ORIGINAL ARTICLE

COVID-19 in Trauma Victim: A Tertiary Centre Cohort Study

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ABSTRACT

Background The pandemic of COVID-19 has spread worldwide. Despite holding elective services for all cold diseases, semi-elective and emergency services continued based on guidelines by WHO and Government. Trauma is an emergent situation dealt with simultaneously during a lockdown in the country. The present study is a pioneer in trauma associated with COVID-19 disease, aiming to assess the scenario of COVID-19 in trauma patients and its influence on overall outcomes.

Material and Method It is a retrospective study conducted over 49 diagnosed COVID-19 patients by Real-Time Polymerase Chain Reaction (RTPCR) after obtaining nasal and oropharyngeal samples and admitted associated with injury and managed in trauma surgery with the collaboration of COVID-19 hospital. The clinical and biochemical parameters were recorded, and outcomes were analyzed.

Results After classification of patients into mild, moderate, and severe based on disease severity. Based on the type and severity of the trauma, each patient's injury severity score and modified shock index were calculated and correlated with the severity of COVID presentation along with biochemical parameters such as Platelet count, absolute lymphocyte count, Liver function tests, and duration of hospitalization.

Severely diseased patients were found to have significant thrombocytopenia. 63% of patients had lymphopenia. A significant correlation was also found between abnormal liver function tests and the severity of COVID-19.

Conclusion The study is one of a kind in defining the association of biochemical parameters in trauma victims along with the pre diseased COVID-19 status. The outcome of these candidates depends upon the severity of the illness. If improperly managed could add to the morbidity and mortality, but they are good for a speedy recovery and do not have any chronic sequelae.

Keywords: COVID-19, Polytrauma, Trauma

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INTRODUCTION

The world was gripped in the paws of this deadly virus, bringing everything to a standstill, but the healthcare sector continued to function.[1] Various time-to-time guidelines were laid out for emergency and semi-elective care in surgical patients.[2] Trauma is one of the emergencies which needed immediate attention irrespective of the COVID-19 status of the patient.[3,4] The current study assesses the scenario of COVID-19 in trauma patients presenting at a tertiary care center and its effect on the patient's overall outcome.

The patients included in the study were diagnosed with COVID-19 infection with trauma. This study primarily aimed to evaluate Clinical and biochemical parameters, the Severity of COVID-19 and its association with Trauma Severity, and their role in predicting outcomes like duration of hospitalization.

MATERIALS AND METHODS

The current study is a retrospective study conducted in the Trauma center, BHU from March to November 2020 both requiring operative intervention and nonoperative management in those diagnosed as positive for COVID-19 and 6 months follow-up through telemedicine.

All patients were screened for the genetic material of the infective virus based on history and real-time reverse transcriptase-polymerase chain reaction (RT-PCR). Forty-nine patients qualified for the inclusion criteria admitted to Trauma surgery. The study primarily focussed on looking at clinical and biochemical parameters and their role in predicting an outcome, that is, duration of hospitalization, the severity of COVID-19, and association with trauma severity.

Statistical Analysis - Data recorded and analyzed with SPSS version 20

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Primary Survey- All trauma patients should be considered COVID-19 positive, and initial management is carried out as per ATLS protocol. COVID-19 screening includes epidemiological H/O like exposure, contact, travel, and symptoms related to COVID-19. Throat and Nasal swabs were placed in Viral Transport Media and transported in a Cold chain with standard precautions.

Diagnostic Criteria- At our trauma center, the recommendations laid as per National Clinical Guidelines from the Ministry of Health Affairs were followed from time to time.[5] The following criteria were standardized for this study.

Epidemiological Criteria

A. Sudden Acute Respiratory Illness [SARI](fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days before symptom onset

B. A patient with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case in the last 14 days before symptom onset;

C. A patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath; AND requiring hospitalization) AND in the absence of resembling comorbid condition.

Clinical Criteria

COVID-19 patients reporting to various COVID-19 treatment facilities have reported the following signs and symptoms:

- Fever
- Cough
- Fatigue
- Shortness of breath
- Expectoration
- Myalgia
- Rhinorrhea, sore throat, diarrhea
- Loss of smell (anosmia) or loss of taste (ageusia) preceding the onset of respiratory symptoms has also been reported

Radiological

Organizing COVID-19 Pneumonia- Imaging characteristics of COVID-19 (CT Thorax: multiple small plaque shadows and interstitial changes in the early stage, which are obvious in the peripheral lung, and then develop into multiple ground-glass shadows and infiltration shadows in both lungs, and lung consolidation may occur in severe cases)

Chest trauma patients with pulmonary contusion require special attention to distinguish between Thoracic CT manifestations of COVID-19 infection and trauma. On Chest CT scan, pulmonary contusions are seen as focal nonsegmental areas of parenchymal opacification in the peripheral lung field with occasional bilaterality.

