Original Article

Prevalence Of Resistance Bacteria In Icu Among Covid-19 Isolation Centers Of Zliten Medical Center

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Abstract

Background Many patients with coronavirus diseases (COVID-19) require intensive care unit (ICU) admission and mechanical breathing, with adverse results. Some research looked into hospital-acquired infections, particularly ventilator-associated pneumonia (VAP), as a cause of patient deterioration. Furthermore, the ICUs of COVID-19 centres must be sterilised and free of bacterial contaminations, as there are numerous links between the frequency of deaths and resistant bacterial co-infections. Respiratory viral-bacterial co-infection is linked to higher mortality and morbidity than either viral or bacterial infection alone. **Objective** Identification of incidence of resistant bacterial infections in the ICU of isolated COVID-19 patients. **Material and Methods** Fifty-five samples were taken from beds, tables, monitors, ventilators, baths, wash devices, and materials in the COVID-19 ICU. The samples were then cultivated, and bacteria resistance was assessed using Pheonix BD CPO. **Results** The samples were divided into sterilized (no bacterial growth) and non-sterilized (bacterial growth). We found that 32 samples (58.18%) were sterilized and the percentage of the most frequently isolated multi-drug resistance (MDR) gram-negative species was Acinatobacter. baumannii (26.08%), Pseudomonas. putida (13.04%), Klebsiella. pneumonia (8.69%), Achromobacter. species (8.69%), Pseudomonas. species (8.69%), Acinetobacter. baumannii/Calcoaceticus.complex (4.34%), Pseudomonas. pseudoalcaligenes (4.34%) respectively. **Conclusion** Based on the results of the trials, it can be stated that the prevalence of resistant bacteria is significant in the ICU of COVID-19, and this resistance may result in increased morbidity and death. Furthermore, the medications that affect this sort of resistant bacteria are restricted.

Keywords: COVID-19, Resistance bacteria, Morbidity, Mortality

INTRODUCTION

The COVID-19 virus is the most dangerous threat to worlwide health since the Spanish Influenza epidemic of the twentieth century [1]. The sickness was called coronavirus disease 2019 because it was discovered to be caused by a novel strain of coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (COVID-19). As of May 23, 2021, WHO had recorded approximately 166 million illnesses and over 3.4 million projected deaths across 186 countries linked to COVID-19 [2]. Fever and cough are the most prevalent symptoms. More severe results (requiring mechanical breathing and intensive care) are linked to older age, a higher percentage of co-morbidities, and a higher mortality rate [3]. Many COVID-19 patients require ICU admission and mechanical ventilation, which has a negative result. Some research looked into hospital-acquired infections, particularly ventilator-associated pneumonia (VAP), as a cause of patient deterioration [4]. Furthermore, the ICUs of COVID-19 centres must be sterilised and free of bacterial contaminations, as there are numerous links between the frequency of deaths and resistant infection.

Respiratory mixed (virual-bacterial) co-infection is linked to higher mortality and morbidity than either viral or bacterial infection alone [5]. The airway can be functionally and histologically destroyed by viral infection. With evidence of cell loss, goblet cell hyperplasia, altered mucus secretion and/or biochemistry, surfactant disruption, decreased ciliary beat frequency, disorganised mucociliary clearance function, and decreased oxygen exchange, the induced histopathology can range from mild to severe depending on the virus. An original investigation from Wuhan, China found bacterial co-infections in 50% of patients who died from COVID-19 [7].

