

Study on the incidence of nosocomial infections in COVID19 patients in a tertiary care Hospital.

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Running title: Incidence of nosocomial infections in COVID19 patients.

Abstract:

Aim: To know the incidence of nosocomial infections in the COVID19 patients admitted in the hospital that may help in the selection of the suitable antibiotics follow the better management of the COVID 19 patients. **Materials and methods:** A total of 1534 COVID 19 patients were included in the study. The respiratory, blood, urinary and pus from surgical site samples were collected to find the incidence of the bacterial infection in hospitalized COVID 19 patients. The samples were collected 48 hours after the admission of the patient in to the hospital. **Results:** The incidence of the nosocomial infections in the COVID 19 patients was 30.24%. The Staphylococcus aureus, Klebsiella pneumoniae, and Coagulase negative staphylococci were more prevalent bacteria causing secondary infection in COVID 19 patients. E. coli was predominantly seen in Urine samples. **Conclusion:** The rate of bacterial infections in the COVID 19 patients was observed as high and need to be considered to take precaution to minimize the spread of nosocomial infections. The incidence of the bacteria reported in this study may be of great value in the management of the COVID 19 patients and may also help to reduce the mortality and morbidity.

Keywords: COVID19, Nosocomial infections, Staphylococcus aureus, Klebsiella pneumoniae,

Introduction:

COVID 19 is a respiratory disease caused by SARS CoV 2 a novel corona virus. The first case of reported in the Wuhan a city in China in December 2019.¹ Later it had spread rapidly all over the world and the world health organization declared the COVID19 as pandemic in March 2020.² Hospital-acquired infections or nosocomial infections are the infections which were typically not present or might be incubating at the time of hospital admission. These infections are usually acquired after hospitalization and manifest 48 hours after admission to the hospital. The most common nosocomial infections are central line-associated bloodstream infections (CLABSI), peripheral line-associated blood stream infections (PLABSI), Surgical site infections (SSI), Catheter-associated urinary tract infections (CAUTI), and Ventilator-associated Pneumonia (VAP).³ The exhibiting variants created a pandemic and to be prone for

high

risk evaluations leading to mortality and morbidity. The COVID-19 positive patients confirmed with RTPCR symptomized being admitted in intensive care units and COVID wards of the hospitals with a prolonged stay for recovery are at a higher risk of acquiring nosocomial or hospital acquired infections. This may be due to the inability of the host to remove the bacterial pathogen that releases specific cytokines like interleukines, reduce the function of certain cells like dendritic cells, macrophages, natural killer cells, CD4+ and CD8+ T cells and also reduces the phagocyte-independent mechanisms by which virus infection may facilitate secondary bacterial infection.^{4,5} Thus, the present study was designed to find the incidence of hospital acquired infections in the COVID-19 patients.

Materials and methods:

It is a descriptive study conducted in a tertiary care hospital to find the incidence of healthcare associated infections in COVID-19 patients from March 2020 to July 2021. A total of 1534 COVID-19 positive adult patients (1029 male and 505 female) admitted in the hospital was included in the study. The age and the gender were noted. The samples were collected from the patients 48 hours after admission into the hospital.

The hospital acquired bacterial infections were Ventilator associated pneumonia (VAP), Central line associated bloodstream infections (CLABSI), Peripheral line associated blood stream infections (PLABSI), Catheter associated urinary tract infection (CAUTI), and surgical site infections (SSI). The samples were collected from various sites that include nasal and throat swabs, sputum and pleural fluid for respiratory infections (VAP), blood for CLABSI and PLABSI infections, urine samples CAUTI and pus for surgical site infections. The specimen collection was done by taking nasal swabs, throat swabs, pleural fluid, sputum, blood, catheters, urine collection and pus from the surgical site. All the samples were processed for the culture of the specimens. The pathogens were identified and observations were noted.

Results:

The patients were classified into 4 groups based on the age. Group A: 30 to 40 years, Group B: 40 to 50 years, Group C: 50 to 60 years, and Group D: 60 years to 75 years (Table 1).

Table 1: Showing the age wise distribution of the COVID-19 patients

Age	Male	Female	Total
Group A	137 (13.31%)	24 (4.75%)	161 (10.49%)
Group B	223 (21.67%)	117 (23.16%)	340 (22.16%)
Group C	304 (29.54%)	203 (40.19%)	507 (33.05%)
Group D	365 (35.47%)	161 (31.88%)	526 (34.28%)
Total	1029 (67%)	505 (33%)	1534

The patients with age group of 60 to 75 years (Group D) were more susceptible to COVID illness. Males were hospitalized more than the females.

