COVID-19 Induced Acute Pancreatitis in a Malagasy Woman Patient: Case Report and Literature Review

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Background: SARS-CoV-2 has been described as a respiratory tropic virus since its emergence in December 2019. During the course of the disease, other extra-pulmonary manifestations have been reported in the literature including pancreatic involvement such as acute pancreatitis. This phenomenon linking COVID-19 and acute pancreatitis has been reported by several case reports and cohort studies. No cases had been reported in sub-Saharan Africa and Madagascar. We report one more case OF COVID-19 induced acute pancreatitis in a Malagasy woman patient without risk factors, further consolidating the existing evidence.

Case Presentation: A 44-year-old woman was diagnosed with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection and had a favorable course under home isolation and drug treatments. One week later, the patient was admitted to hospital with severe acute abdominal pain. Acute pancreatitis was considered according to the revised Atlanta criteria with the presence of the three criteria. Other etiologies of acute pancreatitis (lithiasis, alcohol, hypercalcemia, hypertriglyceridemia, tumor, trauma, surgery) were excluded. Ultimately, a COVID-19 induced acute pancreatitis was retained. The outcome was favorable under symptomatic medical treatment (fluid resuscitation, bowel rest, management of pain and vomiting, and early oral feeding). The patient was discharged after one week of hospitalization.

Conclusion: COVID-19 is a possible etiology of acute pancreatitis. Acute pancreatitis should be routinely ruled out in a patient with COVID-19 infection with acute abdominal pain.

Keywords: acute pancreatitis, COVID-19, Madagascar
COVID-19 has been reported by a number of authors as a possible etiology of AP.\textsuperscript{1,7-36} Although viral AP has been described in other infections, evidence of pancreatic involvement induced by SARS-CoV-2 infection remains limited. Clinicians involved in the management of AP should be aware of its existence in the context of COVID-19.\textsuperscript{10} Moreover, no cases

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|}
\hline
\textbf{Laboratory Tests} & \textbf{Value} & \textbf{Normal Range} \\
\hline
Leukocytes (cells/L) & $15.6 \times 10^9$ & 4–10×10\textsuperscript{9} cells/L \\
Neutrophil (cells/L) & $13.7 \times 10^9$ & 1.3–75×10\textsuperscript{9} cells/L \\
Lymphocyte (cells/L) & $1.3 \times 10^9$ & 1.5–4×10\textsuperscript{9} cells/L \\
Hemoglobin (g/dL) & 14.5 & 12–16 g/dL \\
Platelet count (cells/L) & 331 & 150–450×10\textsuperscript{9} cells/L \\
Hematocrit (%) & 44.7 & 37–47% \\
C-reactive protein (mg/L) & 25 & 0–6 mg/L \\
Aspartate aminotransferase (U/L) & 41 & 5–34 U/L \\
Alanine aminotransferase (U/L) & 196 & 0–55 U/L \\
Total bilirubin (μmol/L) & 4.4 & 0–20 μmol/L \\
Gamma-lutamyl transpeptidase (U/L) & 249 & 9–36 U/L \\
Alkaline phosphatase (U/L) & 73 & 42–98 U/L \\
Serum lipase level (U/L) & 301 & 0–60 U/L \\
Blood sodium level (mmol/L) & 139 & 136–145 mmol/L \\
Blood potassium level (mmol/L) & 4.8 & 3.5–5.1 mmol/L \\
Serum calcium level (mmol/L) & 2.2 & 2.1–2.55 mmol/L \\
Serum triglyceride level (g/L) & 2.1 & 0–1.99 g/L \\
Serum creatinine level (μmol/L) & 54 & 49–90 μmol/L \\
Fasting blood glucose (mmol/L) & 6.9 & 4.1–5.6 mmol/L \\
HbA1c (glycated Hemoglobin) (%) & 6.6 & 4–6% \\
D-dimer (ng/mL) & 805 & 0–500 ng/mL \\
\hline
COVID-19 RT-PCR of nasopharyngeal swabs & Positive & – \\
Hepatitis B surface antigen & Negative & – \\
Hepatitis C antibody & Negative & – \\
Hepatitis A antibody type IgM & Negative & – \\
Human immunodeficiency virus serology & Negative & – \\
\hline
\end{tabular}
\caption{Laboratory Results}
\end{table}

\textbf{Figure 1} Chest computed tomography in a 44-year-old woman showing bilateral ground glass opacities.
have been reported in Madagascar or even in sub-Saharan Africa. We report one more case of SARS-CoV-2 infection induced AP in a Malagasy woman patient without risk factors, further consolidating the existing evidence.