It has been postulated that it occurs when SARS-CoV-2 infects lung cells and causes harm to the cells as well as the lung architecture. This condition recruits neutrophils and macrophages to the infection site, causing inflammation. Finally, the altered environment and epithelium injury might cause bacteria to cling to, invade, and multiply [8]. In severe COVID-19 instances, a link between COVID-19 and bacterial infection began to emerge. Several bacterial healthcare-associated illness (HAI) pathogens isolated from COVID-19 patients are antibiotic-resistant in different classes. The ESKAPE pathogens E. faecium, S. aureus, K. pneumoniae, A. baumannii, P. aeruginosa, and Enterobacter species are the major causes of HAIs worldwide [2]. Klebsiella pneumoniae (41.1%) was the most often isolated, followed by MDR Acinetobacter baumannii (27.4%). Libya was one of the last countries in the region to report the first incidence of Coronavirus. On March 24, 2020, the first case of COVID-19 was discovered in Libya [9]. There are around 501904 COVID-19 cases and 6430 deaths documented in Libya through May 30, 2022. Due to the virus's spread in Libya, only 64 confirmed cases were recorded at Tripoli Laboratory (CDC) during the fourth epi-week of the pandemic (176 million km2; approximately six times Italy) [10]. A investigation of these bacterial strains' antimicrobial susceptibility profiles found that they were multidrug-resistant, with resistance to at least three classes of antimicrobial drugs, including beta-lactams, fluoroquinolones, and aminoglycosides [5].

Superinfection caused by resistant strains of Acinetobacter baumannii and Staphylococcus aureus in COVID-19 Libyan patients. As a result, critical patients who test positive for COVID-19 should be monitored for bacterial co-infections [11]. Secondary bacterial infections may cause complications and even mortality in COVID-19 patients, and the patients may contract this infection from an isolation unit in the hospital. In 2021, we will do a retrospective comparison analysis to determine the frequency of bacterial infection in the ICU among COVID-19-isolated patients at Zliten Medical Center.

Meterial and Methods

1. **Research Design**

   We performed a prospective comparative examination of bacterial co-infections and the antimicrobial resistance profile of bacterial isolates acquired from COVID-19 ICU beds, tables, monitors, ventilators, baths, wash equipment, and materials. The bacterial resistance samples were identified using a Pheonix BD® device.

2. **Population and Sample**

   This study included 55 samples obtained from the ICU of COVID-19 at Zliten Medical Center during the course of one month, from 1/8/2021 to 5/9/2021.

3. **Location and Time**

   The research was conducted at the Laboratory of Zliten Medical Center. It was conducted within a time frame of one month starting from Aug to Sep 2021.

4. **Pheonix BD**

   The Gram-negative (GN) panels incorporate the Phoenix CPO Detect Assay (BD), a qualitative confirmatory growth-based test, for the detection and confirmation of class A, B, and D carbapenemases. For the purpose of identifying and classifying CPO, the Phoenix CPO Detect Test makes use of Meropenem, Doripenem, Temocillin, and Cloxacillin, both alone and in combination with different chelators and -lactamase inhibitors. The Phoenix CPO Detect Test was used in accordance with the manufacturer's instructions [19].

   During the study period, the Zliten Medical Center laboratory conducted bacterial cultures using standard microbiological techniques. To create the final database, the antibiotic susceptibility and identification test results for each microbe obtained from locations admitted to intensive care units were assessed using the following criteria: (a) first +ve culture (b) bacteria found in beds, tables, monitors, baths, and ventilators (c) Automated antimicrobial susceptibility testing that identifies bacteria at least down to the genus level, and (BD PhoenixTM) (d) Microbiological data were divided into genus/species per month for trend and correlation reasons as follows: Other non-fermenting gram-negative bacteria (GNB) included Vibrio vulnificus, Paracoccus yeei, Sphingomonas paucimobilis, Acinetobacter spp., Achromobacter spp., Klebsiella pneumoniae spp., Pseudomonas spp., Cedecea lapagei, and staph. spp.

5. **Data Analysis**

   The data analysis was performed by EXCEL 2007.

