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A RETROSPECTIVE STUDY OF BLOOD CULTURES IN COVID-19 POSITIVE PATIENTS IN A TERTIARY CARE HOSPITAL

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Abstract

Background: Bloodstream infections are one of the leading causes of mortality and morbidity across a wide spectrum of patient populations in developing nations like India. The identification of bacteria and their susceptibility to commonly used antibiotics is critical for patient treatment. The diagnosis of pulmonary embolism in symptomatic COVID-19 patients is difficult because both diseases can cause shortness of breath, chest pain, tachycardia, tachypnea, fever, oxygen desaturation, and high D-dimer blood levels. The objectives of this study are to examine current trends in bloodstream infection by examining their bacteriological profile and antibiotic susceptibility.

Material and Methods: A hospital-based retrospective analysis of blood cultures from patients suspected of having a bloodstream infection was performed. We performed a three-year retrospective analysis of blood culture reports from patients suspected of having a bloodstream infection (January 2021 to March 2021). Pathology report data was used to determine bloodstream infection, blood culture contamination, and pathogen profile.

Results: The analysis indicates that 27 of the 80 blood samples sent to the microbiology laboratory for culture were positive. The most common etiological agent responsible for Bloodstream Infection was discovered to be In the current study, China National Biotec Group (CNBG) (53 percent), CONS (06 percent), Staphylococcus aureus (06 percent), Klebsiella pneumoniae (04 percent), Enterococcus species (02 percent), Escherichia coli (02 percent), and Candida albicans (02 percent) were all present (01 percent).

Conclusion: CNBG and CONS are the most common bloodstream bacteria. Resistance to Bloodstream Infection etiological agents grows every year. Prescribers should worry about drug resistance. We present two COVID-19 patients with suspected pulmonary embolism due to time-dependent increases in D-dimer and decreases in C- reactive protein. Reversal in

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blood levels of both biomarkers over time could be used to predict pulmonary embolism in COVID-19 patients.

Keywords: Blood Culture, Scovid 19, CNBG, D-Dimer Blood Levels, C - reactive protein.

Introduction

In hospitalized patients, a diagnostic test known as a blood culture is used to diagnose infections that have spread through the bloodstream. Rapid diagnosis of bloodstream infections is essential in a hospital setting due to the high risk of progression to sepsis, a condition that can be fatal and occurs when the body attempts to fight off a bloodstream infection by causing severe inflammation throughout the body and, in some instances, leading to organ failure and death.[1] Sepsis is a condition in which the body attempts to fight off a bloodstream infection by causing severe inflammation throughout the body. According to the findings of a study that was conducted by Angus et al. in 2001, there are roughly 751,000 cases of sepsis diagnosed each year in the United States, with a fatality rate of 28.6 percent. The culture becomes contaminated if germs from the skin or the environment are inadvertently introduced into the sample.[2,3]

The pandemic has had a significant and detrimental effect on the individuals who are employed in the health care industry as a direct consequence of the dramatic increase in the number of terminally ill patients who are infected with the COVID-19 virus. As the number of patients admitted to hospitals continues to rise, the critical care unit capacities of hospitals all over the world are reaching their limits, leading to shortages of personal protective equipment, ventilators, medications, and other essential medical supplies.[4,5] This situation poses a constant threat to hospital systems everywhere in the world. In a recent study that was carried out by Adhachi et al., patients who tested positive for COVID-19 were surveyed. The researchers discovered that the presence of bloodstream infections in COVID-19 patients is minimal, but that blood culture contamination is more prevalent.[8,9] Other, more specialized studies have shown that the likelihood of patients who are positive for COVID-19 developing a central line-associated bloodstream infection is significantly higher than the likelihood of patients who are negative for COVID-19 developing such an infection. This is because patients who are positive for COVID-19 are more likely to have a COVID-19-positive bloodstream infection.[10] It is imperative to immediately rule out the possibility of a bloodstream infection before beginning treatment for the condition in patients who have been diagnosed with severe COVID-19 infection because, once a cytokine storm or abnormal immune response has been identified, it is necessary to conduct frequent blood culture examinations in order to rule out the possibility of a bloodstream infection.[12] If higher cases of COVID-19 contributed to greater rates of blood culture contamination, then hospitals should predict exponential rises in both the number of personnel needed and the expenditures associated with hiring them. During the COVID-19 pandemic, more caution and care must be used to correctly collect blood cultures, and quick action must be taken in the event that a discernible shift in the pattern of infection is observed.

