

Bacterial wound contamination is a serious problem in the hospital and the treatment of wound infections remains a significant concern for surgeons. The risk of developing wound infection depends on the number of bacteria colonies on the wound. The problem has been magnified due to the unrestrained and rapidly spreading resistance to the available array of antimicrobial agents[8,11].

The current result revealed that only 62.95% of wound swabs were positive for bacterial growth while 37.05% were negative. In similar result reported by Alhlale *et al.*[7] who observed that

56.67% of surgical wound specimens were showed bacterial growth.

This result is lower than the study by Alghalibi *et al*.[12] found that the bacterial growth was 83.5% recorded among specimens collected from wound patients. Similarly, Mama *et al*.[13] showed that the prevalence of bacterial infection was 87.3% reported among wound patients in South-West Ethiopia. Also, a study in Bangladesh by Roy *et al*.[14] found that 92.3% of swab specimens of wound patients were positive bacterial growth.

The present work revealed that the age group of 41-50 years had a higher rate of wound infection (60.53%) while the lowest rate was 32.25% observed among the age group of 11-20 years. A similar study by Mama *et al*.[13] observed that the age group of 45-59 years has the highest rate of wound infection. Also, Alghalibi *et al*.[12] documented that the high rate of wound infection was among the age more than 50 years.

The incidence of wound infection in this study was more common in males (67.49%) than in females (31.42%). This is in agreement with studies done in Sana'a[12] and Ethiopia[13]. This might be clarified by the fact that traditionally, in this country mainly males are involved in occupations such as farming, construction works, transportation, and industry works where the likely exposure to trauma is common.

In this result, it was found that a high rate of wounds infection was reported among patients coming from rural areas. The high rate of wound infection among the patients living in rural areas may be referred to they are lacking awareness about managing and controlling wound contamination.

The higher frequency of wound infection in this study was recorded among specimens collected from foot (75.67%) followed by leg (70.64%), hand (65.22%), arm (54.17%), and chest (42.86%). A similar finding by Mama *et al*.[13] documented that leg, abdomen, and foot were most parts contaminated by bacteria.

The current result observed that the specimens collected from hospital inpatients showed more rate of infection than other patients. This result is in line with the finding by Yakha *et al*.[15]. The high rate of infection prevalence in these hospitalized patients may be due to factors associated with the acquisition of nosocomial pathogens in patients with recurrent long-term hospitalization, complicating illness, prior administration of antimicrobial agents.

This result revealed that a higher rate of wound infection was reported among patients with diabetic foot ulcers followed by patients with abscess, postoperative, and trauma patients. A different study reported that the more frequency rate of bacterial infection was found in trauma, postoperative, and abscess while the lower was presented in diabetic foot ulcers[13].

The most bacteria isolated in this study from wound infection were *Staph. aureus* (42.45%) followed by *P. aeruginosa* (17.14%), *E. coli* (13.06%), *S. epidermidis* (12.24%), *S. pyogenes* (8.57%), *Klebsiella* sp. (3.27%), *Enterobacter* sp. (1.63%), *Acinetobacter* sp. and *P. mirabilis* (0.82% in each).

A similar study by Alghalibi *et al*.[12] recorded that the *S. aureus* was most frequently bacteria isolated (47.8%), followed by *P. aeruginosa* (23%), *E. coli* (5.3%), *S. plymuthica* (3.8%), *P. mirabilis* (2.9%), *Salmonella* sp. (2.4%), *S. epidermidis* (2.4%), *Acinetobacter* sp. (1.9%), *S. faecalis* (1.4%), and *Bacillus* sp., *Citrobacter freundii*, *Klebsiella* sp., and *S. pyogenes* (0.96% per each).

An investigation in Ethiopia by Roy *et al*.[14] revealed that *S. aureus* was the most bacteria isolates followed by *E. coli, Pseudomonas* sp., and *S. pyogenes* prevalent among patients with wound infection. Another study carried out by Alhlale *et al*.[7] found that the predominant isolated bacteria from wound infection was *S. aureus* (39.70%) followed by *E. coli* (27.94%), *P. aeruginosa* (19.12%), and *P. mirabilis* (13.24%).

S. aureus occurs naturally on the skin surface by 40-60% of healthy people as well as present in the hospital environment. It has the special characteristics for spreading quickly in a hospital environment and causes wound infection. The wound is considering an ideal environment site for the proliferate rapidly of infecting organisms; the mean cell generation time in optimum conditions is approximately 20 min[16,17].

P. aeruginosa is commonly prevalent in hospital environments and the occurrence of diseases associated with hospital-acquired infections. This bacterium has can survive in competition with other organisms and resists antibiotics as well as disinfectants. These factors allow the *P. aeruginosa* to easily transmit to patient wounds from the surrounding environment[18].

