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ORIGINAL ARTICLE

Prevalence of nosocomial infection Pre- and Post-COVID 19 Pandemic in a Tertiary Care Hospital in Karachi.

Mahvesh Mahmud[1], Ashok Kumar[2], Mariam Ali[3], Sareema Eman Akhtar[4], Saad Shakil[5], Maryam Anwar[6]

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ABSTRACT… Objective: To evaluate the role of the COVID-19 pandemic in the prevalence of nosocomial infections in patients admitted to the Ziauddin University Hospital, Clifton Campus, Karachi. **Study Design:** Retrospective Cross-sectional study. **Setting:** Ziauddin University Hospital, Clifton Campus, Karachi. **Period:** Pre-COVID: Feb 1, 2019 – Jan 31, 2019 Post-COVID: May 1 2020- Apr 30, 2021. **Material & Methods:** Clinicians retrospectively reviewed all Infectious Disease Department medical records for a list of all patients who developed a NI after 48 hours of admission to the hospital. The diagnosis of NI had been formulated by clinicians on the basis of clinical, radiological and microbiological findings. **Results:** We found an increase in certain types of NIs, and stability in the infection rate for many other organisms, which may be due to improved infection control practices during COVID. This information will lead to a better understanding of infection control practices in the future, and will better guide clinical decision making. **Conclusion:** The strict and proper implementation of infection control protocols during the COVID-19 outbreak has reduced the rate of NIs. It has been evident that NIs can be minimized by creating a positive attitude, improving awareness and staff hygiene practices and behaviours, and the provision of facilities to comply with the of infection control protocols' standards.

Key words: COVID-19, Infection Control Practices, Nosocomial Infections.

INTRODUCTION

A new coronavirus emerged at the end of 2019, now named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov-2). The outbreak of this relatively new species was soon declared to be a pandemic by the World Health Organization on 11th March 2020, called the Coronavirus Disease 2019 (COVID-19). The first case of COVID-19 infection was reported from Karachi on February 26, 2020.[1] Ziauddin University Hospital started admitting COVID patients from April 2020.

The definition of a nosocomial infection is an infection which develops 48 hours after admission to the hospital, or within 48 hours after discharge, and is an infection which, at the time of admission to the hospital, was not incubating.[2] One of the most common causes of mortality and morbidity in hospitals are Nosocomial Infections (NIs), affecting millions of patients globally.[3] A large number of patients all over the world experience NIs, with incidence rates ranging from 3.5 - 12 percent in the developed world, and 5.7 - 19.1 percent in middle- and lower-income countries.[4] The prevalence of NIs in a recent study in Pakistan was reported as 29.3% in Karachi in 2008[5] and 27% in Rawalpindi in 2016[6], which is higher than the global average.

A rising infections rate leads to a prolongation of the stay in the hospital, disability in the long term, an increasing resistance to antimicrobial agents, and an increased mortality rate. The Nis with the highest prevalence include urinary catheter-associated urinary tract infections (UTIs), central line-associated infections of the bloodstream, infections of surgical sites and ventilator-associated pneumonias (VAP). Nosocomial pathogens comprise viruses, bacteria and fungi.[7] Additionally, the COVID-19 pandemic has

1. DABIM Int Medicine, Associate Professor Nephrology, Watim Medical College, Rawalpindi.
2. FCPS (Pulmonology), Associate Professor, Ziauddin University, Karachi.
3. FCPS (Pulmonology), Assistant Professor, Ziauddin University, Karachi.
4. Medical Student, Ziauddin University, Karachi.
5. Medical Student, Ziauddin University, Karachi.
6. MBBS, Resident Medical Officer, Ziauddin University, Karachi.

Correspondence Address:
Dr. Mahvesh Mahmud
Department of Nephrology
Watim Medical College, Rawalpindi.
mahveshmahmud@gmail.com

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increased general awareness of infection control and prevention, and changed people's way of life and thinking.[8] It is yet not clear how these infection prevention practices have affected the incidence and prevalence of NIs. Furthermore, the speedy and widespread outbreak of COVID-19 has been very challenging for healthcare centers, and an important issue related to this infectious disease has been prevention and control of Nis.[9] Infection control standards have been used For NI prevention in health centers, including the proper provision as well as distribution of sterilized and infection-prevention equipment, triage strategies, congestion reduction, reorganization of wards, attention to environmental health, and the training of personnel regarding the enforcement of standard precautions like safety of injections, hand washing techniques, and proper personal protective equipment (PPE).[10]

OBJECTIVE

Evaluation of the role of the COVID-19 pandemic in the prevalence of NIs in patients admitted to the Ziauddin University Hospital, Clifton Campus, Karachi. This study was conducted to evaluate the impact of COVID-19 on the NI rate, due to a lack of studies from Pakistan on this important aspect.