Results

In our study, a total of 55 samples were collected by swabs (beds, tables, monitors, ventilators, baths, wash devices, and matter) from the ICU of Isolation centers at Zliten Medical Centers. The samples were divided into sterilized (no bacterial growth) and non-sterilized (bacterial growth). We found that 32 samples (58.18%) were sterilized and the percent of the most frequently isolated MDR gram-negative species were Acinetobacter. baumannii(26.08%), *Pseudomonas. Putida*

(13.04%), *K. pneumoniae* (8.69%), Achromobacter. species (8.69%), P. species (8.69%), Acinetobacter. baumannii/Calcoaceticus complex (4.34%), P. pseudoalcaligenes (4.34%) respectively (Figure1).

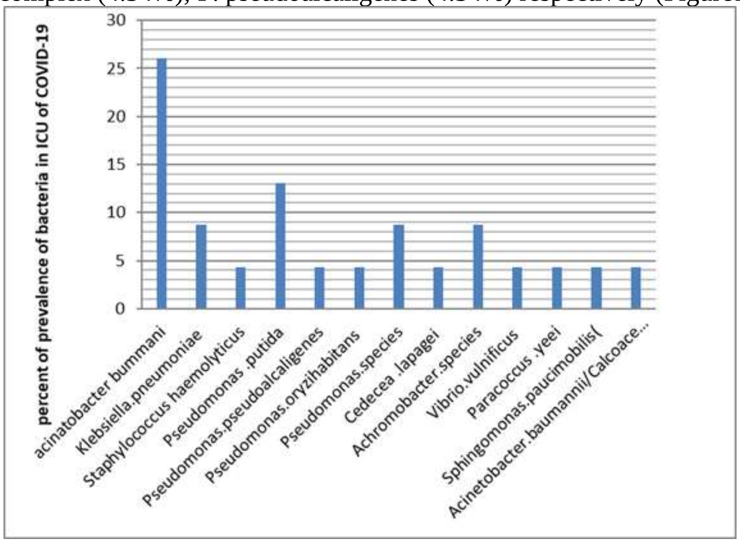

Figure (1) Prevalence of bacteria in ICU of COVID-19 isolation centers in Zliten medical center.

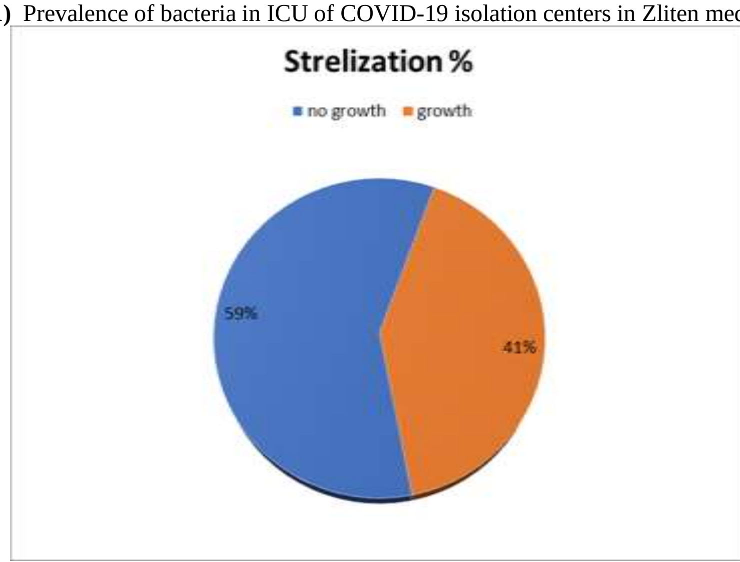

Figure (2) Percentage of sterilization in ICU of COVID-19 isolation centers in Zliten Medical Center.

ESBL production was demonstrated in the majority of *k. pneumoniae* (8.69%) and one sample of gram-positive MRSA production, was found in *Staph. haemolyticus* (4.34%), Five (21.73%) *Acinetobacter. bauamannii*, two (8.69%) *K. pneumoniae* and one sample of *Cedecea. lapagei* isolates (4.34%) was Cabapenem resistant (ALERT).

