The prevalence of secondary bacterial infection among hospitalized patients with covid-19 in Basra Iraq

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Abstract

Purpose: sever ill (COVID-19) patients need admission to hospital leads to an increased risk of secondary bacterial infections. our study considers reports on the predominance of Secondary bacterial infection (SIs) profiles and clinical outcomes of Covid-19 hospitalized patients in Iraq.
Patients and strategies: this is a cross-sectional investigation, two healing clinics in Iraqi Basra were used to study secondary bacterial infections in covid-19 patients between September and November 2021.

Demographic characteristics of microorganisms, antimicrobial resistance, and clinical outcomes of the admitted COVID-19 patients were gathered.
Results: _ A total of 33 patients were admitted, (19\33, 57.6%) patients created a secondary bacterial infection. The mortality rate among patients who acquired secondary infections was 21% against overall death of 12.12% in total admitted COVID-19 patients. Gram-negative bacteria are the most common microorganism 52.6%, Klebsiella pneumonia (31.6%) was the transcendent pathogen, followed by streptococcus pneumonia (26.32%). High third-generation cephalosporin resistance was seen in Klebsiella pneumonia (83%), followed by aminoglycoside at 33% and carbapenem resistance at 16.7%.
Conclusion: _ The prevalence of Gram-negative pathogens in COVID-19 patients related to the tall level of bacterial resistance to antimicrobials may be a caution found. Patients with secondary bacterial infections in Covid-19 had a significant mortality rate. leads to an important point to improve infection control practice to spare patients' lives and avoid drug-resistant infection.

INTRODUCTION

In December 2021, Iraq has seen 2,090,844 infections and death 24,074, with a mortality rate of 0.012% (2). secondary bacterial and fungal infections can increase admission to the intensive care unit and increase death.

Releases of particular cytokines such as IL 10, IL 6, IL 17, and IL 23 reduce macrophage cell activity by killing CD 4+ and CD 8+ T cells., plus another certain phagocyte-the independent mechanism by a virus that facilitates secondary bacterial infection.

Secondary bacterial infection in patients with covid-19 hurts health outcomes and occurs in up to 15% of hospitalized patients.

Several recommendations suggested the utilization of empiric anti-microbials in extremely sick patients.

The prevalence of secondary bacterial infection in covid-19 Iraqi patients is not very well understood.

This study aimed to determine the prevalence of secondary bacterial infection, most commonly microorganisms, the antimicrobial-resistant profile of secondary bacterial infection, and Clinical outcomes among Iraqi patients admitted to the Covid-19 hospital (1).

The primary goal of this research is to optimize antibiotic use in hospitalized covid-19 patients.

Patients and method:

All covid-19 diagnosed patients' microbiological database records in AL-Sadder teaching hospital, AL-Barsha teaching hospital in Iraq from September to November 2021, patients who have secondary bacterial infection were collected and analyzed.

Study design:

We analyzed a cross-section of healing center covid-19 patients from two Iraqi hospitals from September to November 2021, statistic points of interest of conceded patients, age, zone, presence of incessant illness, renal function, oxygen saturable, date of admission, antibiotics administered, and duration, take remdesivir vial or not, length of healing center remain and patient outcome.

Pathogenic identify and antimicrobial susceptibility testing (AST):

Respiratory sputum is collected and processed.

The pathogen identification by gram stain, vatic ID, and AST, isolation with resistance to at least one expert in three or more different classes of anti-microbials (1- penicillin-macrolide-tetracycline: 2- cephalosporin-monobactam-

Penicillin was classified as multidrug-resistant (MDR). While isolation has resistant to all categories of antibiotics except two or fewer group

(1-cephalosporin- penicillin -carbapenem-fluroquinolone: 2-cephalosprrin- penicillin-aminoglycoside- tetracycline- monobactam: 3-cephalosporin- penicillin- tetracycline: 4-pencillin- fluroquinolone- macrolide-rifampicin- trimethoprim\sulfamethoxazole: 5- cephalosporin- penicillin- carbapenem-monobactam- aminoglycoside-fluroquinolone) were classified as extreme drug resistant (XDR)

Antibiotics utilization:

Each hospitalized patient was prescribed antibiotics were assumed.

Information investigation:

For the investigation, all data was gathered in Microsoft Excel.

The number of patients is represented by n.

The age of the patient was given as a mean with a standard deviation (SD).

The p-value was deemed factually significant.

Result:

A total of 33 COVID-19 patients Howes admitted to the two healing centers. between September 2021 and November 2021.

