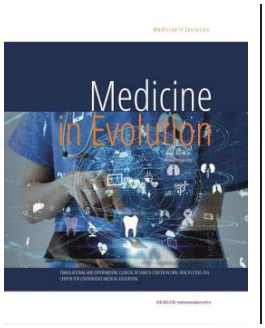
Nosocomial infections in critically ill Covid-19 patients



Olariu T.[1], Bran L.R.[3], Precup C.[4], Toma I.[5], Sandor F.M.[6], Toma V.[7], Popovici R.A.[8], Olariu I.[2]

[1]Department of general medicine, Faculty of Medicine, "Vasile Goldiş" Western University of Arad Department of Dentistry, Faculty of Dentistry, Faculty of Medicine, "Vasile Goldiş" Western University of Arad
[2]Department of Dentistry, Faculty of Dentistry, Faculty of Medicine "Vasile Goldiş" Western University of Arad
[3]Arad College of Nursing
[4]Anatomy and Forensic Medicine Department, Faculty of Medicine "Vasile Goldis" Western University of Arad, Romania
[5]Department XIV – microbiology, Faculty of Medicine, Victor Babes University of Medicine and Pharmacy Timisoara
[6]Anatomy and Forensic Medicine Department, Faculty of Medicine "Vasile Goldis" Western University of Arad
[7]Department of training in residence and postgraduate courses, Faculty of Medicine "Vasile Goldiş" Western University of Arad
[8]Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy Timisoara

Correspondence to:
Name: Toma Ioana
Address: No. 2 Eftimie Murgu Square, Timişoara
Phone: +40 722633206
E-mail address: ioana_toma14@yahoo.ro

Abstract

Nosocomial infections follow the medical practice as a shadow, being present in medical systems worldwide, even in high-performance ones, being a public health problem because it is due to germs resistant to antimicrobials. In the critically ill Covid 19 patient, assisted in the intensive care units, where is subjected to invasive procedures, nosocomials become life-threatening. In 2021, 586 severe and critical Covid_19 cases were treated, the prevalence of nosocomiality being 10.23%. At a severe Covid 19 fatality rate was 70.72%, and reached 88.33% in health-care associated infections. *Acinetobacter baumanii* and *Klebsiella pneumoniae*, resistant to cephalosporins, aminoglycosides, quinolones, carbapenems and even polymyxin b, were frequently involved, identified especially in tracheobronchial secretions, Odds ratio for antimicrobial resistance being 4.3929 compared to other specimens (P = 0.015). It turns out that empirical antibiotic therapy, asepsis and antisepsis in intensive care need to be reconsidered.

Keywords: nosocomial infections, antimicrobial resistance, Covid 19

INTRODUCTION

Nosocomial infections, officially called Healthcare-associated infections (HAI) [1], accompany as a shadow the medical practice worldwide, being usually generated by multidrug resistant germs (MDR) with hospital habitat, are constantly present in the medical departments, especially in those that involve numerous invasive procedures; they often have unfavorable developments, especially in elderly, immunocompromised patients with comorbidities or other pre-existing infections. In addition, nosocomial infections become life-threatening if antimicrobial-resistant germs are involved. Antimicrobial resistance (AMR) is a common occurrence in medical systems, and multidrug resistance (MDR), which is AMR in over 3 classes of antimicrobials, is a public health issue. Severe Covid_19 infections are treated in intensive care units (ICUs) and can progress critically rapidly, especially if they are associated with a superbug infection with MDR germs.

Aim and objectives

We identified HAI cases in Covid_19 patients in ICU and the MDR profile of isolates from specimens, to assess the circulation of in-hospital germs.

MATERIAL AND METHODS

In eight months of 2021 (01.01-07.06.2021 and 18.09-31.12.2021) 70 germs were isolated from 60 Covid_19 patients defined as HAI, in the ICU 1 departmentof the Arad County Hospital, where were assisted a total of 586 Covid_19 cases. Patient demographics, specimen type, and germ MDR attributes were analyzed with Microsoft Excel, MedCalc, and IBM SPSS Statistics 24. Statistical analysis goal was to determine the frequency of isolated germs in ICU 1 versus other sections using Pareto charts and the association of variables.

RESULTS

The data were analyzed in the context in which 3662 germs were isolated, in 2021, in the entire hospital unit, of which 47% displayed MDR characters (n = 1718). Specimens from sections other than ICU 1 showed MDR in 40.46% of cases. In ICU 1, MDR reached 62%. In HAI from ICU 1 MDR reached 67.14%, table 1 and image 1.