In the early phase of COVID-19 infection, B/L ground glass opacities in subpleural areas, and later consolidation s/o organizing pneumonia can be seen.

Pathological

- Detection of SARS-CoV2 through RT-PCR in swabs and Rapid antigen
- The total number of White Blood Cells in the early stage is normal or decreased, and the lymphocyte count is decreased

The Clinical severity of COVID-19 was categorized based on national guidelines

Mild-Patients with uncomplicated upper respiratory tract infection may have mild symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache, and without evidence of breathlessness or Hypoxia (Saturation >94%)

Moderate-Adolescent or adult with clinical features of dyspnea and/or hypoxia, fever, cough, including SpO2 <94% on room air and RR ≥24/minutes.

Severe- Adolescent or adult: with clinical signs of Pneumonia plus one of the following; respiratory rate >30 breaths/min, severe respiratory distress, SpO_2 <90% on room air.

Emergency Management

The aim of emergency surgery was hemorrhage control, prevention of coagulopathy, and restoring normal physiological function. Effective prevention is carried out by taking standard recommended Pre and Intraoperative measures.

Anaesthesia and Intraoperative Precautions

Apart from standard contact and droplet precautions, airborne precautions must be taken into account while performing aerosol-generating procedures like suction of the respiratory tract, intubation, and CPR. Apart from wearing adequate PPE, adequately ventilated negative pressure rooms were used with minimum changes of 12 air/hour or at least 160 liters/second/patient in the presence of natural ventilation. Because of uncertainty around the potential for aerosolization, high-flow nasal oxygen (HFNO), NIV, including bubble CPAP, was used with airborne precautions. Dedicated donning and doffing areas present with control of in and out traffic in the operating room and locking of all doors. The principle of "3 zones and 2 passages" followed, identifying a contaminated zone, a potentially contaminated zone, and a clean zone, separated by adequate buffer areas.

During surgery diagnostic laparoscopy was avoided to prevent aerosol generation along with minimalizing the use of suction cannulas and using mops instead with early and vigilant identification of bleeders in trauma victims.

Figure 1: CT film showing a CECT thorax of COVID-19 infected patient

Post-operative Resuscitation

Surgical patients are at a higher risk of developing severe complications from the SARS-Co-V2 infection. Follow-up visits were limited to essentials. Telemedicine was extensively adopted in follow-up.

RESULTS

After primary management patients were shifted to a dedicated COVID-19unit and followed, data were recorded and analyzed.

A) Demographic Profile

Table 1: Depicting the demographic profile of patients included in this study.

Age	*Patients*
10–20	9
21–40	23
>40	17
Gender	
Male	41
Female	8

None of the patients were found to have any comorbidity.

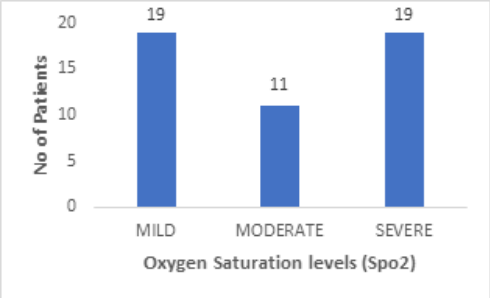
B) Classification of Patients According to Type of Trauma and their Injury Severity Score (ISS) and Modified Shock Index (MSI)

The patient's were classified on the type of injury sustained with patients having Isolated thoracic trauma that included both lung contusion and hemothorax along with fracture ribs, a few cases required intercostal tube drainage but none required thoracotomy.

Abdominal trauma patients included both blunt and penetrating injuries with both solid organ and hollow viscus injuries taken into account; most hollow viscus injuries required laparotomy Isolated limb injuries pertained to autoamputated limbs, multiple lacerations, and degloving injuries.Injuries involving more than one system (i.e., thoracic with abdominal, fracture of long bones, head injury) were classified as Polytrauma.