A total of 1534 samples were collected and tested for the bacterial infection, among these 464 cases showed positive bacterial growth, the incidence of the secondary bacterial infection was 30.24%. Among the total samples, the respiratory samples were 685 (44.65.02%), blood samples were 443 (28.87%), the urine samples were 229 (14.92%), the catheter based urine samples were 152 (9.90%), and the

surgical site infection were 35 (2.28%). The incidence of the isolated pathogens was observed as *Staphylococcus aureus* was highest of all with 28.6% followed by *Klebsiella pneumoniae* 24.35% and *Coagulase Negative Staphylococcus (CONS)* 24.13%. The incidence of the *Escherichia coli*, *Acinetobacter baumannii*, *Streptococcus*, *Pseudomonas*, and *Enterococcus* were 11.85%, 10.34%, 5.60%, 3.44%, and 3.31% respectively. The predominantly isolated bacteria were *Staphylococcus aureus*, *Klebsiella pneumoniae* and *CONS*. The incidence of the isolated bacteria in COVID 19 patients was shown in figure 1. The incidence of the isolation of bacterial in different samples was shown in table 2.

The most common site of isolation of bacteria was surgical site infection, all the

35 cases showed bacterial growth and the incidence of the isolated bacteria were *Staphylococcus aureus* 8 (22.85%), *CONS* 7 (20%), *Klebsiella pneumoniae* 8 (22.85%) and *Pseudomonas* 12 (34.28%). *Pseudomonas* is more prevalent when compared to others in the surgical site infections.

The urine and catheter based infections were next commonly observed infections with the incidence of 54.14% and 34.86% respectively. The incidence of the isolated bacteria in urine was observed as *Staphylococcus aureus* 18 (41.51%), *CONS* 23 (52.27%), *Klebsiella pneumoniae* 4 (9.22%), *Escherichia coli* 52/124 (41.93%) and *Pseudomonas* 4 (3.22%). The *E. coli* was observed to be more prevalent than the other bacteria in urine samples. The incidence of the isolated bacteria in the catheter based infections were *Staphylococcus aureus* 19 (54.29%), *CONS* 27 (77.14%), *Klebsiella pneumoniae* 4 (11.43%), and *Escherichia coli* 3 (8.57%). The incidence of the *CONS* was observed to be higher than the others in catheter associated infections.

The bloodstream infections were observed in 140 (31.60%) cases. The incidence of the isolated bacteria in bloodstream was *Staphylococcus aureus* 47 (33.57%), *CONS* 55 (39.28%), *Klebsiella pneumoniae* 23 (16.42%) and *Enterococcus* was (25) 16.23%. The *CONS* was observed to be more prevalent than the other bacteria in blood stream associated infections.

The respiratory tract infections were observed in 112 (16.96%) cases. The incidence of the isolated bacteria in respiratory samples was *Staphylococcus aureus* 41 (36.60%), *Klebsiella pneumoniae* 32 (28.57%), and *Acinetobacter baumannii* 48 (42.85%). The *Acinetobacter baumannii* was observed to be more prevalent in the respiratory samples. No bacterial growth was observed from the samples of pleural fluid. The incidence of the isolated bacteria from the samples of VAP was observed to 14.28%. The incidence of the isolated bacteria in VAP samples were *Staphylococcus aureus* 23.80%, *Klebsiella pneumoniae* 33.33%, *Acinetobacter baumannii* 23.80% and *Streptococcus* 19.04%

Discussion:

The secondary bacterial infections in COVID 19 are a major risk factor. Literature shows the evidence that the viral infections especially SARS CoV2 may predispose to secondary bacterial infections as the virus damages the respiratory epithelium and also its effect on the immunity. The virus damages the cells which antagonise the interferon (IFN) response that enhances the bacterial adhesions, colonization, followed by growth

and invasion into the healthy tissues. Manna *et al.*, reported that the SARS CoV2 may regulate the gene expression related to immunofunction in monocytes.^{6,7}

Sonam Vijay *et al.*, observed 56.7% mortality among COVID 19 patients with secondary infections and reported that 72% of deaths of COVID19 patients were infected with Gram negative bacteria and 11% with Gram positive bacteria. They also observed that the *Klebsiella Pneumoniae* and *Acinetobacter baumannii* were the most predominant and also they were the multidrug resistant gram negative bacteria.⁸ Hence the present study was designed to find out the incidence of the nosocomial infections in the COVID 19 patients in a tertiary care COVID hospital, that may help in the selection of the suitable antibiotics which may intern reduce the mortality rate in COVID 19 patients.

In the present study the incidence of nosocomial infections was observed as 30.4% which is coinciding with the study by J Marin Corral *et al.*, where they reported that 29.5% had developed nosocomial infection in the ICU patients in which the bloodstream and the urinary tract infections were the most common in Spanish population. These results were nearer to the present study where the urinary tract and blood stream infections were predominant along with high incidence of the surgical site infections.⁹

Clara Chong Hui Onget *et al.*, in the Singapore population reported the incidence of the nosocomial infection in 14.8% of the COVID 19 patients and 2.7% in non COVID19 patients. They focused on the devised associated transmission of the nosocomial infection and found that the incidence of the catheter associated urinary tract infections was high in COVID 19 patients which is similar with the present study where the urinary tract and catheter associated infections were found to be in second place after surgical site infections. The incidence of nosocomial infections were much higher than the non COVID patients but when compared to the present study the incidence was lesser than that may be due to the lesser sample size.¹⁰

Sonam Vijay *et al.*, reported the incidence of the nosocomial infection as 3.6% in COVID 19 patients which is very less compared to the results of the present study. They reported the death rate of the COVID19 patients with secondary infections was reported as 56.7%. In their multicentric study the K P was more prevalent with the incidence of 29% followed by A B with 21% , whereas in the present study the most prevalent bacteria in COVID19 patients was *Staphylococcus aureus* followed by *Klebsiella pneumoniae* and CONS with the incidence of 28.6%, 24.35% and 24.13% respectively.⁸

Conclusion:

The data of the present study may have impact on minimising the spread of nosocomial infections and also in the better management of COVID 19 patients to reduce the mortality rate. Further studies can be carried out to find the drug resistance by the pathogens in larger population.

