Rhabdomyolysis as the Initial Presentation of SARS-CoV-2 in an Adolescent

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The novel coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has created a global pandemic unlike any seen in modern history. Originating from Wuhan, China in December 2019, there have now been 21,294,845 confirmed cases, 761,779 deaths, and 216 countries, areas, and territories reporting cases according to the World Health Organization as of August 16th, 2020.1 Many reported cases have affected the elderly; however, children have been affected as well, with ~2.4% of cases occurring in patients <18 years of age worldwide, with a higher incidence in the United States of up to 3.7% in ages 10 to 19.2,3 Some children remain asymptomatic during infection with the virus; nevertheless, the most-common symptoms reported are fever, cough, chills, dyspnea, myalgias, sore throat, anosmia, ageusia, nausea, vomiting, and diarrhea.4-6 There have been no published cases of rhabdomyolysis as the primary sign of COVID-19 in children and adolescents. In this article, we discuss a case of COVID-19 presenting as rhabdomyolysis in an adolescent boy.

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On physical examination, he had bilateral tenderness to palpation in his anterior shoulders and thighs. His physical examination was otherwise unremarkable. A chest radiograph revealed no evidence of pneumonia or other acute cardiopulmonary process.

Laboratory tests in the ED included a urinalysis, which revealed an amber and cloudy appearance, pH of 6.0, proteinuria measured at 100 mg/dL, and a large amount of blood, measuring >4+ on urine dipstick but <1 intact red blood cell on urine microscopy. A creatinine kinase (CK) level was elevated at 116 640 U/L. A complete metabolic panel revealed an elevated lactate dehydrogenase (LDH) of 7389 U/L and elevated hepatic enzymes, with an aspartate aminotransferase (AST) of 662 U/L and an alanine aminotransferase (ALT) of 131 U/L. The patient’s serum nitrogen and creatinine were within normal range at 12 and 0.8 mg/dL, respectively, on presentation. A nasopharyngeal SARS-CoV-2 real-time reverse transcription polymerase chain reaction test was sent from the ED, which detected the presence of the virus on day 2 of admission. A respiratory viral panel testing for additional viruses was not completed due to hospital protocol to preserve nasopharyngeal viral swabs. The patient was admitted to the PICU, because of COVID-19–positive status per hospital protocol, for management of rhabdomyolysis.

HOSPITAL COURSE

In the PICU, the patient had low-grade fevers on hospital days (HDs) 1 and 2, with a peak temperature of 39.4°C, and remained febrile for the remainder of his hospitalization, without antipyretic therapy. Intravenous fluids were initiated on HD 1 by using 0.9% normal saline at 2 times the maintenance rate. Over the course of his hospital stay, intravenous fluids included a combination 0.9% normal saline and 0.45% normal saline with sodium bicarbonate. Fluids were titrated to achieve alkalinization of the urine, with a goal urine pH of 8.0. The patient’s CK levels continued to uptrend, with a maximum of 392 488 U/L on HD 3, and then began to downtrend with a nadir of 13 912 U/L before discharge. Additionally, his AST, ALT, and LDH began to uptrend until HD 2 to 3, and then steadily decreased until discharge (see Table 1). Because of concern over worsening rhabdomyolysis, leading to the potential for life-threatening electrolyte abnormalities and renal injury, consideration was also given to the administration of remdesivir, which the hospital possessed exclusively for experimental use. After consultation with the infectious disease service, it was determined that the patient could only receive the medication in a compassionate use capacity. He did not qualify on the basis of his age and clinical status. Administration of glucocorticoids was also entertained, to suppress the inflammatory process. However, at that time, the general consensus among medical professionals was that this therapeutic modality was not recommended for infection with this virus. He exhibited myoglobinuria and proteinuria each day until HD 6, with daily improvement in urine color. The pain in his upper and lower extremities also improved, resolving completely on HD 7. His kidney function and electrolyte levels remained stable in normal range over the course of the hospitalization (see Table 1). The patient denied symptoms of shortness of breath, cough, sore throat, and chills throughout his hospital course. The patient was discharged on HD 9, with follow-up 8 days after discharge, at which point he remained asymptomatic. No additional laboratories were completed at this time.