The *E. coli* bacterium normally lives in the human's colon and often causes infections wounds contaminated with urine. Most contaminated wounds with hospital-acquired infections such as bacteria are known due to poor hospital hygiene [19].

The present result showed that 66.86% cases showed single isolates and 33.14% cases showed mixed isolates and this finding is similar to the result reported by Yakha *et al*.[15].

The findings obtained revealed that the isolated bacteria varied in their susceptibility to all the antibacterial used. It was found that the *S. aureus* showed high sensitivity to imipenem and erythromycin and was resistant to ceftriaxone. Also, Mama *et al*.[13] revealed that *S. aureus* was highly sensitive to amikacin, vancomycin, gentamicin, and ciprofloxacin. Another work by Roy *et al*.[14] indicated the imipenem and ceftriaxone had the highest effect against *S. aureus*. Recently, ALhlale *et al*.[7] showed that the ciprofloxacin and vancomycin had a higher effect against *S. aureus* which showed completely and was high resistance to ceftazidime and erythromycin, respectively.

The present result observed that *P. aeruginosa* had higher sensitivity to imipenem, amikacin, and ciprofloxacin and was highly resistant to erythromycin and tetracycline. A similar finding by Yakha *et al*.[15] observed that the imipenem and amikacin were the most effective against *P. aeruginosa* that was highly resistant to ceftazidime. Also, it was found that *P. aeruginosa* isolates were found to be more sensitive to ciprofloxacin and gentamicin and highly resistant to tetracycline[13].

This result reported that a higher rate of *S. epidermidis* sensitivity was noticed for vancomycin amikacin, imipenem, gentamicin, and ciprofloxacin and moderately to ceftriaxone, ceftazidime, and tetracycline. This finding is similar to a study by Mama *et al*.[13].

This study noticed that *E. coli* had highly sensitive to ceftriaxone and moderate resistance to ciprofloxacin. This result is constant with a study by Roy *et al*.[14] and disagreement with a study by Mama *et al*.[13].

These findings reported that the higher rate of *S. pyogenes* sensitivity was recorded for erythromycin, ceftriaxone, and gentamicin and resistance to ciprofloxacin. Similarly, *Klebsiella* sp. showed high sensitivity to amikacin, ceftazidime, and tetracycline and moderate resistance to ciprofloxacin and erythromycin. In a similar study by

Roy *et al*.[14] that the *S. pyogenes* was sensitive to vancomycin, imipenem, ceftriaxone, and gentamicin as well as the *Klebsiella* sp were wholly sensitive to ceftazidime and gentamycin and resistant to ciprofloxacin and tetracycline.

The *Enterobacter* sp. in this work revealed high sensitivity to ceftazidime and ceftriaxone and high resistance to ciprofloxacin. A study by Edrees and Al-Awar[20] found all the isolates of *Enterobacter* sp. were sensitive to gentamicin and vancomycin

This finding showed that the imipenem, ceftazidime, and amikacin were effective against *P. mirabilis* which is completely resistant to gentamicin. A similar study by Mama *et al*.[13] recorded that *Proteus* sp. showed completely sensitivity to imipenem and ceftazidime. Also, ALhlale *et al*.[7] observed that ceftazidime and ciprofloxacin had more effective against *P. mirabilis*.

Several reports that were carried out in some regions of Yemen have documented the increase of resistant-pathogenic microorganisms to antimicrobial which is regularly prescribed by physicians. The rapid increase of resistance of pathogenic agents to antimicrobial maybe resulted from the availability of drugs as over-the-counter-drugs which anyone can buy without prescription and misuse by patients [21,22]. In addition, most physicians are describing the antibiotics for patients as empirical without referring to laboratory results or they didn't recommend the patients to make the antimicrobial susceptibility test [23].

Conclusion

The high rate of bacterial isolates prevalent among patients wound in the present study and their resistance to commonly used antibacterial agents considers the precursor for the health problems in a feature. Therefore, it is required strictly adherent to infection control procedures for reducing the resistant bacteria prevalent among hospitalized patients. Also, antimicrobial susceptibility testing must be performed on all patients who suffering from microbial diseases to determine the effective antibiotics.

Conflict of interest

No conflict of interest is associated with this work.

Author's contribution

All authors have worked equally for this work.

Acknowledgment

The authors thank participating investigators; Abubakr Alazazi, Abdalmajed Al-Hamody, Akram Abdo, Amani Al-Mawery, Amatalrahim Al-Aqel, Balqees Al-Moqbeli, Diana Alyateem, Entsar Alrowni, Eshraq Aldeen, Ghada Al-Sody, Hussein Bara, Ibrahim Aldran, Safwa Alnehmy, and Shaima'a Safah for their help in collecting the data and sampling of specimens. Also, they would like to thank the healthcare workers in the hospitals of Al-Gmohori hospital, Typical Police, and Al-Thourah for their generous help during this work.

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