ISSN: 2789-2220

Colistin Resistance Among Enterobacteriaceae Isolated from Clinical Samples in Benghazi city

[1]Dareen El shareef Jadullah [2]Noor alhooda M. Alawkally, [3]Abdlmanam Fakron, [4]Nessren F. Mousa, [5] Maree Al Douakali Ali,
[1]Microbiology, Faculty of pharmacy, Qurina International University, Benghazi– Libya,
[2,5] Medical laboratory Department, Higher Institute of Science and Technology, Suluq, Libya.
.
[3] Microbiology Department, Faculty of Science, University of Omar AL-mukhtar, Albieda, Libya.
[5] Department of Statistics, Faculty of arts and sciences, University of Benghazi, Libya.
[1] Email: dareenelshareef@qiu.edu.ly
[2]E-mail: noornooor1973@gmail.com

Abstract— ***The increasing number of multi-resistant Gram-negative bacteria has become a major problem worldwide. This study aimed to estimate the antibacterial activity of colistin against gram-negative bacterial infections isolated from clinical specimens in Benghazi city. The highest number enrolled in the present study was the males 96 while females 70. Pus swab (128) was the highest specimen growth enrolled in this study. The highest bacterial growth was recorded in ages between 22-43 years followed by 44-5-65 years. Somewhat, Gram-positive bacteria were intermediately susceptible to bacitracin antibiotic. An improved understanding of the pharmacokinetics and pharmacodynamics of colistin and its methanesulphonate will let the design of appropriate administer medicine procedures to make the most of efficiency while decreasing toxicity and the expansion of resistance.***

Keywords- ***Colistin, wound swab, Staph aureus, Strep pneumonia.***

I. INTRODUCTION

Bacterial resistance to drugs and antibiotics is one of the biggest public health challenges today. Antibiotics are among the most significant tools that utilized in fighting life-threatening infections. Recently, colistin has become one of the main therapeutic options in the management of carbapenem-resistant bacteria. The first mechanism of colistin resistance involves reduced colistin binding to the bacterial outer membrane due to the charge modification of the lipopolysaccharide (LPS) moiety. The second mechanism is the complete loss of lipid A, which also prevents the interaction of the antibiotic with the bacterial outer membrane. 3, 4

The appearance of multidrug-resistant (MDR) Gram-negative bacteria in parallel with the lack of new antibacterial agents led to an important understanding of polymyxins. There has recently been an incredible increase in the infections caused by MDR Gram-negative bacteria, particularly *Klebsiella pneumoniae*, Acinetobacter baumannii and *P. aeruginosa*, for these species, polymyxins are often the only existing active antibiotics. Polymyxins consist of polymyxins A–E, of which polymyxin B (PMB) and polymyxin E or colistin, are presently obtainable in the marketplace. 5 There is an increasing number of infections caused by multi- resistant organisms (MDRO) such as *Pseudomonas aeruginosa* and *Klebsiella* spp development of resistance to most available antibiotics including b-lactams, carbapenems, fluoroquinolones, and aminoglycosides is increasing worldwide at an alarming rate. 6 We had done last two years which produces problems in antibiotic treatment. The lack of development of new antimicrobial agents has encouraged the medical community to reconsider the use of colistin in many healthcare centres around the world, where no other less toxic or effective antibiotic is available. 7 Colistin, a polypeptide antibiotic of the polymyxin family, non-ribosomally synthesized with 1750 Da molecular weight, consisting of a cyclic heptapeptide with a tripeptide side chain acylated at the N terminus by a fatty acid tail. It is important that the hydrophobicity of the N-terminal fatty acyl segment is responsible for the inherent toxicity and greatly affects the antimicrobial activity of colistin. When the use of β-lactam, aminoglycoside or quinolone is ineffective; the polymyxins, especially colistin, serve as the final alternative treatment. Colistin became obtainable for medical use in the 1960s but was substituted in the 1970s with other antibiotics due to its toxicity. 8 There are two forms of colistin existing in the marketplace: colistin sulfate (tablets or syrup for oral use and powder for topical use), which is also available as an aqueous suspension solution for topical use in eyes and ears, and colistin methanesulfonate (colistimethate sodium [CMS] for parenteral use. Both of these forms can also be delivered by inhalation.9, 10 Colistin methanesulfonate or CMS, was mainly replaced with aminoglycosides in the 1970s because of alarm about its neurotoxicity and nephrotoxicity. 13 this study aims to evaluate the antibacterial activity of colistin against of gram-negative bacterial infections isolated from clinical samples in Benghazi city

ISSN: 2789-2220

II. EXPERIMENTAL

In the present study, the specimen of urine, sputum, CSF, swab stool and sections. Specimens processed in the Department of Microbiology from the inpatient and outpatient department of Al Salem laboratory hospital- Benghazi city from period April 2022 to August 2022. The samples were inoculated on blood agar, chocolate, and Macconkey and incubated overnight at 37Co and identified using morphological growth, gram stain and biochemical tests. Paper-based antibiotic tablets containing a specific proportion of antimicrobial drugs obtained from commercial supplying companies are used. The same commercially available antibiotic discs were gently and firmly placed on the agar plate which was then left at room temperature for 1 hour to allow diffusion of the antibiotics into the agar medium. The plates then incubated at 37°C for 24 hours. If antimicrobial activity is present on the plates, it will be indicated by an inhibition zone. The diameter of the inhibition zones was measured in millimetres at 24 hours using a scale. An organism was interpreted as highly susceptible if the diameter of the inhibition zone was more than 19 mm, intermediate if the diameter was [15-18] mm and resistant if the diameter was less than 13 mm. The intermediate readings were considered sensitive in the assessment of the data.