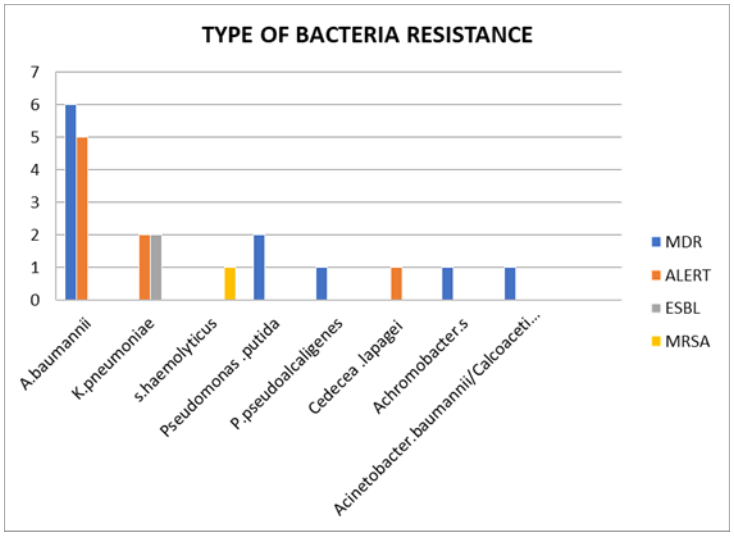

Figure (3) Prevalence of resistance markers in among different types of bacteria in ICU of isolation centers of COVID-19 in Zliten medical center, MDR= multidrug resistance bacteria, ALERT*=potential carbapenmase producer, ESBL= Extend spectrum beta lactamase and MRSA=Methacillin resistance *S. aureus***.**

Table (1) Type of Resistance of each bacteria**.**

Bacteria	**MRSA**	**ESBL**	**ALERT**	**MDR**
A .baumannii	0	0	5	6
K. pneumoniae	0	2	2	0
S. haemolyticus	1	0	0	0
Pseudomonas. putida	0	0	0	2
P. pseudoalcaligenes	0	0	0	1
Cedecea. lapagei	0	0	1	0
Achromobacter. spp	0	0	0	1
Acinetobacter. baumannii/alcoaceticus complex	0	0	0	1

The results of phoenix BD for treatment of resistant bacteria in high response were Colistin, Imepenam, and Cephalotin which the resistance to them were lowest (56.52%) whereas the highest resistance was toward Cefuroxime, Cephalotin, and many other antibiotics (99.9%).

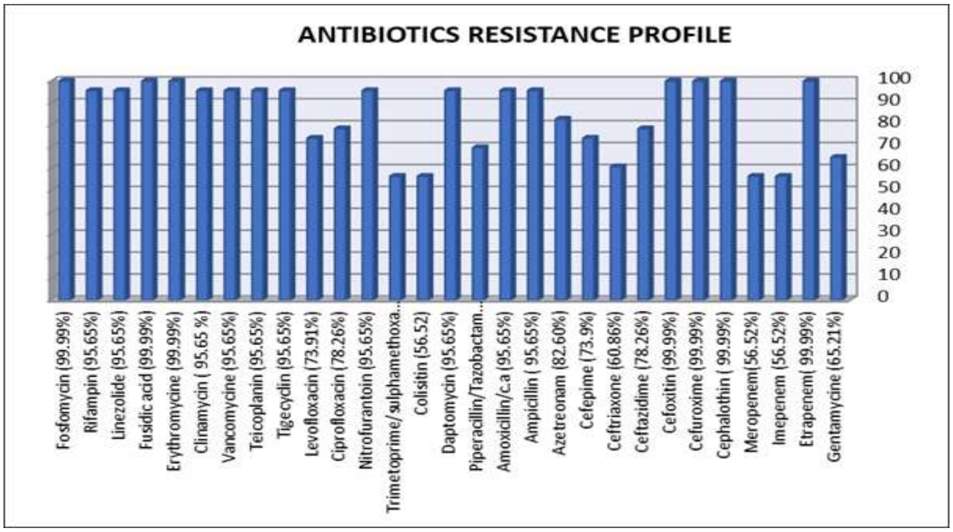

Figure (4) Presentation of resistance profile for a lot of antibiotics in ICU of COVID-19 isolation centers, The result shows Colistin (56.52%) as the most effective one and Fosfomycin (99.99%) most in-effective one**.**