Table 1. Numerical and percentage distribution of MDR germs in the hospital and ICU 1

Year 2021	nonMDR	MDR	Total	%MDR
Hospital, all units	1934	1718	3652	47.04
Other dept. but ICU1	1510	1026	2536	40.46
ICU 1	424	692	1116	62.01
HAI ICU 1	23	47	70	67.14

Legend: HAI= Healthcare-associated infections, ICU 1=Intensive Care Unit 1, MDR= multidrug resistant

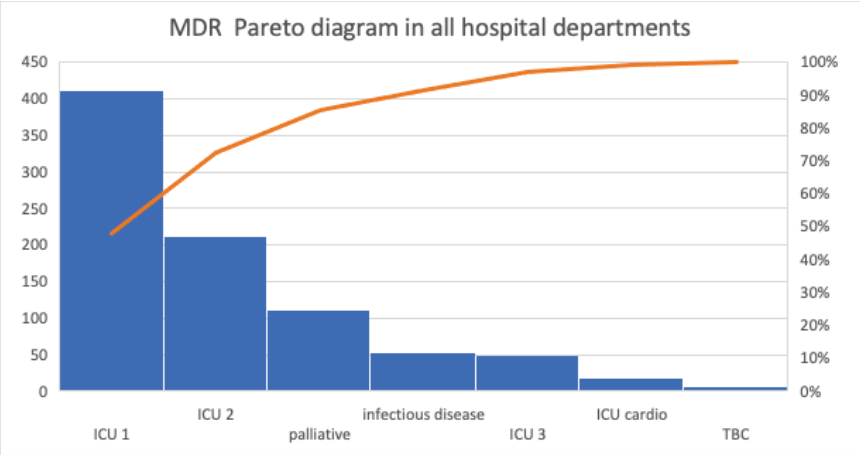


Figure 1. Multidrug resistance, distribution by hospital departments

Gram-negative (GNB) and Gram-positive (GPB) bacteria were relatively balanced in ICUs versus other departments, Table 2, but the MDR percentage of GNB in ICU 1 is significantly increased for *Acinetobacter baumanii, A. calcoaceticus* and *Klebsiella pneumoniae*, Table 3 and image 2.

Table 2. Percentage distribution of total GNB in ICUs versus other departments

item	GNB	GPB	total	%GNB
Other departments	1719	814	2533	67.86
ICUs	747	372	1119	66.75

Legend: ICUs= Intensive care units, GNB=Gram negative bacteria, GPB=Gram positive bacteria

Table 3. Multidrug resistance total and percentage for GNB in ICUs and other departments

Bacteria	MDR total	MDR_ICUs	% MDR_ICUs
Acinetobacter baumanii,, A.calcoaceticus	223	188	84.30
Klebsiella pneumoniae	301	149	49.50
Proteus penneri, P. rettgeri	222	60	27.03
Morganella morganii	42	9	21.43
Serratia marcescens	29	4	13.79

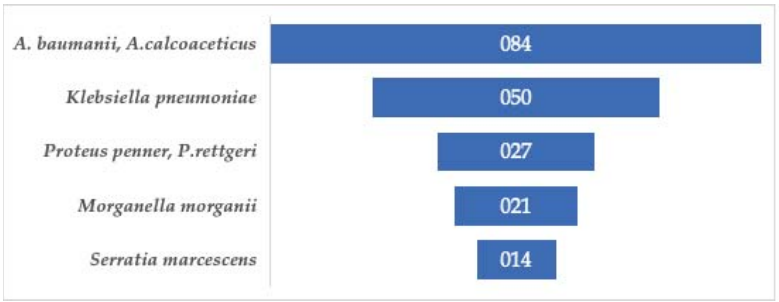


Figure 2. Percentage of Gram-negative bacteria in intensive care units

Average age of HAIs patients was 69 years, extreme 44-85 years. Gender ratio F: M = 1.22. HAI prevalence in Covid_19 patient= 10.23%. In more than half of the HAI cases, Gram-negative bacteria were isolated (n = 43)), especially *Acinetobacter baumanii* (40%) and *Klebsiella pneumoniae* (11.6%), with AMR reaching 79%. Gram-positive GNP germs (n = 27) were represented by enterococci (n = 16) and staphylococci (n = 11), with AMR 92.85%, especially in tracheobronchial specimens and blood cultures.

Table 4. Distribution of antimicrobial resistant bacteria

Bacteria	non AMR	AMR	%AMR	total	%total
Acinetobacter baumanii	6	22	79	28	40
Aeromonas veronii	0	1	100	1	1.4
E coli	1	1	50	2	2.9
Enterococcus faecalis	7	0	0	7	10
Enterococcus faecium	0	4	100	4	5.7
Enterococcus spp	4	1	25	4	5.7
Klebsiella oxytoca	0	1	100	1	1.4
Klebsiella pneumoniae	0	8	100	8	11.4
Pseudomonas aeruginosa	0	1	100	1	1.4
Staphylococcus aureus	3	1	25	4	5.7
Staphylococcus epidermidis	0	1	100	1	1.4
Staphylococcus haemolyticus	0	6	100	6	8.6
Stenotrophomonas maltophilia	2	0	0	2	2.9
Total	23	47	67	70	100

The most frequent specimens for MDR germs in HAI were tracheobronchial secretions, Table 5. The odds ratio (OR) for MDR in tracheobronchial specimens is 4.3929 (P = 0.0155) compared to other specimens, Table 6. Tracheobronchial specimens are most commonly positive for SARS_CoV-2 in lower respiratory tract infections in adult cases, but in children the situation is in negative concordance with nasopharyngeal secretions, say some researchers [2].