Material and Methods

This is a retrospective study that was conducted at a single community-based academic hospital with the purpose of examining the link between various acute phase reactants and

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inflammatory markers in patients who were admitted with COVID 19. The hospital was chosen because it is located in a community setting. A COVID-19 diagnosis was determined for each patient between the first of the year 2021 and the thirty-first of the month of March 2021. The Institutional Review Board (IRB) agreed to give their approval for the study, and the Research Ethics Committee came to the conclusion that it would not be necessary for the subjects to submit their informed consent for the study (REC).

Data collection

For each comparison, patients were divided into 2 groups. On day one and day seven of hospitalisation, comparisons were made between patients in the high D-Dimer (>501 ng/ml) and low D-Dimer (500 ng/ml) groups. In a similar manner, high CRP levels (>101 mg/dl) and low CRP levels (100 mg/dl) were compared for the purpose of assessing in-hospital outcomes. Using a standardised data collection form, clinical, demographic, laboratory, treatment, and outcome data were retrieved from electronic medical records (Sunrise). These records were accessed using the software programme Sunrise. The majority of the writers were involved in the data extraction process, while one author acting independently resolved any conflicts in interpretation that arose between the various data extractors. The protocols and methods used in the laboratory to confirm a SARS-CoV-2 infection have been standardised. SARS-CoV-2 detection in respiratory specimens (throat swabs) by next-generation sequencing or real-time qualitative polymerase chain reaction (RT-qPCR) procedures at Thomas Jefferson University Hospitals, USA, was used for all included populations. The absence of fever, relief from symptoms for at least one day, and significant clinical or radiological improvement were the requirements for discharge from the hospital. A coagulation profile, complete blood count, serum biochemical assays (renal function, liver function), lactate dehydrogenase (LDH), cardiac enzymes (troponin T TnT), and serum ferritin were all part of the routine blood work.[10,11]

Results

From January 2021 to March 2021, 80 non-repetitive blood samples were collected from patients suspected of having bloodstream infections that attended and were admitted to Medical College. In a formatted proforma, details such as hospital identity, registration number, laboratory number, age and sex of the patients, and type and location of specimen collection were recorded.

Table 1: Age wise Distribution of Culture Positive Patients

	0	**11-20 years**	**21-30 years**	**31-40 year**	**41-50 year**	**51-60 + Year**	**Total**
Male	2	0	4	6	2	1	16
Female	2	0	2	3	3	1	09

Out of the 25 COVID19 positive patients, 16 were male and nine were female. Maximum number of patients was between the ages of 31 and 40, while there were none between 11 and 20.

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Table 2: Distribution of Micro Organism Isolated From Culture

	OrganismIsolated	**Number (%) Total 40**
1.	China National Biotec Group (CNBG)	53 %
2.	CONS	12 %
3.	Staphylococcusaureus	06 %
4.	Klebsiellapneumoniae	04 %
5.	Enterococcus species	02 %
6.	Escherchia coli	02 %
10.	Candidaalbicans	01 %

In our study, 80 patients with a confirmed COVID-19 diagnosis were included. For comparison, patients were divided into two groups: low D-Dimer (500 ng/ml) vs. high D-Dimer (>501 ng/ml) and low CRP (100 mg/dl) vs. high CRP (>100). CRP patients had a mean age of (63.6 vs. 61.6) years, while D-Dimer groups had a mean age of (62.6 vs. 63.7) years. Except for the higher CRP group (>101 mg/dl), all groups' baseline comorbidities were comparable.

Discussion

According to the findings of a study conducted by Ranjit and colleagues, bloodstream infections made up 3.41 percent of all blood cultures. A study with the same objective was carried out in Western Nepal, and it found a culture positivity rate of 6%. One year later, the same study found 13.3% in a teaching hospital in Nepal. A total of 15 investigations have found significantly higher rates of BSI and other there was a considerable difference in the incidence of BSI between different age groups, with the most people being afflicted being adults aged 16-65 years, followed by children aged 2-15 years. The vast majority of studies on sepsis have demonstrated that newborns are more susceptible to the disease. 11-14, which does not square with the findings of our research. According to the findings of the current investigation, infections of the blood stream were found in 10.0% of the total COVID 19 patients and 33.75.0% of the total blood culture samples. Other there was a substantial difference in the incidence of BSI between the different age groups, with the greatest number of cases occurring in people aged 31–40 years, followed by those aged 21–30 years. The vast majority of studies on sepsis have found that youngsters are not susceptible to the disease11-20, which is not consistent with the findings of our study. Ranjit et al research Salmonella Typhi was the bacterium that was isolated the most frequently throughout our research (30.9%), which suggests that enteric fever is becoming an increasingly prevalent health concern in Nepal. Other bacteria that belonged to the Enterobacteriaceae family that were isolated were Salmonella Paratyphi (9.8 percent), Escherichia coli (23.3 percent), and Klebsiella pneumoniae (3.3 percent) (16.5 percent). An identically high incidence of Enterobacteriaceae was observed in both Nepal and India in a study that was carried out in both countries. Previous research carried out in Nepal has revealed that the country is home to an isolated population of Enterobacteriaceae. S. I. Nwadioha et al., observed in their study that the rate of bacterial isolation in the blood culture of children in this study (18.2 percent) was relatively low compared to some previous studies done in Nigeria, specifically; Calabar