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Figure 1: The incidence of the isolated bacteria in COVID 19 patients

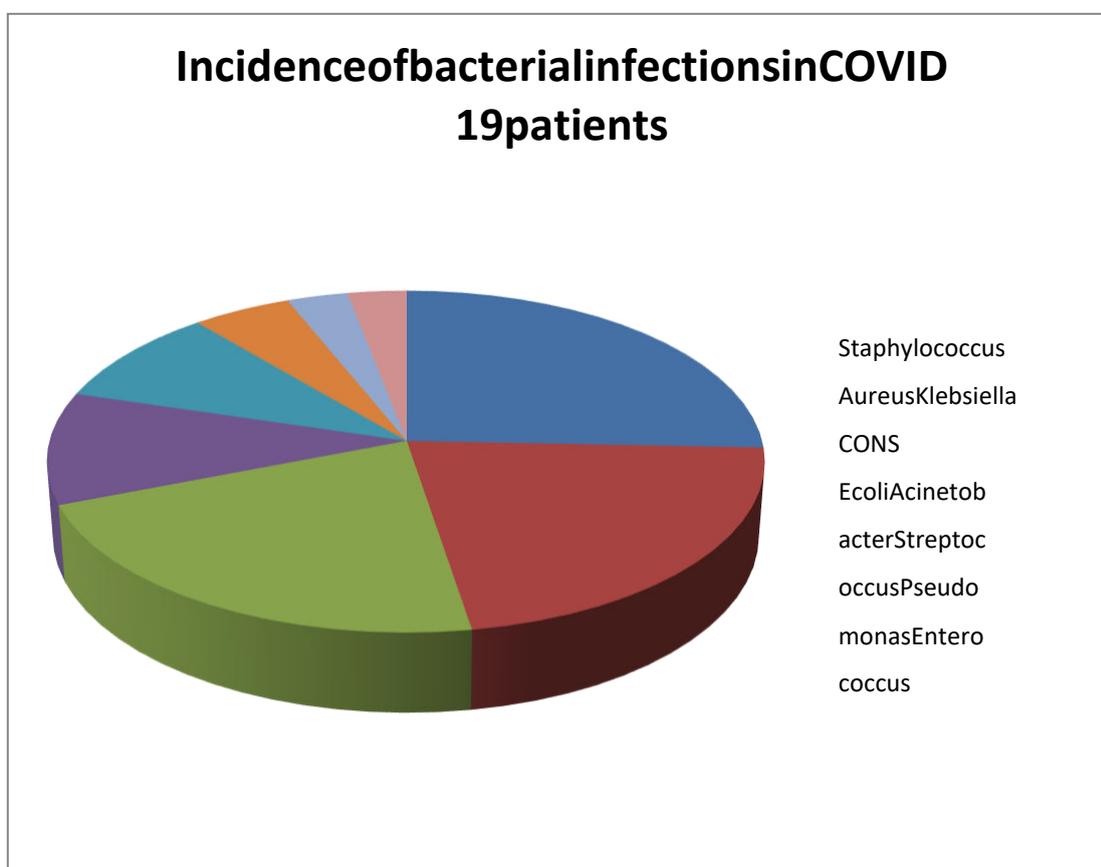


Table2: Showing the incidence of the isolated bacterial in different samples of the COVID19 patients

Isolated bacteria	Respiratory samples		Blood	Urinesamples		Pus from SS I
	Others	Pleural fluid		UTI	CAUTI	
Totalsamples	660	25	443	229	152	35
Totalbacteriadetected	112	0	140	142	82	35
Staphylococcus aureus	41	0	47	18	27	8
CONS	0	0	55	22	42	7
Klebsiella pneumoniae	32	0	23	46	0	8
Pseudomonas	0	0	0	4	3	12
Acinetobacter	48	0	0	0	2	0
baumannii						
Escherichia coli	0	0	0	52	3	0
Streptococcus	26	0	0	0	0	0
Enterococcus	0	0	15	0	5	0

Table3: Showing the incidence of the instrument associated infections in COVID19 patients

Bacteria isolated	VAP	CLABSI and PLABSI	CAUTI	SSI
Totalsamples	147	444	152	35
Totalbacteriadetected	21	154	82	35
Staphylococcus aureus	5	47	27	6
CONS	0	55	42	9
Klebsiella Pneumoniae	7	23	0	8
Pseudomonas	0	0	3	12
Acinetobacter	5	0	2	0
baumannii				
Escherichia coli	0	0	3	0
Streptococcus	4	4	0	0
Enterococcus	0	25	5	0