A. Methodology:

The data analyzed by SPSS version 20.

III. RESULTS AND DISCUSSION

A total of 166 specimens were identified, also detecting the mode of colistin against various isolated bacteria.

A. A. Distribution of various bacteria isolates from males and females

.

The highest number enrolled in the present study was the males 96 while females 70.

TABLE I. Distribution of various bacteria isolates from males and females.

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

B. Distribution of the clinical specimens according to various bacterial growths

128 pus swab was the highest specimen growth enrolled in this study, followed by 18 fluid.

TABLE II. *Distribution of the clinical specimens according to various bacterial growths*

Sample	Frequency	Per cent
Blood	14	8.4
Ear swab	2	1.2
Fluid	18	10.8
Pus swab	128	77.1
Throat swab	4	2.4
Total	166	100.0

C. Distribution of various bacterial growths isolated according to the age.

The highest bacterial growth was recorded in age between 22-43 years followed by 44-5-65 years while the lowest growth was observed in age between 66-87 years.

TABLE III. *Distribution of various bacterial growths isolated according to the age.*

Age	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

D. Distribution of bacteria isolated from patient samples culture.

A total of 57 *pseudomonas* spp isolates were obtained from the sample**,** followed by 30 *E. coli*.

TABLE IV. Distribution of bacteria isolated from patient samples culture.

ISSN: 2789-2220

Isolates	Frequency	Percent
Alcaligenes spp	1	.6
Citrobacter spp	2	1.2
E. coli	30	18.1
Enterobacter spp	12	7.2
klebsiella pneumoniae	18	10.8
Proteus mirabilis	2	1.2
Pseudomonas aeruginosa	12	7.2
Proteus spp	15	9.0
klebsiella oxycota	2	1.2
pseudomonas spp	57	34.3
Klebseilla spp	3	1.8
Enterobacter spp	1	.6
Enterobacter cloacae	9	5.4
Serratia spp	2	1.2
Total	166	100.0

E. Percentage susceptibility of various bacteria isolates to colistin.

Treatment with colistin has been represented in clinical preparation against multi-resistant Gram-negative organisms (MDRO). For many years, its clinical consumption has been narrowed by the reported toxicities. However, much of these toxicities may be found to its unsuitable for use before the 1980s. There is an increasing obligation, especially with the alarming development of resistance to the presently available agents. An improved understanding of the pharmacokinetics and pharmacodynamics of colistin and its methanesulphonate will let the design of suitable administer medicine procedures to make the most of efficiency while decreasing toxicity and the expansion of resistance. In the present study, Somewhat, Gram-positive bacteria were intermediately susceptible to bacitracin antibiotic. After additional research, it is not difficult to guess that colistin will be the main antimicrobial option against multi-resistant Gram-negative bacteria in the 21st century. Varying degrees of susceptibility observed for the isolates against the tested antimicrobials even within members of the same antimicrobial class**.** Our results showed that the percentage of colistin resistance was 6%. Interestingly, this percentage is lower than the percentage reported in (17) a study which revealed a per cent of 63.4% of colistin resistance and higher than the percentage of colistin resistance in the study conducted on *E. coli* isolates. 18 which was 14.5%.

TABLE V. Percentage susceptibility of various bacteria isolates to colistin.

Colistin	Frequency	Per cent
I	131	78.9
R	10	6.0
S	25	15.1
Total	166	100.0

F. Percentage susceptibility of various bacteria isolates from all clinical samples.

Colistin resistance is caused by decreases in the net negative charge of the outer membrane, loss of lipid A, or efflux pumps, and the most common resistance mechanism Enterobacteriaceae is the covalent modification of the lipid A moiety of lipopolysaccharide (LPS) via cationic substitution; these modifications neutralize the negative charge of LPS and subsequently reduce the binding affinity of colistin for its target. 18 In the present study, *Klebseilla* spp isolates, 57 were intermediate sensitive to Colistin antibiotic. Percent of *Klebseilla oxycota* sensitive to colistin was 3.6%.

TABLE VI. Percentage susceptibility of various bacteria isolates from all clinical samples.