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(44.9 percent) (Martins et al., 2005), Ilorin (30.8 percent) (Mokuola et al., 2002), and Ife (55 percent) (Martins et al., 2005). In addition, the (Ako-Nai et al., 1999). According to research done by Madhu et al. in 2002, the percentage of children in India who had positive blood culture results was quite low at 22.9%. In the current investigation, the rate of bacterial isolation from group A (neonates) was 25.7%, while the rates from blood cultures were 17.4% and 12.7% respectively.In the research conducted by Rani and colleagues, it was discovered that out of 327 positive cultures, 299 (91.4 percent) demonstrated bacterial growth. Of these, gram- negative bacteria made up 161 (53.8 percent) of the sample, and gram-positive bacteria made up 138 (46.2 percent) of the sample (46.1 percent). Candida species were isolated from 13 of the positive samples, which accounts for 3.97 percent of the total, while 15 of the samples revealed contamination. Escherichia coli was discovered to be the most prevalent Gram- negative isolate (37.80 percent), followed by Klebsiella species (24.20 percent), Pseudomonas species (13.60 percent), and Acinetobacter species (13.60 percent) (6.80 percent) Among Gram-positive isolats, those that are negative for coagulase The most common type of bacteria found was staphylococci, which made up 52.80 percent of the sample, followed by staphylococcus aureus, which made up 14.40 percent, and enterococcus species, which made up 10.14 percent. Research being Carried Out by the China National Biotec Group (CNBG)(53 percent), CONS (06 percent), Staphylococcus aureus (06 percent), Klebsiella pneumoniae (04 percent), Enterococcus species (02 percent), Escherchia coli (02 percent), Candida albicans (01 percent). In this particular study, the highest rate of positive blood culture results was discovered in intensive care units (ICUs). This may be because blood stream infections are more likely to occur in patients who are critically ill or who have undergone medical or surgical procedures that can result in nosocomial infections. The timely detection, diagnosis, and anti- microbial susceptibility testing of blood borne infections is one of the crucial activities of a diagnostic laboratory. Because the condition can occasionally be fatal, this is one of the most significant functions of a diagnostic laboratory. According to our research, the age range of 31– 40 years contained the greatest number of positive cases, which is in line with the findings of Vasudev et al. (2015).[12] The findings of this study showed that men had a higher level of culture positive than women did. These findings are in line with those found in a study conducted by Kaur and Singh (2014), and a similar observation was made by Vasudev et al (2015).[13] The most common blood culture isolates in our research were S. aureus (20, or 50 percent), followed by K. pneumoniae (4, or 10 percent), which is consistent with the findings of a study by Prabhu et al. (2010), which showed that S. aureus was present in 50.61 percent of cases, and K. pneumonia was present in percent of cases.[14] The current investigation discovered that the most common blood culture isolates were CNBG at 53 percent, followed by CONS at 12 percent. There is a significant elevation of inflammatory cytokines and biomarkers in the systemic hyperinflammation phase of COVID-19 proposed by Siddiqi and Mehra. These include interleukin (IL)-2, IL-6, IL-7, granulocyte-colony stimulating factor, macrophage inflammatory protein 1-, tumour necrosis factor- (TNF-), CRP, ferritin, PCT, and D-dimer.[15] This stage is characterised by the most severe expression of the cytokine storm, which is characterised by extreme hyperinflammation that may lead to cardiac collapse and failure of many organs. CRP is a protein that is produced by the liver during the acute phase of the inflammatory response. CRP levels may be raised in a variety of illnesses, including