DISCUSSION

In hospitals treating coronavirus diseases, multidrug-resistant gram-negative bacteria have recently been observed to spread quickly among patients. Multidrug-resistant A. baumannii, or MDR-Ab, is a sign of a serious underlying illness. Research on Carbapenem resistance in Libya has been conducted [13].

In our study, 8 out of 23 participants (34.8%) had crab. In contrast, 11 of 83 (13.3%) Gram-negative bacteria in a recent research from Libya were carbapenem-resistant variants [14]. Contrary to a prior study in Libya, where it was discovered that K. pneumoniae's carbapenem resistance predominated, we discovered that A. buamannii's prevalence was the primary carbapenem resistance, followed by K. pneumoniae and Cedecea [20].

With the exception of Colistin, A. baumannii isolates shown broad resistance to all various kinds of antibiotics in 2020, comparable with our investigation, which was quite similar [11]. The study also revealed that the prevalence of A. baumanni is more common in COVID-19 ICUs. The findings of a study conducted in Spain in 2022, which were comparable to those of ours in that all A.baumannii strains were multidrug-resistant (MDR) and solely responsive to Colistin, are also reported there [15].

In a study done in Sudan in 2022, samples of patients' sputum, blood, urine, wound swabs, central catheters, and tips were gathered. The study revealed that A. buamannii prevalence in the ICU was 100% resistant. While in our investigation, samples of A. buamnii from beds, tables, monitors, ventilators, restrooms, washing machines, and materials in the intensive care unit of COVID-19 patients in Libya were (83.3%) resistant to carbapenem [16].

In contrast to the Paris study during the outbreak, we discovered two samples of K. pneumoniae that were both ALERT + ESBL according to the Pheonix BD device, indicating that it is 100% resistant to all forms of antibiotics. When blood, airway, and rectal samples were collected using the polymerase chain reaction (PCR) method, 5/12 (58.33%) individuals had a k.pneomoniae resistance profile [17]. HAIs are frequently linked to the presence of contaminated environmental surfaces, and they are made worse by pathogens that produce spores or form biofilms that are difficult to disinfect.

Our findings indicated a high prevalence of bacteria and resistance to many antibiotics, which may be due to a variety of factors, the most likely of which is antibiotic misuse. We also discovered that 41% of the ICU centres we examined had poor sterilisation practises when compared to CDC guidelines. other studies indicate. Healthcare-associated pathogens with high morbidity and mortality, such as vancomycin-resistant Enterococci (VRE), methicillin-resistant Staph. aureus (MRSA), Clostridium difficile, and Candida. auris, are particularly problematic in the intensive care unit (ICU), where patients are frequently immunocompromised. Pathogens and HAIs can be transmitted in a variety of ways through the environment. They involve, among other things, medical tools, air ventilation systems, environmental components like beds and floors, water, healthcare professionals' hands, and transportable components like wheelchairs and shoes. The study that was presented suggests that floors may play a significant role in these factors [18].

Limitations

The number of samples collected was minimal, the patient's samples were not collected, and PCR was not used to identify the resistance-induced gene.

Strengths

The samples were collected during COVID-19's second waves, when death and morbidity rates were high, and Pheonix BD fresh updates were applied.

Conclusion

According to tests, there are a lot of resistant bacteria in the ICU of COVID-19, and this resistance may increase morbidity and mortality. Additionally, there are only a few antibiotics that can combat this particular strain of resistant bacteria.