Total 33 patients the mean age was 54± 13 (SD) years (range18-74 years); 19 (57.58%) were female and 14 (42.4%) were males, (69.7%) have chronic disease, diabetic was included (39.4%), hypertension was (39.4%), CVA (6.1%), IHD (15.2%), cancer (3.1%), SCA (9.1%), asthma (9.1%), CKD (6.1%). (93.9%) how take remdesivir vial. (18.2%) of patients on CPAP, (81.8%) of patients on HFNC, lung involvement is more than 50% which occurs in 70% of patients.

Statistic characteristics of all patients are summarized in Table 1

Secondary infections have been confirmed in some patients, who were inwards at this time.

Out of the overall patients having affirmed diagnosis of secondary bacterial infection, a larger part (57.6%) of patients obtained secondary bacterial infections within the healing center, so Mortality among COVID-19 patients was 12.12%, as included in table 1.

Table 1 Statistic and clinical characteristics of COVID-19 hospitalized cases between September and October 2022.

(n = 33)	N (%), SD
gender	
male	14 (42.4%)
female	19 (57.58%)
mean age	54± 13 (SD)
comorbidities	23 (69.7%)
Diabetics	13 (39.4%)
Hypertension	13 (39.4%)
CVA	2 (6.1%)
IHD	5 (15.2%)
Asthma	3 (9.1%)
Cancer	1 (3.1%)
SCA	3 (9.1)
CKD	2 (6.1%)
Lung=>50% (n total CT scan 20)	14 (70%)
HFNC	27 (81.8%)
CPAP	6 (18.2%)
take Remdesivir	31 (93.9%)
infection	19 (57.6%)
gram negative	10 (52.6%)
gram positive	9 (47.4%)
overall mortality	4 (12.12%)

Etiology of the Secondary Infections

Out of an add up to of 33 tests collected for microbiological culture, 57.6% of samples were positive for bacterial infection, while 42.4%were normal flora. The total samples tested were sputum.

Gram-negative microbes were the overwhelming pathogen (52.6%, 10/19), most commonly separated pathogens were Klebsiella pneumoniae (6\19,31.6%), Pseudomonas aeruginosa (2\19,10.52%), and E. col (2\19,10.52%). Gram-positive bacteria were included (9\19,47.4%), from this methicillin-resistant Staphylococcus aureus (MRSA) was separated in (3\19,15.8%) of patients, streptococcus pneumonia (5\19,26.32%), as shown in table 2, figure 1 and 2

Table 2: Bacterial Etiology and Dissemination at a Site-Specific for Gram-Negative and Gram-Positive Bacteria

Bacteria	N %
Klebsiella pneumonia	6\19 (31.6%)
Pseudomonas aeruginosa	2\19 (10.52%)
E. coli	2\19 (10.52%)
Staphylococcus aureus	3\19 (15.8%)
Streptococcus pneumonia	5\19 (26.32%)
Enterobacter cloacae	1\19 (5.26%)

Figure 1 Dissemination of bacterial isolated from COVID-19 patients

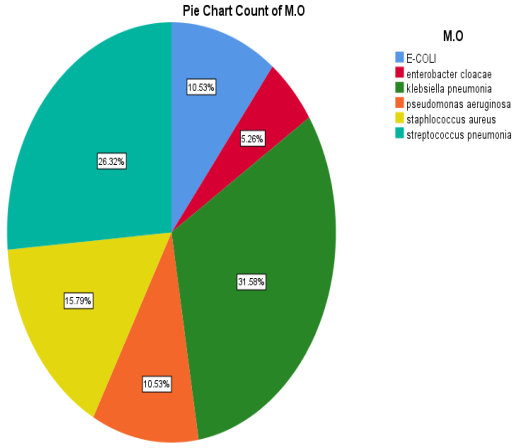
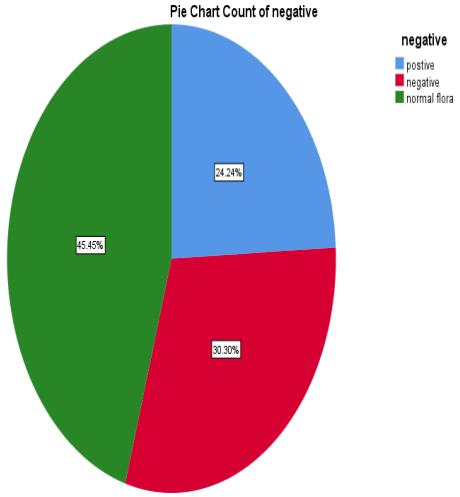


Figure 2 distribution of gram-negative, positive and normal flora in covid-19 patients



Medicate Resistance Profile of Confined Pathogens

Among all patients admitted to the hospital with confirmed bacterial infection,

send for microbiological tests, only 14 patients made AST, from this, 50% (7/14) were infected with MDROs, and (14.3%, 2\14) were infected with extreme drug resistance.