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inflammation, cardiovascular disease, and infection. An elevated CRP was found to be associated with severe COVID-19 and the requirement for ICU care in our meta-analysis of other studies; however, our research shows that higher D-Dimer levels (>501 ng/ml) on admission may signal a greater requirement for invasive mechanical ventilation (IMV). When compared to D-Dimers, a high C-reactive protein (CRP) (>101 mg/dl) on admission predicts not just a larger requirement for IMV but also an upgrading to a higher level of care. This is because CRP is a marker of inflammation in the body. After the treatment for COVID-19 was finished, having a high CRP (more than 101 mg/dl) and increased D-Dimer values (greater than 501 ng/ml) were both related with higher probabilities of in-hospital death, the requirement of IMV, and an upgrading to the ICU. Patients who come with a CRP level that is greater than 101 mg/dl have a two-fold increased likelihood of requiring IMV and a three-fold increased likelihood of being upgraded to the intensive care units after having their baseline comorbidities and medications taken into account (ICU). When compared to patients who have a CRP level that is lower (100 mg/dl), those who have a continuously higher CRP level (>101 mg/dl) on day-7 have increased likelihood of requiring IMV and being upgraded to the intensive care unit by a factor of three to four. In a similar vein, it was discovered that high levels of CRP (more than 101 mg/dl) were associated with a death rate in the hospital that was four times greater for all causes when major confounding factors were taken into account. When compared to CRP, elevated D-Dimer levels (>501 ng/ml) during hospitalisation can serve as a more sensitive indication for the severity of COVID-19 infection. This is because D-Dimer levels are measured in milligrammes per millilitre. According to the findings of our research, on the seventh day after admission, patients whose D-dimer levels were greater than 500 ng/mL had a mortality risk that was ten times higher than that of patients whose D-dimer levels were lower than 500 ng/mL. In contrast, the risk of death was increased by a factor of 2.5 in patients whose CRP was higher than 101 mg/dl as compared to those whose CRP was lower than 100 mg/dl. Even at presentation, elevated levels of D-Dimer (more than 501 ng/ml) and rising levels of CRP (greater than 101 mg/dl) were related with a higher likelihood of mortality; however, these values did not meet the level of statistical significance required to be considered significant. In contrast to these findings, a study that was just published out of Wuhan in China reported that a higher D-Dimer level was associated with an increase in in-hospital mortality that was four times higher. Previous research,[16,17] has demonstrated that patients with medical conditions who have D-dimer levels that are twice as high as the normal upper limit are at an increased risk of developing venous thromboembolism (VTE).Patients who are admitted to the hospital because of COVID 19 can suffer from acute renal injury and proteinuria, both of which are associated with a greater mortality rate.[18] This was demonstrated in previous research as well. Despite the fact that patients who were receiving hemodialysis had a higher mean CRP at entrance on day-7 of admission, our research did not find any significant connection between CRP and D- Dimer levels and the requirement for in-hospital hemodialysis treatment (HD). In summarize, our study suggested for the use of CRP and D-Dimer levels at admission and during hospitalisation as severity and prognostic markers. Patients whose indicators are found to be growing may require higher levels of care and more diligent monitoring. Our research demonstrates that this particular patient population is at a greater risk of experiencing unfavourable outcomes, which not only enables medical professionals to

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anticipate and forecast the occurrence of such unfavourable outcomes but also to incorporate this information into decisions regarding resource distribution.

Limitations of the study:

The results of our research need to be understood carefully, bearing in mind the constraints of the study. As a result of the fact that the study was retrospective and non-randomized, it was not possible to determine whether or not there was a causal connection. Although the overall findings were corrected for variables, such as baseline comorbidities and medications, it was not possible to evaluate the impact of unmeasured confounders such as the introduction of many complementary therapies at the treating physician's discretion. Because the typical length of any therapy for COVID-19 was fewer than seven days, we decided to use day-1 and day-7 laboratory data. This decision was based on our clinical experience. It is not feasible for us to determine whether or not these actually represented pre- and post-treatment results precisely in all cases due to the varying frequency with which laboratory specimens were collected. Because patients who were still in the hospital were not included in our study, the case fatality ratio does not accurately reflect the true mortality rate associated with COVID-19. In conclusion, due to the small sample size, there is a possibility that our findings cannot be interpreted fully. Nevertheless, by selecting the adult patients who already had a diagnosis of the condition, we were able to create a population that, in our opinion, is the most accurate representation of the real-world cohort.

Conclusion

According to the findings of this study, CNBG and CONS are the primary causes of septicemia in ICU patients, followed by S. aureus and Klebsiella pneumonia. This trend is comparable to that which is seen in other low-income nations. Another finding is that common organisms are becoming less susceptible to conventional antibiotics, which highlights the need for more responsible antibiotic utilisation. Both improper infection control practises and inappropriate use of medicines are major driving forces behind the rise in the number of bacteria that are resistant to antimicrobials. Certain approaches to the use of antibiotics, such as limiting the use of antibiotics, using antibiotics in combination with other treatments, or recycling antibiotics, could be helpful in reducing or preventing the development of resistance. At the time of presentation, a high CRP level (more than 101 mg/dl) seems to indicate a greater requirement for IMV and intensive care. After COVID-19 therapy, a high CRP (more than 101 mg/dl) and an elevated D-Dimer (greater than 501 ng/ml) predict higher odds of mortality; however, large-scale and longer-term investigations are required to corroborate our findings.

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