ISSN: 2789-2220

Common Causes of Nosocomial Infections and Their Susceptibility Patterns to Ceftriaxone

[1]Dareen El shareef Ahmed Jadullah [2] Noor alhooda M. Alawkally, [3]Sara El- warred, [4] Fathia M. Senossi, [5] Maree Al Douakali Ali, [6] Rana Mohammed Alabeedi
[1] Microbiology, Faculty of pharmacy, Qurina International University, Benghazi– Libya
[2,5] Medical laboratory Department, Higher Institute of Science and Technology, Suluq, Libya
[3] Statistics Department, Arts and Science Faculty, Benghazi University, Libya
[4] Department of Zoology, Collage of Art and Science, Benghazi University, Libya
[5] English Departments, Faculty of Education, University of Benghazi, Libya
[1]Email: dareenelshareef@qiu.edu.ly
[2]E-mail: noornooor1973@gmail.com

Abstract— ***Drug resistant microorganisms lead to an increase in morbidity and mortality as they boost the risk of inappropriate therapy. Hence, data on antimicrobial resistance help define the best possible treatment for individual patients. Therefore, this study aimed to screen the antimicrobial resistant profile of 3rd generation cephalosporin drugs in Benghazi city. Methods. A laboratory based cross-sectional study was conducted in Al saleem laboratory from April 2022 to August 2022. The clinical samples such as wound swab, fluid and blood were collected from out patients. Then, bacterial species were isolated and identified as per the standard microbiological methods. Antimicrobial susceptibility tests were carried out using various antimicrobial discs by Kirby–Bauer disc diffusion method. Results. The infection rate was higher in males than in females. Gram-positive organisms Staphylococcus aureus, E. coli and accounted for most of the isolates. Almost isolated strains showed a high ratio of sensitive to the ceftriaxone. Most of the positive patients were identified in the 22-43 age groups, followed by the 44-65 age groups. Conclusion: The right medications should be selected based on susceptibility data of causative agents towards the drugs for the treatment of right disease agents.***

Keywords- ***Ceftriaxone, Cephalosporin, E. coli, fluid, Staph aureus, swab.***

I. INTRODUCTION

Nosocomial infections (NIs) can be defined as hospital-acquired infections that occur at least 48 to 72 hours after admission. (1) Antimicrobial resistance (AMR) is a growing and prominent problem in the 21st century and one of the most serious global public health threats. (2) Resistant microorganisms increase morbidity and mortality because they increase the risk of inappropriate treatment. (3, 4) This resistance can delay and hinder treatment, leading to complications and/or even death. (5, 6) Public misuse of antimicrobials is widespread in Libya. In Libya, as in many developing countries, antibiotics are available in pharmacies without a prescription. Numerous studies have also shown that the controlled use of antibiotics can increase the susceptibility of microorganisms to antimicrobial agents. (6) This study involves screening for antimicrobial resistance of third-generation cephalosporin drugs used to treat infectious diseases in Benghazi City

II. EXPERIMENTAL

A. Study Design and Specimen Collection.

A laboratory based cross-sectional study was conducted in Al saleem laboratory from April 2022 to August 2022.

B. Bacteria Identification.

All clinical specimens were collected using standard microbiological techniques to detect and isolate pathogenic bacteria. Each sample was then plated on MacConkey agar, blood agar, mannitol salt agar, chocolate agar, and blood agar, depending on the sample source, and then incubated aerobically at 37°C for 24 hours. (7)
Combining catalase- and coagulase-positive gram-positive cocci and characteristic yellow to golden colonies on blood agar with mannitol fermentation on mannitol salt agar to combine S. aureus with other gram-positive bacteria positive cocci are distinguished.
Gram-negative bacilli, or coliforms, are gram-negative bacteria
Recognized by standard microbiological algorithms, such as
Standard biochemical tests described in reference materials. Biochemical tests such as fermentation of lactose, glucose and sucrose and utilization of indole and citrate (MIS); Methyl Red (MR), Voges-Proskauer (VP); (7) Staphylococcus aureus, Escherichia coli, Cree Clinical strains of Primary, Proteus, Citrobacter, and Enterobacter. Clinical specimens collected in isolation. (8)

ISSN: 2789-2220

C. Antimicrobial Susceptibility Testing.

Antimicrobial susceptibility testing was performed using the disk diffusion technique according to the Kirby-Bauer method. (9) Correspondingly, at least 3 to 5 well-isolated identical colonies Morphotypes were selected from agar plate cultures and transferred to Muller-Hinton broth and incubated at 37°C for 24 hours. The turbidity of the suspension is Adjust with sterile saline to obtain turbidity equivalent to the 0.5 McFarland standard. Then spread the cotton swab over the fresh entire surface Prepare Mueller Hinton agar plates. Apply the antimicrobial disk to the plate within 15 minutes of inoculation. Plates were then incubated at 37°C for 24 hours. A zone of inhibition was measured based on the interpretation of resistance data studied by clinical and laboratory standards, and the results were interpreted as susceptibility, resistance, or intermediateness. (9) The antibacterial drug tested is the third generation cephalosporin: ceftriaxone (30 μg).