DISCUSSION

Rhabdomyolysis is “the dissolution of striated muscle,” resulting in the release of muscle cell contents, including electrolytes (potassium and phosphates), enzymes (CK, LDH, and AST), and proteins (myoglobin), as demonstrated in the laboratory abnormalities of our patient. The underlying pathophysiology resulting in the lysis of myocytes involves increased intracellular calcium levels that increase calcium-dependent enzyme activity that subsequently destroys cell membrane proteins. Rhabdomyolysis is commonly the result of congenital disorders or infections in children, with viral infections accounting for the majority of the pathogens. Influenza A and B, enteroviruses, and HIV have been most implicated in precipitating rhabdomyolysis. Less commonly, it can be triggered by herpesviruses, Chinkungunya, and norovirus. Infection with another coronavirus, severe acute respiratory

<table>
<thead>
<tr>
<th>HD</th>
<th>CK (U/L)</th>
<th>AST (U/L)</th>
<th>ALT (U/L)</th>
<th>LDH (U/L)</th>
<th>Potassium, mEq/L</th>
<th>Phosphate, mg/dL</th>
<th>Calcium, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>116 640</td>
<td>662</td>
<td>131</td>
<td>7389</td>
<td>4.0</td>
<td>4.8</td>
<td>9.1</td>
</tr>
<tr>
<td>1</td>
<td>196 341</td>
<td>991</td>
<td>185</td>
<td>10 728</td>
<td>4.0</td>
<td>4.2</td>
<td>8.7</td>
</tr>
<tr>
<td>2</td>
<td>268 526</td>
<td>1291</td>
<td>261</td>
<td>10 774</td>
<td>4.4</td>
<td>4.3</td>
<td>8.4</td>
</tr>
<tr>
<td>3</td>
<td>392 488</td>
<td>2055</td>
<td>385</td>
<td>13 942</td>
<td>4.7</td>
<td>4.2</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>160 975</td>
<td>1695</td>
<td>426</td>
<td>6059</td>
<td>4.4</td>
<td>3.9</td>
<td>8.4</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>1053</td>
<td>381</td>
<td>2214</td>
<td>4.2</td>
<td>3.9</td>
<td>8.4</td>
</tr>
<tr>
<td>6</td>
<td>28 965</td>
<td>558</td>
<td>342</td>
<td>563</td>
<td>4.1</td>
<td>3.9</td>
<td>8.6</td>
</tr>
<tr>
<td>7</td>
<td>15 912</td>
<td>230</td>
<td>263</td>
<td>—</td>
<td>4.2</td>
<td>4.4</td>
<td>9.2</td>
</tr>
</tbody>
</table>

—, laboratory value not obtained on this day.
Rhabdomyolysis has also been associated with COVID-19, with several cases reported in the literature. Jin and Tong presented a case of rhabdomyolysis as a late complication of COVID-19 infection in a 60-year-old man in Wuhan, China. Suwanwongse and Shabarek presented a case of an 88-year-old man with rhabdomyolysis as an initial presentation of COVID-19; and Valente-Acosta et al also presented a case of a 71-year-old man with rhabdomyolysis as an initial presentation of COVID-19. In each case, the primary signs and symptoms were cough and fever. Rhabdomyolysis was an incidental finding and the peak CK of <14 000, hardly life-threatening. However, current working theories include direct invasion into muscle tissue by a viral agent and myotoxic cytokines released in response to a virus. With our case, we report the first pediatric patient with COVID-19, or other coronaviruses, whose presenting symptom was severe rhabdomyolysis with an extremely elevated CK, which peaked at almost 400 000. This case adds to the growing body of literature of a variety of life-threatening manifestations associated with SARS-CoV-2 infection. One limitation of this report is that there was no way to definitively rule out other viruses as a cause of this patient’s disease; however, other viruses are less likely given the time of presentation in May, which is after the typical respiratory season. Pediatric patients with COVID-19 have increasingly started having unique presentations of this disease, including immune thrombocytopenia, respiratory failure, severe thrombocytopenia, multisystem inflammatory syndrome, and myocarditis, especially with those patients presenting with predominantly gastrointestinal symptoms. Prompt recognition of these associations is important for proper testing, triage, and isolation precautions. Furthermore, continuous monitoring and publications of novel presentations will be important for clinicians as this disease continues to manifest itself in various ways.

**CONCLUSIONS**

Rhabdomyolysis can be a presenting finding of COVID-19 in pediatric patients, and high clinical suspicion must be held for any patient demonstrating signs or symptoms of rhabdomyolysis.

**ACKNOWLEDGMENTS**

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**ABBREVIATIONS**

ALT: alanine aminotransferase  
AST: aspartate aminotransferase  
CK: creatinine kinase  
COVID-19: novel coronavirus disease 2019  
ED: emergency department  
HD: hospital day  
LDH: lactate dehydrogenase  
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

**REFERENCES**


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