Case Report

ACUTE NEUROMUSCULAR RESPIRATORY FAILURE: A DIAGNOSTIC CHALLENGE DURING THE COVID-19 PANDEMIC

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ABSTRACT

Background: Acute respiratory failure is a common presentation in COVID-19 patients, but other causes should not be overlooked. Neurotoxic snake bites can also cause acute respiratory system involvement, though they are rare.

Case Presentation: We report the case of a 20-year-old male who presented to the emergency department during the peak of the COVID-19 pandemic with sudden onset dyspnea and low-grade fever. Although the absence of any significant history initially raised suspicion of COVID-19 induced lung involvement, radiological findings and PCR swab results ruled out COVID-19 infection. Reevaluation revealed a neuromuscular cause due to recent flooding in the patient's area and subsequent snakebite. Empiric anti-venom therapy was initiated, and the patient showed remarkable recovery after 24 hours, weaning off the ventilator.

Conclusion: This case highlights the importance of considering alternative diagnoses in patients presenting with acute respiratory failure during the COVID-19 pandemic, especially in regions with a higher risk of snakebite.

Keywords: Snake Bite, COVID-19, Respiratory Paralysis, Antivenom, Pakistan

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INTRODUCTION

Snakebite remains a significant public health concern in many tropical and subtropical countries, leading to millions of bites and tens of thousands of fatalities each year globally[1]. In Pakistan, the estimated annual mortality rate from snakebites is 1.9 per 100,000, with various venomous snakes, such as Saw Scaled Viper, Lavantine Viper, Persian Horned Viper, Asian Cobras, Common Indian Krait, and Russel's Viper, pose a threat to human health. Symptoms of snakebites can be categorized into hemotoxic, neurotoxic, and myotoxic, with Kraits and Cobras being neurotoxic in nature. Envenomation by these snakes can result in a broad spectrum of presentations, ranging from ptosis and ophthalmoplegia to respiratory arrest due to neurotoxic effects.

During the COVID-19 pandemic, respiratory failure was a common presentation in affected patients, primarily associated with severe COVID-19 pneumonia[2]. However, it is essential for clinicians to recognize that not all cases of respiratory failure are related to COVID-19. Snakebite-induced acute respiratory failure is a significant differential diagnosis that may present as a diagnostic challenge, particularly when there is no clear history of envenomation. Clinicians need to be aware of rare and uncommon presentations of respiratory failure in order to identify the cause correctly. In this context, we present a case

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report of acute neuromuscular respiratory failure, suspected to be caused by a snakebite, which posed a diagnostic dilemma during the COVID-19 pandemic. This report highlights the importance of considering uncommon causes of respiratory failure to ensure timely and accurate management of such cases.

CASE PRESENTATION

A 20-year-old healthy nonsmoker male was presented to the emergency department (ED) in early September 2020, with acute dyspnea and low-grade fever that started abruptly the previous morning. At around 10 AM, he experienced dyspnea accompanied by occasional dry cough, but no chest pain, cyanosis, or wheezing. The patient had no history of headache, vomiting, muscle pain, or contact with any COVID-19 infected individuals. He reported vague abdominal pain and fatigue, for which he took acetaminophen with no relief.

During his ED stay, his oxygen saturation began to drop, and with the rising number of COVID-19 cases during the first wave in Pakistan, the suspicion of severe COVID-19 pneumonia led to immediate intubation and ventilatory support, followed by transfer to the Covid intensive care unit (ICU). He was managed as a case of presumed COVID-19 pneumonia and received appropriate antibiotics, steroids, and general supportive care according to hospital protocol. He was afebrile with a heart rate of 100 beats per minute and blood pressure of 100/60 mmHg. Oxygen saturation was 100% at a fraction of inspired oxygen of 40%. The chest was clear on auscultation, and normal heart sounds were audible. Neurological examination revealed bilaterally reactive pupils, no papilledema, and down going planters. Peripheral reflexes could not be elicited. His complete neurology assessment could not be performed as he was sedated and paralyzed.

