Sympathetic storm or Cytokine storm: A diagnostic dilemma in patient of traumatic brain injury with COVID 19.

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Abstract

Purpose: Paroxysmal sympathetic hyperactivity (PSH) occurs in around 15-33% patients of traumatic brain injury. Due to presence of non-specific symptoms, it's always difficult to differentiate between paroxysmal sympathetic storm and cytokine storm syndrome and hence can delay specific treatment.

Case Report: We report a clinical case of 19-year-old male tested COVID 19 positive with diffuse axonal injury presented with features of paroxysmal sympathetic storm and cytokine storm syndrome. The patient showed the signs clinical improvement when we treated both these conditions.

Conclusion: We suggest that clinicians need to have a high degree of suspicion of paroxysmal sympathetic storm in patients of traumatic brain injury and consider its diagnosis. Also, if patient is COVID 19 positive, early identification of signs of developing cytokine storm with monitoring of biomarkers is important for its timely management.

Keywords: COVID-19; Paroxysmal Sympathetic Hyperactivity, Cytokine Storm syndrome.

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INTRODUCTION

Paroxysmal sympathetic hyperactivity (PSH) occurs in around 15-33% patients of traumatic brain injury(1). It presents with signs and symptoms of sympathetic overactivity which includes tachycardia, hypertension, tachypnea, hyperthermia, diaphoresis and dystonia. Delay in timely detection and management of paroxysmal sympathetic storm (PSS) is associated with higher mortality. In present time of pandemic cytokine storm may play a role in increasing mortality in COVID-19 patients by causing acute respiratory distress syndrome and multiorgan failure. Cytokine storm results because of hyperactivated immune system releasing immense amounts of proinflammatory mediators. Non-specific symptoms make it difficult to differentiate between PSS and cytokine storm syndrome (CSS) and hence can delay specific treatment. We report a clinical case of COVID-19 and diffuse axonal injury with paroxysmal sympathetic storm that improved when treated for PSS and CSS. A written informed consent was obtained from patient relative.

CASE REPORT

A 19 years old male had a road traffic accident

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as he lost control of his motorcycle and was brought to the hospital via ambulance. On arrival to the emergency department, patient was unresponsive and had a Glasgow Coma Scale (GCS) of 5. His pupils were symmetric and reactive bilaterally, vital were: blood pressure (BP) 185/105 mm Hg, pulse rate 125 beats/min and oxygen saturation 85% on room air. In order to maintain oxygenation, protect airway, patient was intubated by performing a rapid sequence induction. Other examination and Focused Assessment with Sonography for Trauma (FAST) were unremarkable. An urgent non-contrast computed tomography scan of the head showed concussion injury probable diffuse axonal injury in Figure 1. Due to ongoing pandemic a SARS-CoV2 RT-PCR test was done which was positive and chest x-ray suggestive of COVID-19 pneumonia. The patient was admitted to the intensive care unit (ICU) for monitoring and further management. To receive intravenous fluids, medications and for invasive monitoring a central venous catheters and arterial line were placed. He received conservative treatment diffuse axonal injury with controlled ventilation and pharmacological strategies. As the patient was also COVID 19 positive he was started with dexamethasone and low-molecular-weight heparin.

On day 6 of the admission the patient developed sudden onset of tachycardia, hypertension, tachypnea and fever. At this point of time there was no change in GCS and pupil size. On further evaluation there was no evidence of any acute infection & inflammatory markers were also not raised significantly. Patient was sedated and received invasive mechanical ventilation with a tidal volume (Vt) of 6 mL/kg ideal body weight (IBW) and 8 cmH_2O of positive end-expiratory pressure (PEEP), RR of 20 breaths/min and 60% FiO_2. Bed side ECHO did not show any evidence of pulmonary embolism and other causes of tachycardia with hypertension were ruled out. The clinical episodes were suggestive of paroxysmal sympathetic storm. In order to control these acute events he was treated with labetalol 10mg IV and in addition sedation was escalated with fentanyl and midazolam. The rapid response to treatment favored diagnosis of sympathetic storm syndrome (PSS). To manage recurrent episodes of PSS propranolol 20 mg 12 hourly was also added. Patients clinical condition deteriorated on day 8 with heart rate 137 beats/min, BP of 155/101 mm Hg, respiratory rate up to 35/min and fever of 102 Fahrenheit. There was increase in oxygen requirement, X-rays showed increased infiltrates bilaterally & his inflammatory markers continued to rise (serum ferritin 1071.8 ng/ml, serum LDH 138 U/L, C-reactive protein > 220 mg/L and IL-6 1634.7 pg/ml). In view of raised inflammatory markers and ruling out all possible contraindications we added immunomodulator, tocilizumab at a dose of (8mg/kg) 400 mg intravenously and was repeated after 24 hrs. Patient also underwent surgical tracheostomy as prolonged ventilator support was anticipated. After 18 days of mechanical ventilation patient showed clinical improvement with a gradual decrease in oxygen requirement. His level of consciousness improved and he was gradually weaned from mechanical ventilator. The patient was oriented and following commands, Glasgow Coma Scale (GCS) score of E4VTM5. Repeat testing for COVID-19 was negative, with decrease level of inflammatory markers (serum ferritin 900.20 ng/ml, serum LDH 1168.40 U/L, C-reactive protein 30.98 mg/ml and IL-6 6.50 pg/ml) as patient made good progress he was transferred to a ward.