D. Data Analysis

The data was analyzed by SPSS programs.

III. RESULTS AND DISCUSSION

The wide use of posterity diapason antibiotics has led to the emergence of antibiotic resistant strains of bacteria. High rates of resistance have been primarily observed in bacteria that beget common health problems. In the present study further than half of the insulated bacteria strains were resistant to either ceftriaxone medicines which are in agreement with 2014 WHO reports.(10)

A. Distribution table of different swab, fluid and blood Infection by genders

The gender distributions of the patients with swab infection are reported in Table. 1 Concerning gender, the swab infection rate was higher in males than in females.

TABLE I. Distribution table of different swab, fluid and blood Infections by genders

Gender	Frequency	Percent
Female	70	42.2
Male	96	57.8
Total	166	100.0

B. Distributions of bacterial infection in wound pus, burn, medical device tips and blood specimens Collected from Patients.

Overall, Gram-positive organisms *Staphylococcus aureus*, *E. coli* and accounted for most of the isolates. Among the Gram-negative isolates identified, *E. coli* was the predominant isolate, followed by *Klebseilla* spp with an isolation rate of 18.1% and 10.8% respectively.

TABLE II. Distributions of bacterial infection in wound pus, burn, medical device tips and blood specimens Collected from Patients.

Bacteria	Frequency	Percent
Alcaligenes spp	1	.6
Citrobacter spp	2	1.2
E.coli	30	18.1
Enterobacter spp	12	7.2
klebsiella spp	18	10.8
MRSA	2	1.2
Proteus spp	12	7.2
Pseudomonas spp	15	9.0
pseudomonas aeruginosa	2	1.2
staph aureus	57	34.3
staph epidermidis	3	1.8
strep pyogens	1	.6
Strep pneumoniae	9	5.4
strep viridans	2	1.2
Total	166	100.0

C. Distributions of swab, fluid and blood specimens Collected from Patients.

The wound swab was the most samples from which bacteria were isolated, followed by fluid, and least isolation was from ear swab specimen.

TABLE III. Distributions of swab, fluid and blood specimens Collected from Patients.

Sample	Frequency	Percent
Blood	14	8.4
Ear swab	2	1.2

ISSN: 2789-2220

Fluid	18	10.8
Wound swab	128	77.1
Throat swab	4	2.4
Total	166	100.0

1) Resistance pattern of the different clinical isolates to ceftriaxone

In the present study, the antimicrobial resistance profile of isolates had been analyzed. Almost isolated strains showed a high ratio of sensitive to the ceftriaxone.

TABLE IV. Resistance pattern of the different clinical isolates to ceftriaxone.

CRO	Frequency	Percent
I	49	29.5
R	56	33.7
S	61	36.7
Total	166	100.0

Note: R- resistant; S-Sensitive; I- Intermediate.

D. Distribution of positive cases by age groups.

Regarding age distribution, most of the positive patients were identified in the 22-43 age groups, followed by the 44-65 age groups.

TABLE V. Distribution of positive cases by age groups.

Age group	Frequency	Percent
0-21	37	22.3
22-43	65	39.2
44-65	52	31.3
66-87	12	7.2
Total	166	100.0

E. Antibiotic sensitivity, resistance and intermediate sensitivity of bacteria isolated to ceftriaxone

The drug resistance pattern differences among isolates grounded on colorful characteristics were estimated(Table 6). In view of that, there were no significant differences observed except for the instance types from which the strains were insulated. nearly the bacterial isolates were tested for vulnerability against ceftriaxone. Among the Gram-positive bacteria anatomized, the most resistant species to ceftriaxone were represented byE. coli andS.aureus. Utmost of Escherichia coli strains insulated from the whole instance were set up to be sensitive to the action of ceftriaxone in the present study. Else, other exploration finding reported that Escherichia coli displayed the loftiest resistance to ceftriaxone.(13, 14) Staphylococcus aureus strains were set up to be more susceptible than other bacteria strains to ceftriaxone which is inconsistent with former study in which utmost of the strains were resistant.(11) also, other exploration finding reported that Staph aureus displayed the loftiest sensitive to ceftriaxone.(12) still, it's in line with other studies conducted in different areas which reported the vulnerability of the strains towards the ceftriaxone.(15, 16)