Case Presentation
A 44-year-old woman was admitted to hospital during the 2nd wave of the COVID-19 pandemic in Madagascar (April 2021), for severe epigastric pain. She was neither an alcoholic nor a smoker. The patient did not report a history of trauma or recent surgery. The patient presented a week earlier with asthenia, myalgia, dry cough, a few episodes of difficulty breathing and fever. The Chest computed tomography scan showed bilateral ground glass opacities (Figure 1). COVID-19 reverse transcription polymerase chain reaction (RT-PCR) of nasopharyngeal swabs was positive. A moderate COVID-19 was retained. The patient had a favorable evolution with home isolation and drug management (paracetamol, aspirin, atorvastatin, amoxicillin-clavulanic acid, enoxaparin preventive dose). One week later, severe epigastric pain (visual analog scale 9/10), associated with nausea and vomiting (3–4 times) suddenly appeared, leading to hospitalization. General examination reported a Body mass index of 28.5 kg/m$^2$, a blood pressure of 100/70 mmHg, a heart rate of 64 bpm, a respiratory rate of 26/min and an oxygen saturation of 94%. Physical examination on admission showed epigastric tenderness and abdominal bloating. Laboratory tests reported a serum lipase level at 301 U/L (> 3 X Upper limit of normal), C-reactive protein at 25 mg/L, serum calcium level at 2.2 mmol/L, serum triglyceride level at 2.1 g/L, D-dimer at 805 ng/mL. The other laboratory tests are reported in Table 1. Abdominal ultrasound showed no extrahepatic or intrahepatic lithiasis. The Abdominal computed tomography scan showed a benign edematous pancreatitis with no evidence of gallstones (Figure 2). The outcome was favorable under symptomatic medical treatment associating fluid resuscitation, bowel rest, management of pain and vomiting, preventive dose of enoxaparin and early oral feeding upon pain resolution. The patient was discharged after one week of hospitalization. We ultimately retained the diagnosis of SARS-CoV-2 infection induced AP in a woman patient without risk factors.

Discussion and Conclusions
AP appears to be an uncommon complication or association of COVID-19.\textsuperscript{37} A retrospective American study had objectified a point prevalence of AP of 0.27% (32 patients) out of 11,883 hospitalized COVID-19 patients.\textsuperscript{38} We report