OPERATIONAL DEFINITIONS

- **Nosocomial Infection (NI):** NI occurs 48-72 hours post-admission to health care units; the infection is not in the incubation period and non-existent at the time of admission to the hospital
- **Hospital Acquired Pneumonia (HAP):** Also known as nosocomial pneumonia, it is a lower respiratory infection that was not present or incubationg at the time of admission to the health-care unit, clinically presents after 48 hours or more after hospitalization
- **Blood stream Infection (BSI):** An infectious disease in which viable bacterial or fungal microorganisms are present in the bloodstream (shown later by the positivity of at least one blood culture), causing an inflammatory reaction in which laboratory, hemodynamic and other clinical parameters are altered.
- **Surgical Site Infection (SSI):** is an infection that occurs after an invasive surgical procedure in the incision site
- **Catheter-Associated NIs**
- -**Ventilator Associated Pneumonia (VAP):** A pneumonia which occurs more than two days after endotracheal intubation.
- -**Central Line Associated Bloodtream Infection (CLABSI):** is a primary bloodstream infection (there is no other nidus of infection), which develops in a patient with a central line in place within the two-day period before the onset of the BSI, and is not related to infection at another site.
- **-Catheter Associated Urinary Tract Infection** (**CAUTI):** a urinary tract infection which occurs after placement of an indwelling urinary catheter

MATERIAL & METHODS

This observational retrospective cross-sectional study was conducted at the Ziauddin University Hospital, Clifton Campus, Karachi during Pre-COVID: Feb 1, 2019 – Jan 31, 2019 and Post-COVID: May 1 2020- Apr 30, 2021. All inpatients with NIs fulfilling the inclusion criteria admitted in Dr Ziauddin Hospital Clifton at the above dates were included in the study.

Inclusion Criteria

All patients fulfilling the criteria and having a chart diagnosis for different NIs, including Ventilator-Associated Events (VAEs), HAP, BSI, UTI, CLABSI, CAUTI, SSI and others
Age above 18 years

Exclusion Criteria

- Patients whose data was incomplete
- Patients with age less than 18 years

This data collected included positive culture reports including the site of the culture (blood, urine, tracheal aspirate, wound site, catheter related), organism type, and colony count. Medical records were thereafter reviewed for basic demographic and clinical data, for the type(s) and duration of antibiotics used, use of ionotropes, and Chest X ray findings.

Ethical Review The authors received approval from the Ethical review Committee (3930621MAPUL) of the hospital. As this was a retrospective review of medical data, written informed consent was waived. Data was entered in the SPSS version 20.

RESULTS

After assessing the basic demographic data, the presence of different NIs was assessed before and after the COVID era.

The table below summarizes the results.

CLABSI:

	Positive	Negative	Total
Pre COVID	11 (36.7%)	19 (63.3%)	30
Post COVID	26 (32.5%)	54 (67.5%)	80
Total	37	73	110

CAUTI:

	Positive	Negative	Total
Pre COVID	8 (26.7%)	22 (73.3%)	30
Post COVID	17 (21.3%)	63 (78.8%)	80
Total	25	85	110

Surgical Site Infection

	Positive	Negative	Total
Pre COVID	3 (10%)	27 (90%)	30
Post COVID	12 (15%)	68 (85%)	80
Total	15	95	110

VAP

COVID	Positive	Negative	Total
Pre COVID	6 (20%)	24 (80%)	30
Post COVID	12 (15%)	68 (85%)	80
Total	18	92	110

VENT Associated Events

	Positive	Negative	Total
Pre COVID	2 (6.7%)	28 (93.3%)	30
Post COVID	13 (16.3%)	67 (83.3%)	80
Total	15	95	110

Next, the growth of different organisms was assessed.