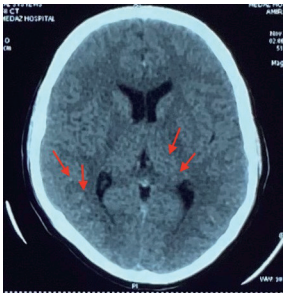

Fig. 1. Non contrast Computed tomography scan of head showing Diffuse Axonal Injury (red arrow)

DISCUSSION

Clinical presentation of paroxysmal sympathetic storm has been well described in literature since long time. Some of the important risk factor for the development of PSS is traumatic brain injury followed by hypoxia, stroke, tumor and infections[2]. Although the mechanism of PSS is not fully understood, functional disconnection of systems may be important factor for autonomic control and is considered to be one reasons and noxious stimuli may act as a trigger. It is a syndrome that manifest acutely in cyclic episodes and is characterized by fever,

diaphoresis, tachycardia, hypertension, tachypnea and dystonic posturing. No confirmatory tests are available for diagnosis of PSS however a clinical feature scale and diagnosis likelihood tool has been developed to help in making the probable diagnosis[3]. Paroxysmal Sympathetic Hyperactivity Assessment Measure scale evaluates the probability of PSS. It consists of clinical feature scale (CFS) to assess severity of the clinical parameters (heart rate, respiratory rate, systolic pressure, posture etc) and diagnosis likelihood tool (DLT) to assess the characteristics of the episodes (frequency, duration, persistence over time, simultaneity, etc.). The total score obtained by addition of CFS and DLS scores gives the estimate of PSS diagnosis[4]. PSS is a neurological emergency that will affect the outcome so high index of suspicious is important for its early diagnosis and management. As PSH is diagnosed by exclusion, in critically ill patients other pathologic cause needs to be ruled out like seizures, sepsis and pulmonary embolism. In our case as the patient was also COVID 19 positive it was very essential to distinguish PSS from cytokine storm as their manifestation are similar but the treatment is different[5]. The management of PSS comprises of avoiding triggering events and controlling excessive sympathetic activity. Pharmacological therapies include use of sedatives, analgesics, muscle relaxants and antiadrenergic drugs. Whereas the treatment planning for cytokine storm involves removing triggers for hyperactivation of immune system, use of immunomodulators or immunosuppressants and controlling of the underlying disease. In this case patient initially presented with PSS therefore he was treated with labetalol and propranolol which was effective in resolving the signs & symptoms. But 2 days later there was similar presentation accompanied persistent fever, hypoxia, high inflammatory markers (ferritin and CRP) and raised IL6 levels. This time patient was managed in the line of cytokine storm and received tocilizumab a monoclonal antibody, after which there was gradual improvement evident by reduction in oxygen requirement and reduction in inflammatory markers. This case describes the successful management of diffuse axonal injury with paroxysmal sympathetic and a cytokine storm in COVID 19 patient.

CONCLUSION

We suggest that clinicians need to high degree of suspicion of PSS in patients of traumatic brain injury and consider its diagnosis. Also, if patient is COVID 19 positive, early identification of signs of developing cytokine storm with monitoring of biomarkers is important for its timely management.

AUTHOR CONTRIBUTIONS

K.S. Drafting/revising the manuscript, data acquisition, study concept or design, analysis or interpretation of data.

N.K. Drafting/revising the manuscript, data acquisition, study concept or design, analysis or interpretation of data.

A.K. Drafting/ revising the manuscript, data acquisition, study concept or design, analysis or interpretation of data.

A.K. Drafting/ revising the manuscript, Data acquisition, critical review of manuscript.

A.R.S. Data acquisition, analysis or interpretation of data.

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