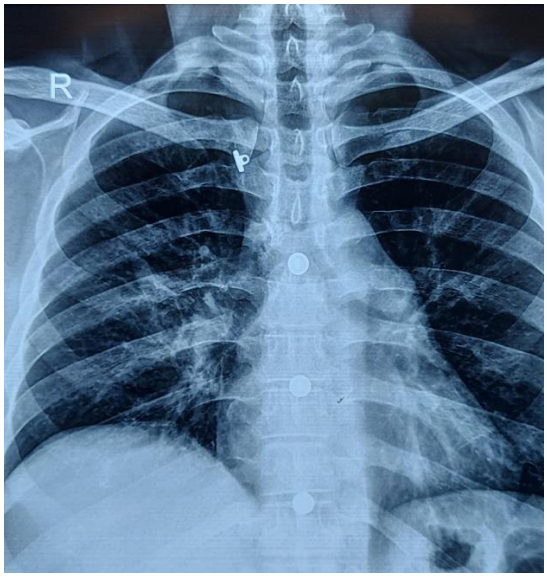

Figure 1: Chest X-Ray showing normal findings

Figure 2: High-resolution computed tomography (HRCT) chest showing normal findings

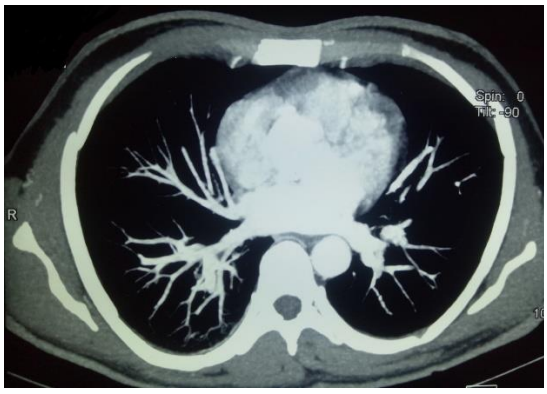

Figure 3: CT pulmonary angiogram of chest showing normal findings

However, the patient's COVID-19 PCR test was negative, and further evaluation by a neurologist and infectious disease specialist

was initiated. The Total Leucocyte Count (TLC) was elevated, and mild coagulopathy was noted in Prothrombin time (PT) and Partial Thromboplastin time (PTTK) tests. As the investigations did not provide a clear cause for the symptoms, the team shifted the focus to a possible neuromuscular cause for the respiratory failure. Considering the patient's mild coagulopathy, abdominal pain, and acute neuromuscular respiratory failure as the primary presentation, the team explored the possibility of a snake bite, despite no visible fang marks. Empirically, the patient received anti-venom treatment and a neostigmine infusion to address neuromuscular junction paralysis. The patient responded remarkably to this treatment, and within 72 hours, he was successfully weaned off the ventilator.

The case was a medical mystery for the treating team. The team decided to follow the principle of parsimony of diagnosis. The primary author had previous experience of dealing with such cases. During the multidisciplinary meeting, he recommended focusing on two important things in the history and findings pertinent to the diagnosis. The first was mild coagulopathy and abdominal pain, and the second was an acute neuromuscular respiratory failure as the initial presentation. There was a consensus that considering all the investigations and a negative COVID-19 test, the most likely explanation for acute respiratory failure was a possible undetected snake bite. The legs, arms, and buttocks were thoroughly inspected for any possible fang marks, but no marks were found. The coagulation profile, including PT, PTTK was repeated and was still abnormally high (PT 18/14 seconds and PTTK 46/34). The team decided to administer anti-venom as empirical treatment[4]. In addition, the patient was given a neostigmine infusion for eight hours to help recover neuromuscular junction paralysis. The patients responded very well to this treatment protocol. The coagulation profile returned to normal within 24 h, and within 72-hour time, he was successfully weaned from the ventilator. We inquired about any history of insect or snake bites that he denied. He was discharged after seven days of hospital stay with a normal coagulation profile.

DISCUSSION

This case highlights the unique and life-threatening presentation and management of neurotoxic snake bite with evident neuromuscular respiratory failure during the peak of COVID-19. The COVID-19 is an unprecedented global health care crisis. We have presented a case of acute respiratory failure, which presented as a diagnostic dilemma. A complete history could not be obtained, and the initial radiological and laboratory data did not suggest a clear diagnosis. However, in clinical medicine, one can identify and join relevant pieces of information just like in a jigsaw puzzle and ignore red herrings to reach a conclusion. The case presented during the first peak of the COVID-19 pandemic and the index of suspicion was high, and COVID-19 pneumonia leading to the respiratory failure was usually the first consideration in such cases.