Table 5. Distribution of antimicrobial-resistant bacteria in specimens

Ítem	Non AMR	AMR	total
Blood	2	3	5
Wound	1	1	2
Pus	1	0	1
pharyngeal exudate	5	0	5
tracheobronchial secretion	14	41	55
Urine	0	2	2
Total	23	47	70

Table 6. Odds ratio AMR in tracheobronchial secretions

Odds ratio AMR tracheobronchial secretion versus other specimens	4.3929
95% CI	1.3257 to 14.5557
z statistic	2.421
Significance level	P = 0.0155

Antibiotic resistance for *Acinetobacter baumanii* and *Klebsiella pneumoniae* has been demonstrated for cephalosporins, aminoglycosides, quinolones, carbapenems and even polymyxin b, these two germs manifested this tendency decades ago [3], Table 7.

Table 7. Antibiotic resistance for *Acinetobacter baumanii* and *Klebsiella pneumoniae*

GNB	*Acinetobacter baumanii*	*Klebsiella pneumoniae*
total	28	8
cephalosporins	4	8
aminoglycosides	28	7
quinolones	28	5
carbapenems	28	8
polymyxin b	2	3

Legend: GNB=Gram-negative bacteria

The Covid_19 fatality rate is 70.72% and reaches 88.33% in HAI with Covid_ 19 (n = 53). Comorbidities due to diabetes, hypertension and obesity (n = 44) are risk factors for death (n = 38), the fatality rate in patients with these pre-existing conditions being 86.36%. Deaths in HAIs cases with MDR is n = 37 of n = 53 (69.81%).

DISCUSSIONS

Nosocomial infections in ICUs are much more common than in other hospital departments worldwide, because patients are in critical condition, requiring invasive interventions and the risk of being inseminated with resistant germs is much higher. The literature is not very abundant in articles investigating whether SARS CoV 2 has anything to do with the vulnerability of these patients to associated infections, opinions being divided; in general COVID-19 patients seem to be more predisposed to catheter-associated urinary tract infection despite a higher proportion of non-COVID-19 patients having urinary catheters, which is not valid in ICUs [4]. On the other hand, hospital care did not benefit from new hospitals, specially dedicated to Covid 19 patients, hospitalization being carried out in the same congested conditions and sometimes deficient in human resources and materials, which maintains the risks of associated infections.

Although the years 2020-2021 were mainly dedicated to the Covid 19 patient, MDR bacteria continued to be present at an increased rate for those resistant to cephalosporins, aminoglycosides, quinolones, carbapenems and even polymyxins b. This may be due to the empirical use of antimicrobials and requires dedicated studies. Pan American Health Organization has a valuable study on this issue (Document Number)

PAHO/CDE/AMR/COVID-19/22-0006), which we quote in full, considering it covering also in terms of conclusions: "The COVID-19 pandemic has fueled the ongoing antimicrobial resistance (AMR) global crisis due to the increase in the use of antibiotics to treat COVID-19 patients, disruptions to infection prevention and control practices in overwhelmed health systems, and diversion of human and financial resources away from monitoring and responding to AMR threats. Moreover, AMR is likely to have caused more COVID-19 deaths, as secondary bacterial infections can worsen the outcome of severe and critical COVID-19 illness. Therefore, it is more urgent than ever to prioritize efforts towards AMR containment and support countries to improve the detection, characterization and rapid response to emerging AMR. This policy brief compiles strategic information for policy and decision makers to continue prioritizing the AMR response and implementation of developed national action plans on AMR while ensuring that adequate resources are allocated to the latter. It also encourages countries to measure and monitor the impact of the COVID-19 pandemic on AMR epidemiology in the region." [5].

Nosocomial infections in intensive care units were due to germs with high rates of resistance over 67%. The association of pandemic viral infection with multidrug-resistant bacteria in nosocomial infections mainly affects Covid_19 patients over 65 years of age, whose critical evolution requires intubation and assisted ventilation, which are perfect conditions for the development of "supebugs" in tracheobronchial secretions.

CONCLUSIONS

Antibiotic resistance of isolates from hospital-associated infections increases the risk of death, which means that empirical antibiotic therapy, asepsis, and antisepsis in ICUs need to be reconsidered. Across the EU, 25,000 people die each year from drug resistant infections [6], and prognosis look likea worldwide, this number will increase to 10 million by 2050[7].

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