TABLE VI. Antibiotic sensitivity, resistance and intermediate sensitivity of bacteria isolated to ceftriaxone

CRO				
Bacteria	**I**	**R**	**S**	**Total**
Alcaligenes spp	0	1	0	1
Citrobacter spp	1	0	1	2
E.coli	3	10	17	30
Enterobacter spp	4	7	1	12
MRSA	1	1	0	2
Proteus spp	3	2	7	12
Pseudomonas spp	3	8	4	15
Strep pneumonia	4	0	5	9
klebsiella spp	1	8	9	18
pseudomonas aeruginosa	1	0	1	2
staph aureus	24	18	15	57
staph epidermidis	2	1	0	3
strep pyogens	0	0	1	1
strep viridans	2	0	0	2
Total	49	56	61	166

F. Types of specimen according to the gender.

The wound pus was the most samples from which bacteria were isolated from both gender, followed by fluid, and least isolation was from ear swab.

TABLE VII. Types of bacteria isolated according to the specimen.

gender			
Sample	**F**	**M**	**Total**
Blood	8	6	14

ISSN: 2789-2220

Ear swab	0	2	2
Fluid	1	17	18
Wound swab	59	69	128
Throat swab	2	2	4
Total	70	96	166

G. Prevalence of different bacterial growth among female and male patients.

A total of 166 specimen culture results of patients with suspected infection during twelve months period were studied. The isolates and sex distribution of the patients are shown in Table 12. Bacteria isolation rate was in male 96 (57.8%) than females 70 (42.1%) had a positive bacterial culture result. *Staph aureus* was the most frequent isolate from female patients.

TABLE VIII. Prevalence of different bacterial growth among female and male patients.

Gender			
Bacteria	**F**	**M**	**Total**
Alcaligenes spp	1	0	1
Citrobacter spp	0	2	2
E.coli	16	14	30
Enterobacter spp	7	5	12
MRSA	1	1	2
Proteus spp	6	6	12
Pseudomonas spp	5	10	15
Strep pneumoniae	4	5	9
klebsiella spp	9	9	18
pseudomonas aeruginosa	0	2	2
staph aureus	18	39	57
staph epidermidis	2	1	3
strep pyogens	1	0	1
strep viridans	0	2	2
Total	70 (42.1%)	96 (57.8%)	166

H. Frequency of isolated pathogens from each nosocomial infection.

The wound swab was the most sample from which bacteria were isolated, followed by fluid and least isolation was from ear swab specimen. *Staph aureus* was the most prevalent pathogen of wound swab contagion. In this study, the most common causes of nosocomial bloodstream infections were gram-negative bacteria, in particular *Enterobacter* spp followed by *Klebseilla* spp. This was dissimilar to previous studies from Asia. (17)

TABLE. IX Frequency of isolated pathogens from each nosocomial infection.

	sample					
Bacteria	**Blood**	**Ear swab**	**Fluid**	**Wound swab**	**Throat swab**	**Total**
Alcaligenes spp	0	0	0	1	0	1
Citrobacter spp	0	0	0	2	0	2
E.coli	2	1	3	24	0	30
Enterobacter spp	3	0	4	5	0	12
MRSA	1	0	0	1	0	2
Proteus spp	0	0	0	12	0	12
Pseudomonas spp	0	1	4	10	0	15
Strep pneumonia	0	0	2	5	2	9
klebsiella spp	3	0	0	15	0	18
pseudomonas acruglnosa	0	0	2	0	0	2
staph aureus	4	0	1	51	1	57
staph epidermidis	1	0	0	2	0	3
strep pyogens	0	0	0	0	1	1
strep viridans	0	0	2	0	0	2
Total	14	2	18	128	4	166

IV. CONCLUSION

Microbial resistance to Ceftriaxone medicine has been adding significantly as the finding of the present study indicated. also, those strains which developed resistance to Ceftriaxone were also resistant to multiple medicines which could make treatment of contagious complaints touched off by these microbial strains come grueling. Thus, the right specifics should be named grounded on vulnerability data of causative agents towards the medicines for the treatment of right complaint agents.

ACKNOWLEDGEMENTS

The authors are appreciative of the support of colleagues in the Bacteriology Department at Al Saleem laboratory

.

REFERENCES

ISSN: 2789-2220

[1] Vincent J. Nosocomial infections in adult intensive-care units. Lancet; 361(9374):2068–77, 2003.