References

1. Polly, M., et al., Impact of the COVID-19 pandemic on the incidence of multidrug-resistant bacterial infections in an acute care hospital in Brazil. American journal of infection control, 2022. **50**(1): p. 32-38.
2. O'Toole, R.F., The interface between COVID-19 and bacterial healthcare-associated infections. Clinical Microbiology and Infection, 2021. **27**(12): p. 1772-1776.
3. Lansbury, L., et al., Co-infections in people with COVID-19: a systematic review and meta-analysis. Journal of Infection, 2020. **81**(2): p. 266-275.
4. Meawed, T.E., et al., Bacterial and fungal ventilator associated pneumonia in critically ill COVID-19 patients during the second wave. Journal of Infection and Public Health, 2021. **14**(10): p. 1375-1380.
5. Liu, Y., et al., Outcomes of respiratory viral-bacterial co-infection in adult hospitalized patients. EClinicalMedicine, 2021. **37**: p. 100955.
6. Bakaletz, L.O., Viral–bacterial co-infections in the respiratory tract. Current opinion in microbiology, 2017. **35**: p. 30-35.
7. Singh, V., et al., SARS-CoV-2 respiratory co-infections: Incidence of viral and bacterial co-pathogens. International Journal of Infectious Diseases, 2021. **105**: p. 617-620.
8. Mirzaei, R., et al., Bacterial co-infections with SARS-CoV-2. IUBMB life, 2020. **72**(10): p. 2097-2111.
9. Elhadi, M., et al., Epidemiological and clinical presentations of hospitalized COVID-19 patients in Libya: An initial report from Africa. Travel Medicine and Infectious Disease, 2021. **42**: p. 102064.
10. Daw, M.A., A.H. El-Bouzedi, and M.O. Ahmed, How are countries prepared to combat the COVID-19 pandemic during the armed conflict? the case of Libya. Travel Medicine and Infectious Disease, 2021. **40**: p. 101977.
11. Sharifipour, E., et al., Evaluation of bacterial co-infections of the respiratory tract in COVID-19 patients admitted to ICU. BMC infectious diseases, 2020. 20(1): p. 1-7.
12. Croxatto, A., et al., Evaluation of the BD Phoenix™ CPO Detect Test for the detection of carbapenemase producers. Clinical Microbiology and Infection, 2020. 26(5): p. 644. e9-644. e15.
13. Gargoum, H.M., et al., Prevalence of meropenem and imipenem resistance in gram-negative uropathogens in ibn sina clinic in Benghazi-Libya. Libyan Journal of Medical Sciences, 2021. **5**(4): p. 148.
14. Slimene, K., et al., High carbapenem resistance caused by VIM and NDM enzymes and OprD alteration in nonfermenter bacteria isolated from a Libyan hospital. Microbial Drug Resistance, 2021. **27**(11): p. 1546-1554.
15. Nebreda-Mayoral, T., et al., Bacterial/fungal infection in hospitalized patients with COVID-19 in a tertiary hospital in the Community of Castilla y León, Spain. Enfermedades infecciosas y microbiologia clinica (English ed.), 2022. **40**(4): p. 158-165.
16. Ibrahim, S.M., et al., Molecular Detection of Carbapenemase Genes in Extensive Drug Resistant Acinetobacter baumannii Clinical Isolates from ICU Patients, Khartoum. Open Journal of Medical Microbiology, 2022. **12**(1): p. 38-48.
17. Amarsy, R., et al., Outbreak of NDM-1-producing Klebsiella pneumoniae in the intensive care unit during the COVID-19 pandemic: Another nightmare. American Journal of Infection Control, 2021. **49**(10): p. 1324-1326.
18. Christenson, E.C., et al., Evidence Map and Systematic Review of Disinfection Efficacy on Environmental Surfaces in Healthcare Facilities. International journal of environmental research and public health, 2021. **18**(21): p. 11100.