First was Klebsiella…. in the pre-COVID era, 40% growth of Klebsiella was noted whereas this reduced to 15% in the post COVID era. The growth of Acinetobacter also decreased from 33% to 16%. Similarly, the growth of Serratia also declined from 16% to zero. The growth of Pseudomonas Stutzeri, Carbapenem resistant Enterobacter and MRSA also became zero. The growth of Enterococcus declined from 20 to 15%. The growth of Proteus Mirabilis decreased from 6.7 to 3.8%. The prevalence of Pseudomonas Aeroginosa and E.coli decreased from 23% to 18%. The growth of Burkholderia Cepacia decreased from 3.3 to 1.3%. Stenotrophomonas Maltophilia's prevalence also decreased from 6.7 to 3.8%.

However, the growth of Coagulase Negative staphylococcus increased from 20% to 31%. The growth of Candida Tropicalis increased from 0 to 10% in the post COVID times. Similarly, the growth of Candida Albicans also increased from 3.3 to 16.3%. The growth of Streptococcus D increased from zero to 17.5%. The growth of Enterobacter also increased from 0 to 16.3%. The growth of Bacillus species increased from 0 to 3.8%. The growth of Morganella Morgani, mould Aspergillus flavus and Aeromonas hydrophillia also increased from 0 to 1.3%.

DISCUSSION

This study was aimed at evaluating the impact of COVID-19 on the NI rate, due to a lack of studies from Pakistan on this important aspect.

As seen from the results above, we can conclude that the prevalence of ventilator associated events and surgical site infections increased during the era of COVID-19. Ventilator associated events increased from 6% to around 16%. Similar studies were also conducted in other countries. For instance, one study conducted in Tehran also concluded that the commonest type of NI in 66% of patients was ventilator-associated pneumonia / events (VAE). *Acinetobacter baumannii, Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, respectively were the coomonest microorganisms causing pneumonia.[11] A higher SSI rate is noted in the developing world, for which the reasons include operating room congestion, unnecessary use of antimicrobial, and poor hand hygiene.[12]

In our study, we see that the growth of specific organisms increased during the COVID era. These organisms include Coagulase negative Staphylococcus, Candida Albicans and Tropicalis, Streptococcus D, Enterobacter, Bacillus, Morganella Morgani, mould Aspergillus flavus and Aeromonas hydrophillia. There was a decrease in the growth of the rest of the organisms. There was also a decrease in the prevalence of CLABSI and CAUTI. The decrease in CAUTI correlates with another study done by Meddings et al.[13] Various other studies also showed a reduction in CLABSI.[14]

This relatively stable NI rate has also been noted in other studies, for instance in one study conducted in Singapore, and this could be due to increased infection prevention and control measures at the time of the COVID-19 outbreak. Improved precautions, like better hand hygiene practices greatly reduces the transmission of NIs between patients.[15] A study conducted in New York revealed a lower incidence of Nis after the application of contact precautions.[16] During the COVID-19 outbreak, infection control standards include identifying and isolating infected patients and personnel, contact, droplet, and aerial precautions, and finally, eliminating the infections by using antimicrobial agents. Moreover, increasing awareness is one of the most effective ways in fighting NIs, and the infections rate will decrease by using appropriate and effective infection control methods, and by continuing education and increasing awareness of Nis.[17]

The implementation of stringent public health measures inadvertently affects health care systems, and this has undoubtedly been crucial for controlling COVID-19. Moreover, the fear of getting an infection in health-care centers, and stay-at-home and work from home instructions and methods have also prevent people from going to the hospitals unnecessarily.[18]

LIMITATIONS

A possible limitation was the time when the study was conducted, in the early months of the COVID-19 pandemic, when strict health protocols were observed, therefore the risk of NIs was greatly reduced.

CONCLUSION

The strict and proper implementation of infection control protocols during the COVID-19 outbreak has reduced the rate of NIs. It has been evident that NIs can be minimized by creating a positive attitude, improving awareness and staff hygiene practices and behaviours, and the provision of facilities to comply with the of infection control protocols' standards.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Mahvesh Mahmud	Final Deaft of manuscript.	
2	Ashok Kumar	Critical revision of the article.	
3	Mariam Ali	Data analysis.	
4	Sareema Eman Akhtar	Data acquisition.	
5	Saad Shakil	Data acquisition.	
6	Maryam Anwar	Wrote first draft of manuscript.	