K. pneumoniae isolates showed a high level of resistance to third-generation cephalosporins (83%), fluoroquinolones

(16.7%), aminoglycoside 33.3%, and β-lactam-β-lactamase inhibitor combinations, piperacillin/ tazobactam (16.7%). Carbapenems resistance in K. pneumoniae was 16.7%, as shown in figure 3.

Overall, (2\10,20%) of Gram-negative bacteria were resistant to carbapenems.

As demonstrated in figure 4, all strains of Staphylococcus aureus and Enterococcus spp. were susceptible to vancomycin.

(19\33,57.6%) of conceded Patients with COVID-19 had bacterial infections.

Figure (3) AB resistant profile for Klebsiella pneumonia.

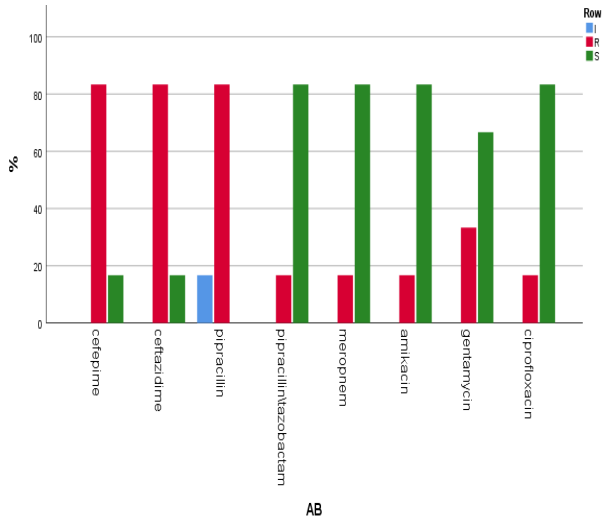
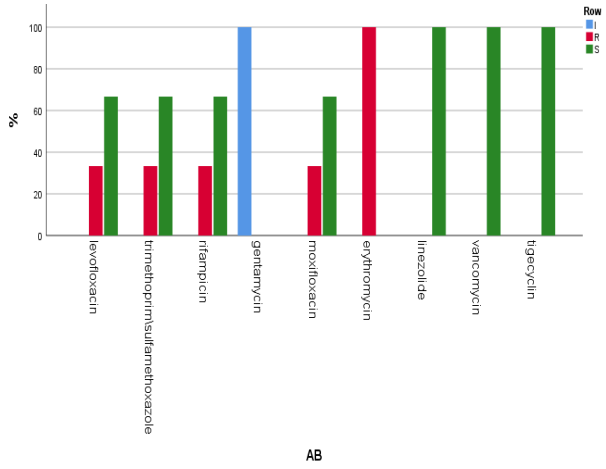


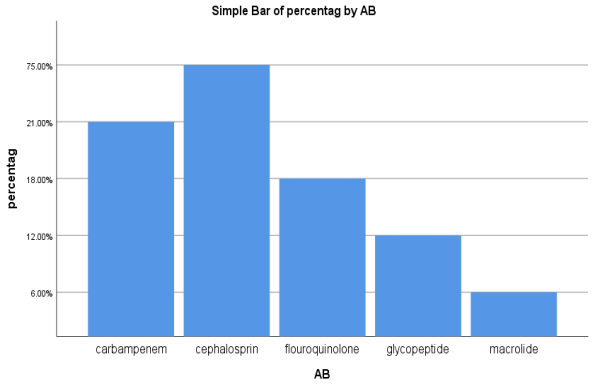
Figure (4) AB resistant profile for staphylococcus aureus



Antibiotic Usage

Third-generation cephalosporin (25\33,75.7%), β-lactam-βlactamase inhibitors like carbapenems (7\33, 21.2%), fluoroquinolone (6\33, 18.2%), macrolide (2\33, 6.1%) were the foremost commonly prescribed anti-microbials in our consider gather. Vancomycin was prescribed to (4\33, 12.1%) of patients, as shown in figure 5.