Isolates	Colistin			Total
	I	R	S	
Alcaligenes spp	1	0	0	1
Citrobacter spp	1	1	0	2
E. coli	24	0	6	30
Enterobacter spp	11	1	0	12
Klebseilla pneumoniae	2	0	0	2
Proteus mirabilis	9	3	0	12
Pseudomonas aeruginosa	4	0	11	15
Proteus spp	9	0	0	9
klebsiella oxycota	8	4	6	18
pseudomonas spp	0	0	2	2
Klebseilla spp	57	0	0	57
Enterobacter spp	2	1	0	3
Enterobacter cloacae	1	0	0	1
Serratia spp	2	0	0	2
Total	131	10	25	166

IV. CONCLUSION

Topical antimicrobials have been used successfully to decrease bacterial infections in wounds for decades. Bacitracin

ISSN: 2789-2220

is a broad-spectrum antibiotic with a wide range of biological interventions that may be used to prepare a variety of formulations to treat inflammation, wounds and microbiological infections.

REFERENCES

[1] Azeli MR, Ghaemi E, Tabarraei A, Kaplan EL, Johnson DR, Vakili MA, Khodabakhshi B. Group a streptococcal serotypes isolated from healthy school children in Iran. Eur J Clin Microbiol Infect Dis 2003;22:475-8.

[2] Digiovine B, Chenoweth C, Watts C, Higgins M. The attributable mortality and costs of primary nosocomial bloodstream infections in the intensive care unit. Am J Respir Crit Care Med 1999 Sep;160(3):976-981.

[3] Mesiano ER , Merchán-Hamann E. Bloodstream infections among patients using central venous catheters in intensive care units. Rev Lat Am Enfermagem 2007 May- Jun;15(3):453-459.

[4] JEFFREY, J. S. & SKLAROFF, S. A. (1958). Incidence of wound infection. Lancet. i, 365.

[5] WILLIAMs, R. E. O., JEVONS, M. P., SHOOTER, R. A., HUNTER, C. J. W., GIRLING, J. A., GRIFFITHS, J. D. & TAYLOR, G. W. (1959). Nasal staphylococci and sepsis in hospital patients. Br. med. J. ii, 658.

[6] ROGERS, L. S., DUFFY, J. P. & Mou, T. W. (1965). Staphylococcal sepsis and patient's nasalcarrier state. Archs Surg., Chicago 90, 294.

[7] Abraham, E. P., and G. Newton, Ciba Found. Symp. Amino Acids Peptides Antimetab. Ac- tivity, 205 (1959).

[8] Meng, L.; Deresinski, S.; Holubar, M. Intraoperative bacitracin irrigations for the prevention of surgical site infections- Consider the alternatives. Infect. Control Hosp.

[9] Del Valle, L.J.; Díaz, A.; Puiggalí, J. Hydrogels for biomedical applications: Cellulose, chitosan, and protein/peptide derivatives. Gels 2017, 3, 27. [CrossRef] [PubMed]

[10] Clinical and Labo ratory Standards Institute (CLSI). Per- formance standards for antimicrobial suscepti bility testing; Twenty second informational supplement. CLSI doc- ument M100-S22. Wayne, PA: CLSI; 2012.

[11] Ananthi, B.; Ramakumar, M.; Kalpanadevi, V.; Abigail, R.S.; Karthiga, L.; Victor, H.K. Aerobic bacteriological profile and antimicrobial susceptibility pattern in postoperative wound infections at a tertiary care hospital. Proteus 2017, 3, 4–11.

[12] Mama, M.; Abdissa, A.; Sewunet, T. Antimicrobial susceptibility pattern of bacterial isolates from wound infection and their sensitivity to alternative topical agents at Jimma University Specialized Hospital, South-West Ethiopia. Ann. Clin. Microbiol. Antimicrob. 2014, 13, 1–10. [CrossRef] [PubMed]

[13] Mohammed, A.; Endris, M.; Gebrecherkos, T.; Tiruneh, M.; Moges, F. Bacterial Isolates and Their Antimicrobial Susceptibility Patterns of Wound Infections among Inpatients and Outpatients Attending the University of Gondar Referral Hospital, Northwest Ethiopia. Int. J. Microbiol. 2017, 2017, 8953829. [CrossRef] [PubMed]

[14] Meng, L.; Deresinski, S.; Holubar, M. Intraoperative bacitracin irrigations for the prevention of surgical site infections—Consider the alternatives. Infect. Control Hosp. Epidemiol. 2020, 41, 831–832. [CrossRef]

[15] D. Gottlieb et al. (eds.), Antibiotics. Springer-Verlag Berlin Heidelberg 1967

[16] Bardet, L. Okdah, S. Le Page, S. A. Baron, and J.-M. Rolain, “Comparative evaluation of the UMIC Colistine kit to assess MIC of colistin of gram-negative rods,” BMC Microbiology, vol. 19, no. 1, p. 60, 2019.

[17] A. A. Elmanama, M. R. Al-Reefi, E. M. Diab, and N. K. Al- Tawil, “Colistin resistant Escherichia coli isolated from chicken fecal materials in Gaza strip,” Journal of Al Azhar University- Gaza (Natural Sciences), vol. 20, no. 2, pp. 25–38, 2018.