Table 2: Spectrum of patients on type of trauma and its severity Indices

Types of Trauma	*Frequency*
Thoracic	16
Abdominal	10
Limb	6
Polytrauma	17
ISS SCORE	*NO OF PATIENTS*
0–9	3
10–16	13
17–25	14
>25	19
MSI	*NO OF PATIENTS*
<1.3	30
>1.3	19



Graph 1: Severity based on SpO2 levels

C) Spectrum of COVID-19

Based on clinical oxygen saturation levels, it was subclassified as mild, moderate, and severe.

D) Biochemical Parameters

Table 3: Biochemical parameters at presentation

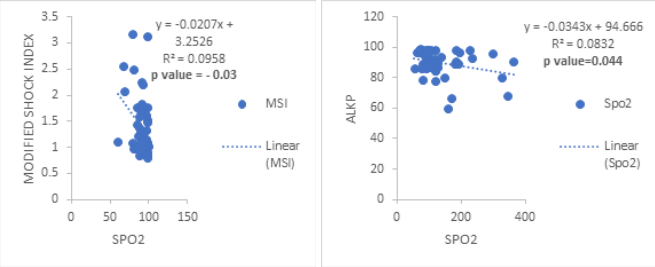
Platelet Count	*Frequency*
150000–450000	20
50000–150000	22
<50000	7
Absolute Lymphocyte Count	Frequency
<800	31 (63.3)
800–5000	18 (36.7)
>5000	0 (0)
SGPT	Frequency
≤ 40 U/L	15 (30.6%)
>40 U/L	34(69.4%)
SGOT	Frequency
≤40 U/L	10 (20.4%)
>40 U/L	39 (79.6%)
Total Bilirubin	Frequency
<1.2 mg/dL	44 (89.8%)
>1.2 mg/dL	5(10.2%)
Alkaline Phosphatase	Frequency
<120 U	32(65.3%)
>120 U	17(34.7%)

E) Correlation of Clinical and Biochemical Parameters

- Modified shock Index correlated with Injury severity score with a p-value of 0.013

Table 4: The correlation of SpO2 with the Platelet count of patient (p value 0.007).

Platelet count	*SpO2*		
	>94%	*90–94%*	*<90%*
150000–450000	11	4	5
50000–150000	8	6	8
<50000	0	1	6
TOTAL	19	11	19



Graph 2: The above chart shows a negative correlation with a) Modified Shock Index and a positive correlation with b) Alkaline phosphatase levels

DISCUSSION

No one knew about a newly discovered organism in the Hubei province of China in December 2019 results' Pneumonia of unknown etiology' would bring the world to a halt, beginning of the pandemic 300 cases in January 2020 and crossed 100 million in March, which 11 million cases alone from India.[6]

The Coronavirus is a known single-stranded RNA virus that causes disease in humans and other mammals like rabbits, dogs, and sheep. In the past, it has been known to cause two other epidemics, one being Severe acute Respiratory distress (SARS) in 2002-2003 and the other being Middle East Respiratory Syndrome (MERS) in 2012.[7,8]

SARS-CoV-2 is the causative organism of the pandemic 2020-2021, having a diameter of 60–140 nm with spikes that give the appearance of a solar corona to the virions. The mechanism of infection is via targeting nasal and bronchial epithelial cells and pneumocytes via S protein (Spike Protein) which binds the ACE 2 receptor. The type 2 transmembrane serine protease (TMPRSS2) in the host cell promotes viral uptake by cleaving ACE2 and activating the SARS-CoV-2 S protein, which mediates coronavirus entry into host cells.[9]

The SARS-CoV-2 is similar to the influenza virus in the mode of transmission via droplets, fomites, contact, and disease presentation as both cause mild to severe respiratory illness but differ in speed of transmission having a shorter incubation period in influenza (3 days) as compared to COVID-19 (5-6 days). The number of secondary infections from one infected individual is 2 to 2.5 for COVID-19. WHO stated eighty percent of infections are mild or asymptomatic, 15% are severe infections, requiring oxygen and 5% are critical infections of COVID-19, requiring ventilator support this fraction of severity and critical infection is higher as compared to influenza, the crude mortality ratio is between 3–4% for COVID-19 but lower in influenza 0.1%.[10]

Since the rapid spread of the virus and its mode of human-to-human transmission via respiratory droplets, fomites have played an environmental role.[11,12] The strict restriction of human activities with restriction of school opening, labeling regions as red, yellow, orange, and green based on several active cases, and implementation of strict quarantine protocols mandated to intercept transmission led to worldwide lock down.[13]

In trauma scenarios apart from universal precautions, routine testing should be mandated as the history of COVID-19-like symptoms may or may not be present. If fever is present must be differentiated from traumatic causes as an inflammatory response like SIRS to infection or post-procedural complications.[14]

In the first wave of COVID-19 experienced target population of age was usually older and patients with underlying chronic medical and immunosuppressive conditions. However, in our study, the spectrum of patients affected ranged from 13–85 years of age with the majority of male patients belonging to the middle age group 21–40 years of age (47%) and older than 40 years in 35%. This could verily be explained by the age commonly affected by trauma, as the highest number of injuries occurs among men and in the economically productive age group of 21–49 years in India.[15] None of the patients had any associated chronic co-morbid illness.