Figure 5 percentage of AB used in covid-19 patients



Patient Outcomes Overall mortality is a concern

Mortality among COVID-19 patients with Secondary bacterial infection was 21%.

prevalence of secondary bacterial infection in females was (3\19,15.8%) while in males (1\14,7.1%), Table 3 shows that mortality following the occurrence of SIs was 25% (3/12) in females patients and 14.2% (1/7) in male patients. Among the patients who died with SIs, (1\12, 8%) had Gram-negative infections, and (3\7,42.8%) had Gram-positive infections.

Mortality was very high among those with secondary bacterial infection (21%) compared with those who don't have infection was 0%. WBC accounts for more than 11,000 in gram-negative infections was (2\10, 20%), in gram-positive infections was (1\9,11.1%).

While normal flora show (6\14,42.9%), secondary bacterial infection leads to an increased duration of hospital stay of more than 10 days (11\19, 57.9%), as shown in Tables 3 and 4.

Table 3: patients' outcomes in male and female

	female	male
Secondary bacterial infection	3\19 (15.8%)	1\14 (7.1%)
Mortality following Sis	3\12 (25%)	1\7 (14.2%)

Table 4: COVID-19 Hospitalized Patients: Characteristics and Outcomes

Outcome	Patients have Sis n % Gram-negative	Gram-positive n %	Normal flora n %
mortality	1\12 (8.33%)	3\7 (42.8%)	0 (0%)
Mean age	55	59	51
WBC account>11.000	2\10 (20%)	1\9 (11.1%)	6\14 (42.9%)
comorbidity	7\10 (70%)	9\9 (100%)	9\14 (64.2%)
Lung involvement >50%	5\10 (50%)	2\2 (100%)	7\8 (87.5%)

Discussion:

We found in our study overall predominance of secondary bacterial infection in COVID-19 patients is 57.6%, secondary bacterial infection study found similar occur in Saudi Arabia at 53%(3), while in another study in India, Iran secondary bacterial infection was 3.6%(4) and 11.9%(5) respectively. The most common microorganism was Gram-negative pathogens in these patients. 33 respiratory sputa in COVID-19 patients, these were the most common sites of secondary infection. Gram-negative organisms dominated respiratory infections, with Gram-positive germs isolated from sputum to a key level. It is commonly known that the majority of hospitalized extreme COVID-19 patients are given steroids and undergo invasive procedures. and in some cases, have a delayed healing center remain, rendering them helpless to HAIs. In these patients, gram-negative organisms can be acquired from obtrusive device-associated infections, mechanical ventilation, and central venous catheter insertion during hospitalization. During

In comparing, the overall death rates in COVID-19 patients admitted to hospitals, death was very high among those with secondary bacterial infection (21%) versus the overall mortality rate was 12.12% in hospitalized COVID-19 patients.

while another study in India found a higher rate of death in covid-19 patients was 54% compared with the by and large mortality in hospitalized covid-19 patients was 11.6%(4). another study in Saudi Arabia found that a higher mortality rate in secondary bacterial infection was 61% compared with general mortality in hospitalized covid-19 patients was 13% (3). In Iran, the death rate among COVID-19 patients who obtained bacterial infections was 83%, whereas the mortality rate among patients without bacterial superinfections was 32.1% (5).

Out of 33 patients with secondary bacterial infection, (23\33, 69.7%) patients have comorbid illnesses, with 39.4 % (13\33) having diabetes and (13\33,39.4%) having hypertension. We found no significant difference in death rates between males and

females during our analysis, implying that sex was not a risk factor for death among Iraqi Sis patients., this result was smellier in India that found no significant difference in mortality between males and females in covid-19 patients have Sis(4). Studies from another country reported that the male gender is a risk factor for disease severity and death (6). Gram-negative infections were responsible for 8.33 % of the SIs deaths, whereas Gram-positive pathogens were responsible for 42.8 %.

Other countries found that 72% 0f death was attributable to gram-negative pathogen and 11% due to gram-positive pathogen(4). Gram-negative pathogens (K. pneumonia) were the transcendent pathogens of Sis at 32%, the rate of multidrug-resistance was very high in third-generation cephalosporin at 83%, for carbapenem was 16.7%, while another country (k. pneumonia) is the most common gram-negative pathogen, carbapenem is the most common multidrug-resistant 83%(4). From 19 isolations of secondary bacterial infections in COVID19 patients, extremely drug-resistant (XDR) was 14.3%, and MDR was 50% of the isolate. This result is similar in India, where Klebsiella pneumonia is the most common isolated pathogen with high multidrug-resistant (4)

In Saudi Arabia, among all other bacterial isolates, K. pneumoniae was the most frequently reported organism, followed by A. Baumann isolates (57.69 % and 11.5 %, respectively) (3). Iran found that K. Pneumonia was the most common isolated pathogen at 13%, followed by A. Baumann at 10%(5).