Figure 2 Abdominal computed tomography in a 44-year-old woman showing interstitial edema of the pancreas with the homogeneous enhancement of the pancreatic suggesting benign edematous pancreatitis with no evidence of gallstones.
<table>
<thead>
<tr>
<th>Authors, Years [Ref]</th>
<th>Country</th>
<th>Age (Years)</th>
<th>Sex</th>
<th>Clinical Manifestations</th>
<th>COVID-19 PCR Status</th>
<th>Severity of COVID</th>
<th>Lipase and Amylase</th>
<th>Severity of AP</th>
<th>Treatments</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acherjya GK et al, 2020</td>
<td>Bangladesh</td>
<td>57</td>
<td>F</td>
<td>Arthralgia, generalized aching, then abdominal pain on the 5th day</td>
<td>P</td>
<td>Moderate</td>
<td>L: 8352 U/L A: 80 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Eldaly AS et al, 2021</td>
<td>Egypt</td>
<td>44</td>
<td>M</td>
<td>Abdominal pain, vomiting, no respiratory symptoms</td>
<td>P</td>
<td>Asymptomatic</td>
<td>L: 286 U/L A: 773 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Wifi MN et al, 2021</td>
<td>Egypt</td>
<td>72</td>
<td>F</td>
<td>Coughing, sneezing, abdominal pain, vomiting</td>
<td>P</td>
<td>Mild</td>
<td>L: 710 U/L A: 1667 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>da Costa Ferreira et al, 2021</td>
<td>Brazil</td>
<td>35</td>
<td>M</td>
<td>Epigastric pain, dyspnea, nausea, vomiting</td>
<td>P</td>
<td>Severe</td>
<td>A: 1669 U/L</td>
<td>Severe</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Kandasamy S, 2020</td>
<td>India</td>
<td>45</td>
<td>F</td>
<td>Intense epigastric pain, nausea, vomiting, then dyspnea 1 week later</td>
<td>P</td>
<td>Moderate</td>
<td>L: 294 U/L A: 364 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Cheung S, et al, 2020</td>
<td>USA</td>
<td>38</td>
<td>M</td>
<td>Severe epigastric pain, vomiting, fever</td>
<td>P</td>
<td>Asymptomatic</td>
<td>L: 20,320 ukat/L A: N/A</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Kumaran NK, et al, 2020</td>
<td>United Kingdom</td>
<td>67</td>
<td>F</td>
<td>Epigastric pain, diarrhea, vomiting</td>
<td>P</td>
<td>Severe</td>
<td>L: N/A A: 1483 U/L</td>
<td>Severe</td>
<td>(necrotizing), antibiotic therapy</td>
<td>Favorable</td>
</tr>
<tr>
<td>Arbati MM, et al, 2021</td>
<td>Iran</td>
<td>28</td>
<td>M</td>
<td>Dyspnea, cough, myalgia, fever, severe epigastric pain, nausea, vomiting</td>
<td>P</td>
<td>Severe</td>
<td>L: 759 U/L A: 1273 U/L</td>
<td>Severe</td>
<td>(necrotizing)</td>
<td>Favorable</td>
</tr>
<tr>
<td>AlHarmi RAR et al, 2021</td>
<td>Bahrain</td>
<td>52</td>
<td>F</td>
<td>Cough, fever, dyspnea, then abdominal pain days later</td>
<td>P</td>
<td>Moderate</td>
<td>L: N/A A: N/A</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Brikman S et al, 2020</td>
<td>Israel</td>
<td>61</td>
<td>M</td>
<td>Fever, cough, dyspnea then abdominal pain at the 14th day of evolution</td>
<td>P</td>
<td>Severe</td>
<td>L: 203 U/L A: 142 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Authors</td>
<td>Country</td>
<td>Age</td>
<td>Gender</td>
<td>Symptoms</td>
<td>Prognosis</td>
<td>Treatment</td>
<td>Outcome</td>
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<tr>
<td>Kataria S et al, 2020</td>
<td>USA</td>
<td>42</td>
<td>F</td>
<td>Fever and cough then abdominal pain 2nd day</td>
<td>P Moderate</td>
<td>Benign Symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td>Purayil et al, 2020</td>
<td>Qatar</td>
<td>58</td>
<td>M</td>
<td>Fever, vomiting, epigastric pain, no respiratory symptoms</td>
<td>P Asymptomatic</td>
<td>Benign Symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td>Lakshmanan et al, 2020</td>
<td>USA</td>
<td>68</td>
<td>M</td>
<td>Anorexia, nausea then persistent nausea, vomiting several weeks later, no abdominal pain</td>
<td>P Asymptomatic</td>
<td>Benign Symptomatic medical treatment</td>
<td>Favorable</td>
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<tr>
<td>Alwaeli H et al, 2020</td>
<td>USA</td>
<td>30</td>
<td>M</td>
<td>Abdominal pain, vomiting, diarrhea, dyspnea</td>
<td>P Mild</td>
<td>Severe Symptomatic medical treatment</td>
<td>Favorable</td>
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<tr>
<td>Sandhu et al, 2021</td>
<td>India</td>
<td>25</td>
<td>F</td>
<td>Abdominal pain, fever and shortness of breath</td>
<td>P Severe</td>
<td>Severe Symptomatic medical treatment, intubation, mechanical ventilation</td>
<td>Death</td>
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<tr>
<td>Gupta A et al, 2021</td>
<td>India</td>
<td>25</td>
<td>F</td>
<td>Fever, headache, ageusia, then abdominal pain on 8 days later</td>
<td>P Severe</td>
<td>Benign Symptomatic medical treatment, antibiotic therapy, oxygenation</td>
<td>Favorable</td>
<td></td>
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<tr>
<td>Rabice SR et al, 2020</td>
<td>USA</td>
<td>36</td>
<td>F (Pregnant)</td>
<td>Cough, fever, then abdominal pain 2 days later</td>
<td>P Moderate</td>
<td>Benign Symptomatic medical treatment, then cesarean section at 38 week and 2 days of gestation</td>
<td>Favorable with alive baby</td>
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<tr>
<td>Alves AM et al, 2020</td>