[2] World Health Organization, Essential Drugs Monitor: Antimicrobial Drug Resistance: A Global Threat, World Health Organization, Geneva, Switzerland, 2000.

[3] A. Kapil, "The challenge of antibiotic resistance; need to contemplate," Indian Journal of Medical Research, vol. 121, no. 2, pp. 83–91, 2005.

[4] C. L. Ventola, "The antibiotic resistance crisis—part 1: causes and threats," P&T, vol. 40, no. 4, pp. 277–283, 2015.

[5] R. J. Fair and Y. Tor, "Antibiotics and bacterial resistance in the 21st century," Perspectives in Medicinal Chemistry, no. 6, pp. 25– 64, 2014.

[6] F. Prestinaci, P. Pezzotti, and A. Pantosti, "Antimicrobial resistance: A global multifaceted phenomenon," Pathogens and Global Health, vol. 109, no. 7, pp. 309–318, 2015.

[7] Alawkally, Noor Alhooda & Nag, Miftah & Ali, Maree & Al-Awkally, Nesrine & Al-Awkally, Abeer & Al-Awkally, Alreda. Antibiotic sensitivity of Escherichia coli isolated from different clinical specimens of patient human in Al-jala hospital-Benghazi Libya. International Journal of Current Research in Science Engineering & Technology. 8. Pages: 509-517.

[8] Fakron, A., Alawkally, N., El- warred, S., Aldouakali Ali , M., El-amari , M., Awkally, A., Soutiyah, M., Suliman, N. and Ibrahim, H. 2022. Risk Factors for Ciprofloxacin and Gentamycin Resistance among Gram Positive and Gram Negative Bacteria Isolated from Community-Acquired Urinary Tract Infections in Benghazi city. Scientific Journal for the Faculty of Science-Sirte University. 2, 1 (Apr. 2022), 76-87. DOI:https://doi.org/10.37375/sjfssu.v2i1.204

[9] Clinical and Laboratory Standards Institute (CLSI), Performance Standards for Antimicrobial Disk Susceptibility Tests, Clinical and Laboratory Standards Institute, Wayne, PA, USA, 13 edition, 2018.

[10] World Health Organization, Essential Drugs Monitor: Antimicrobial Drug Resistance: A Global Threat, World Health Organi- zation, Geneva, Switzerland, 2000.

[11] H. M. Shoaib, S. N. Baqir, D. Sheikh, and H. K. Hashmi, "Cephalosporin resistance and β-lactamase production in clinical isolates of staphylococcus aureus in Karachi," Pakistan Journal of Pharmaceutical Sciences, vol. 14, no. 2, pp. 23–32, 2001

[12] Fanta Gashe ,1 Eshetu Mulisa,1 Mekidim Mekonnen,2 and Gemechu Zeleke. Antimicrobial Resistance Profile of Different Clinical Isolates against Third-Generation Cephalosporins. Hindawi Journal of Pharmaceutics Volume Article ID 5070742, 7 pages, 2018. https://doi.org/10.1155/2018/5070742

[13] Polse, S. Yousif, and M. Assafi, "Prevalence and antimicrobial susceptibility patterns of uropathogenic E. coli among people in Zakho, Iraq," International Journal of Research in Medical Sciences, vol. 4, no. 4, pp. 1219–1223, 2016.

[14] S. Sabir, A. A. Anjum, T. Ijaz, M. A. Ali, M. U. R. Khan, and M. Nawaz, "Isolation and antibiotic susceptibility of E. coli from urinary tract infections in a tertiary care hospital," Pakistan Journal of Medical Sciences, vol. 30, no. 2, pp. 389–392. 15. A. O. Nkang, I. O, 2014.

[15] Okonko, O. K. Mejeha, O. G. Adewale, A. O. Udeze, and A. Fowotade, "Assessment of antibiotics susceptibil- ity profiles of some selected clinical isolates from laboratories in Nigeria," Journal of Microbiology and Antimicrobials, vol. 1, no. 2, pp. 019–026, 2009.

[16] Breurec, C. Bouchiat, J.-M. Sire et al., "High third-generation cephalosporin resistant Enterobacteriaceae prevalence rate among neonatal infections in Dakar, Senegal," BMC Infectious Diseases, vol. 16, article 587, 2016.

[17] Sritippayawan S, Sri-Singh K, Prapphal N, Samransamruajkit R, Deerojanawong J. Multidrug-resistant hospital-associated in- fections in a pediatric intensive care unit: a cross-sectional survey in a Thai university hospital. Int J Infect Dis; 13: 506-12, 2009..