The team applied the principle of parsimony of diagnosis or Occam's Razor that states that "Among competing hypotheses, favor the simplest one"[5]. This means that when investigating a patient with multiple symptoms, clinicians should aim to find a single diagnosis rather than multiple unrelated ones[6]. While this principle is not absolute and may not apply to the elderly, cancer patients, or those with multiple comorbidities, it remains valuable for younger patients.

After excluding COVID-19 pneumonia as a possible cause, we systematically analyzed the patient's signs, symptoms, and diagnostic data to determine the most likely explanation for his acute respiratory failure and mild coagulopathy. Our analysis led us to a hypothetical diagnosis that was later confirmed by the patient's recovery with the prescribed treatment.

One key factor in our differential diagnosis was the normal HRCT chest, which ruled out COVID-19 pneumonia and pulmonary

embolism which helped to narrow down the possible causes of neuromuscular failure as being the likely reason of dropped oxygen saturation. We also considered the possibility of Guillain-Barré syndrome, but the patient's symptoms and progression were not typical of this condition[7]. In addition, COVID-19 is unlikely to present as Guillain-Barré syndrome without lung involvement and a negative PCR test. Given the short duration of onset, toxic causes were the first consideration compared to infectious or metabolic causes. Additionally, there was evidence of mild coagulopathy, as shown by the deranged PT and PTTK results.

Botulism was also considered, but it is rare in Pakistan and did not match the patient's symptoms. Given that the city was experiencing urban flooding, we considered the possibility of snakebite, which often increases after flooding. Reports from neighboring countries like India suggest that up to 35% of snakebites occur in the early morning hours without any documented history[8]. This makes it crucial for healthcare professionals to be aware of the unusual presentation of snakebites, especially when patients present with sudden onset respiratory failure.

It is worth noting that identifying the snake species responsible for the bite is often challenging, as majority of healthcare workers and physicians in Pakistan are not formally trained to do so. Kraits, cobras, and vipers are commonly found in the region, with kraits being particularly dangerous due to their potent neurotoxic venom. Their dark bodies and tendency to remain low in vegetation make them difficult to notice, especially during the early morning hours when people are out for prayer, fieldwork, or defecation[9]. Furthermore, kraits can have a painless bite and cause minimal local swelling. Therefore, increasing awareness among healthcare professionals regarding the unique presentation of snakebites is crucial for timely intervention and potentially lifesaving treatment.

Acute neuromuscular paralysis is the most frequent and severe manifestation of neurotoxicity resulting in death. Kraits and cobras produce pre-synaptic and post-synaptic neurotoxins that mainly target the muscles of the throat, eye, tongue, and chest, leading to respiratory paralysis[10]. The severity of envenomation and respiratory paralysis depends on various factors such as the amount and potency of venom injected, the anatomical location of the bite, age, health status, and immune system of the victim[10,11]. However, prompt diagnosis followed by administration of anti-snake venom can be lifesaving in snakebite cases.

As Sir Arthur Conan Doyle said, "when you have eliminated the impossible, whatever remains, however improbable, must be the truth." This quote still holds true today, emphasizing the importance of considering all possible explanations and ruling out the unlikely ones to reach an accurate diagnosis[10].

CONCLUSION

This case report highlights the importance of considering alternative causes of acute respiratory failure in COVID-19 negative patients. Healthcare professionals practicing in regions where snake bites are prevalent must be vigilant regarding the atypical symptoms of snake envenomation, particularly in instances where patients experience sudden respiratory distress in the early morning, despite no apparent history of snake bites. Timely and accurate diagnosis, along with prompt administration of antivenom, plays a critical role in saving lives. Furthermore, during global health crises like COVID-19, maintaining vigilance and exploring alternative diagnoses for conditions with overlapping presentations is paramount. Early identification and treatment of snake bite is pivotal in avoiding unnecessary ventilator support and enhancing patient outcome.

AUTHORS CONTRIBUTIONS:

IA: Identification, diagnosis, and management of the case, drafting the manuscript, critical

review, approval of the final version to be published.
FAR: Literature search, drafting the manuscript, critical review, approval of the final version to be published.
MAA: Drafting the manuscript, critical review, approval of the final version to be published.

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