Based on the injury site, the traumatic patient was classified as thoracic, abdominal, limb, and polytrauma. The majority of cases presented had polytrauma 34.7% followed by isolated Thoracic trauma 32.7% and abdominal trauma 20.4%. An Injury severity score (ISS) of more than 25 was found in 38.8% of patients with only 6% of patients having a score value of <9. On the other hand, 61% of patients had a Modified Shock index value between 0.7–1.3 and 39% as >1.3, thus giving us an idea of the severity of trauma.

***The national guidelines have sub-classified patients into mild, moderate, and severe depending on clinical presentation and clinical parameters, around 39% (38.8) of cases belong to the mild and severe disease, with the moderate disease in 22.44%. Management of mild required only symptomatic treatment and moderate oxygen support with anticoagulation, corticosteroids, and antiviral. Severe category on the other hand, required early oxygen support, corticosteroids, high dose anticoagulation, management of shock, convalescent plasma, and remdesivir and ventilator.[16] Out of 49 patients, 1 with severe disease (SpO2) expired with an Injury severity score of 16 and MSI of < 1.3, and platelet count was 45,000. It revealed a mortality rate of 2%. Rest severe disease patients needed respiratory support as high flow nasal oxygen (10–15 Litres/min) or noninvasive mechanical ventilation.

The proposed mechanisms remain unclear, however, dysregulated megakaryocytic maturation due to SARS-CoV-2 infection with increased platelet destruction and consumption due to intravascular coagulation may play a role.[17] The majority (73%) of the patients having severe disease had platelet counts of less than 150,000 with 31.5% having less than 50,000 platelet count. Thrombocytopenia is associated with DIC, severe manifestations, and mortality of the patient. A significant positive correlation of SpO_2 with platelet count was seen (p-value of 0.014).

Similar to other respiratory viral diseases, like influenza, profound lymphopenia may occur in individuals with COVID-19 when SARS-CoV-2 infects and kills T lymphocyte cells. In addition, the viral inflammatory response, consisting of both the innate and the adaptive immune response

(comprising humoral and cell-mediated immunity), impairs lymphopoiesis and increases lymphocyte apoptosis.[9,18,19]

Majority of patients (63.3%) had lymphopenia in the present study, however, no correlation was established between the Clinical Severity of COVID-19 and Absolute lymphocyte count levels. This finding may be attributable to the fact that the Lymphocyte count taken into the study was at the initial presentation and not during the course of the disease when lymphopenia would have been more renounced. This finding corroborates this finding because there could be normal or decreased lymphocyte count at the initial stage of SARS-COV2 infection.[20]

After assessment of various clinical and biochemical parameters, Oxygen saturation levels were found to have a positive correlation between alkaline phosphatase levels in LFT (0.044) and a negative correlation with the Modified shock index (p value=-0.03).

No significant correlation between Absolute lymphocyte count or the number of days of hospitalization was found with the severity of COVID-19 based on Clinical SpO2 level. Also, no correlation was found between SpO2 and the Injury severity score of the patient.

In our study, abnormal liver function tests were present in 79% of patients although the traumatic liver injury was present in only 10.2% of cases. As most patients did not have any history of hepatotoxic drug intake and as the LFT values were taken at the time of presentation, this led to the thought that disease per se is causative of liver injury. A study pointed out that SARS-CoV-2 might directly bind to ACE2-positive cholangiocytes and cause liver damage,[21] explaining the finding of liver dysfunction.

The current study is a pioneer study describing the clinical and biochemical implications of COVID-19 in trauma victims. The burden of COVID-19 on trauma patients is increasing. These patients are usually asymptomatic at presentation and are more likely to worsen on surgery and follow-up due to their immune-compromised state about their trauma severity. Hence a keen eye is required from the diagnosis to post-operative management as a disease per se also limits the contact with the patient. These candidates, if improperly managed, could add to the morbidity and mortality number, but they are good candidates for a speedy recovery if managed well as the majority do not have any underlying chronic comorbidity to add on with.

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