Pseudomonas aeruginosa (20%), E-coli (20%) were also gram-negative pathogens isolated from respiratory infections.

Third-generation-cephalosporin and carbapenem over-use as an empirical treatment can worsen resistance to these agents.

Lessening such anti-microbial determination weight ought to be direly considered to anticipate the determination of safe isolates. High separation rates also point to a source near the patient, implying a lack of hand hygiene and the necessity to follow device-related bundle care practices as contributing reasons.

Because the majority of secondary infections in our study were nosocomial in origin, and because they were caused by highly drug-resistant organisms, it emphasized a lack of infection control practices and antimicrobial overuse. Gloves are known to be colonized by germs and cause cross-contamination, therefore hand hygiene should be done later and after putting on gloves, and gloves should be removed after a single patient's aftercare. Sending suitable cultures can offer assistance in diminishing superfluous anti-microbial medicines and driving to way better results for control of antimicrobial resistance amid this widespread.

Limitation:

They are a few impediments to our study: _

1- Few samples size

2- Few vatic kits

3- Hospitals may have different protocols for sending culture.

Despite these limitations, according to our knowledge, this is the primary study that determines the prevalence of secondary bacterial infections among COVID-19 patients in Basra city- Iraq, and it highlights the need to improve infection control techniques in clinics and rationalize antimicrobial selection.

Conclusion:

In conclusion, this can be the primary study to assess secondary bacterial infection in covid-

19 patients in Basra city- Iraq, with a tall predominance of secondary bacterial infection among patients with COVID-19 (57.6%) between 1 September and 1 November 2022. Bacterial infection in our research increments the mortality rate. Gram-negative microbes were the foremost common organism isolated from covid-19 patients, which also show up high resistance to antibiotics.

As a result, more research is needed to determine the impact of antimicrobial-resistant bacteria on COVID-19 patients' clinical outcomes.

Furthermore, because our study's sample size is small, additional research is needed to include a wide population from several Iraqi governorates to assess the prevalence of secondary bacterial infection in covid-19 patients.

Abbreviations

AMR stands for antimicrobial resistance; AST stands for antimicrobial susceptibility test; SD stands for standard deviation; SIs stands for secondary infections; CKD stands for chronic kidney disease; SCA stands for sickle cell anemia; CVA stands for a cerebral vascular accident; CPAP stands for continuous positive airway pressure; HFNC stands for high flow nasal cannula; WBC stands for whole blood count; MDR stands for multidrug-resistant; EXD stands for extreme drug-resistant

Reference

Vijay S, Bansal N, Rao BK, Veeraraghavan B, Rodrigues C, Wattal C, et al. Secondary Infections in Hospitalized COVID-19 Patients: Indian Experience . Infection and Drug Resistance [Internet]. 2021 May 24 [cited 2021 Dec 17];14:1893–903. Available from: https://www.dovepress.com/secondary-infections-in-hospitalized-covid-19-patients-indian-experien-peer-reviewed-fulltext-article-IDR

كورونا في العراق [Internet]. [cited 2021 Dec 20]. Available from: https://stayhome.iq/map

Alqahtani A, Alamer E, Mir M, Alasmari A, Alshahrani MM, Asiri M, et al. Bacterial Coinfections Increase Mortality of Severely Ill COVID-19 Patients in Saudi Arabia. International Journal of Environmental Research and Public Health. 2022 Feb 1;19(4).

Vijay S, Bansal N, Rao BK, Veeraraghavan B, Rodrigues C, Wattal C, et al. Secondary infections in hospitalized COVID-19 patients: Indian experience. Infection and Drug Resistance. 2021;14:1893–903.

Pourajam S, Kalantari E, Talebzadeh H, Mellali H, Sami R, Soltaninejad F, et al. Secondary Bacterial Infection and Clinical Characteristics in Patients With COVID-19 Admitted to Two Intensive Care Units of an Academic Hospital in Iran During the First Wave of the Pandemic. Frontiers in Cellular and Infection Microbiology [Internet]. 2022 Feb 23 [cited 2022 Mar 31];0:141. Available from: https://www.frontiersin.org/articles/10.3389/fcimb.2022.784130/full

Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, et al. Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. Frontiers in Public Health [Internet]. 2020 Apr 29 [cited 2022 Apr 1];8:152. Available from: /pmc/articles/PMC7201103/