<td>Brazil</td>
<td>56</td>
<td>F</td>
<td>Cough, dyspnea, general malaise and abdominal pain</td>
<td>P Severe</td>
<td>Benign Mechanical ventilation, antibiotic therapy, symptomatic medical treatment</td>
<td>Favorable</td>
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<tr>
<td>Karimzadeh et al, 2020</td>
<td>India</td>
<td>65</td>
<td>F</td>
<td>Abdominal pain, nausea, chills, myalgia</td>
<td>P Severe</td>
<td>Benign Symptomatic medical treatment, antibiotics, hydroxychloroquine, antivirals</td>
<td>Favorable</td>
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<tr>
<td>Auteurs, Years [Ref]</td>
<td>Country</td>
<td>Age (Years)</td>
<td>Sex</td>
<td>Clinical Manifestations</td>
<td>COVID-19 PCR</td>
<td>Severity of COVID</td>
<td>Lipase and Amylase</td>
<td>Severity of AP</td>
<td>Treatments</td>
<td>Outcomes</td>
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<tr>
<td>Alloway BC et al, 2020[25]</td>
<td>USA</td>
<td>7</td>
<td>F</td>
<td>Abdominal pain, anorexia, fever</td>
<td>P</td>
<td>Mild</td>
<td>L: 676 puis 1672 U/L A: N/A</td>
<td>Severe (necrotizing)</td>
<td>Symptomatic medical treatment, antibiotic therapy</td>
<td>Favorable</td>
</tr>
<tr>
<td>Bokhari SMM et al, 2020[26]</td>
<td>Pakistan</td>
<td>32</td>
<td>M</td>
<td>Recurrent fever, myalgia, cough, diarrhea, then severe abdominal pain one week later</td>
<td>P</td>
<td>Mild</td>
<td>L: 721 U/L A: 672 U/L</td>
<td>Benign</td>
<td>Symptomatic medical treatment, antibiotic therapy</td>
<td>Favorable</td>
</tr>
<tr>
<td>Simou EM et al, 2020[27]</td>
<td>Morocco</td>
<td>67</td>
<td>-</td>
<td>Dyspnea, fever, myalgia, arthralgia then deterioration with sepsis at 5th day</td>
<td>P</td>
<td>Severe</td>
<td>L: 576 U/L A: N/A</td>
<td>Grave (stage C)</td>
<td>Symptomatic medical treatment, antibiotic therapy</td>
<td>Death</td>
</tr>
<tr>
<td>Sudarsanam et al, 2021[28]</td>
<td>India</td>
<td>35</td>
<td>M</td>
<td>Abdominal pain, fever, cough</td>
<td>P</td>
<td>Mild</td>
<td>L: 42 U/L A: 46 U/L</td>
<td>Grave (necrotizing)</td>
<td>Symptomatic medical treatment, antibiotic therapy</td>
<td>Favorable</td>
</tr>
<tr>
<td>Basukala S et al, 2021[31]</td>
<td>Nepal</td>
<td>49</td>
<td>F</td>
<td>Severe abdominal pain, fever, shortness of breath</td>
<td>P</td>
<td>Severe</td>
<td>L: 568 U/L A: 1563 U/L</td>
<td>Severe (necrotic and hemorrhagic), sepsis</td>
<td>Surgery, symptomatic medical treatment, antibiotics</td>
<td>Death</td>
</tr>
<tr>
<td>Ghosh A et al, 2020[33]</td>
<td>India</td>
<td>63</td>
<td>M</td>
<td>Fever, shortness of breath, cough, no digestive signs, hypoglycemia</td>
<td>P</td>
<td>Moderate</td>
<td>L: 412 U/L A: 58 U/L</td>
<td>Severe (necrotizing)</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Country</td>
<td>Age</td>
<td>Sex</td>
<td>Symptoms</td>
<td>Test Results</td>
<td>Diagnosis</td>
<td>Treatment</td>
<td>Outcomes</td>
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<tr>
<td>Berrichi S et al, 2021</td>
<td>Morocco</td>
<td>36</td>
<td>F</td>
<td>Cough, shortness of breath, headache, then a week later, dyspnea and abdominal pain</td>
<td>P</td>
<td>Severe</td>
<td>VV-ECMO, symptomatic medical treatment, plasmapheresis</td>
<td>Death</td>
<td></td>
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<td></td>
<td></td>
<td>51</td>
<td>F</td>
<td>Severe epigastric pain, nausea, vomiting, shortness of breath</td>
<td>P</td>
<td>Moderate</td>
<td>Oxygenation, corticosteroid therapy, symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>63</td>
<td>F</td>
<td>Intermittent epigastric pain, nausea, no respiratory signs</td>
<td>P</td>
<td>Asymptomatic</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>87</td>
<td>F</td>
<td>Diffuse abdominal pain, nausea, vomiting</td>
<td>P</td>
<td>Asymptomatic</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
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<tr>
<td></td>
<td></td>
<td>64</td>
<td>F</td>
<td>Severe abdominal pain, nausea, vomiting</td>
<td>P</td>
<td>Asymptomatic</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td>Higgans JS et al, 2021</td>
<td>Malta</td>
<td>63</td>
<td>F</td>
<td>Intermittent epigastric pain, nausea, no respiratory signs</td>
<td>P</td>
<td>Asymptomatic</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
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<tr>
<td></td>
<td></td>
<td>87</td>
<td>F</td>
<td>Diffuse abdominal pain, nausea, vomiting</td>
<td>P</td>
<td>Asymptomatic</td>
<td>Symptomatic medical treatment</td>
<td>Favorable</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>64</td>
<td>F</td>
<td>Sudden-onset abdominal pain, nausea</td>
<td>P</td>
<td>asymptomatic</td>
<td>Necrotizing pancreatitis</td>
<td>Favorable</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>M</td>
<td>Sudden-onset abdominal pain, nausea</td>
<td>P</td>
<td>asymptomatic</td>
<td>Surgery, symptomatic medical treatment, antibiotics</td>
<td>Favorable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations**: Ref, reference; F, female; M, male; P, positive; L, lipase; A, amylase; COVID-19, coronavirus disease 2019; PCR, polymerase chain reaction; AP, acute pancreatitis; N/A, not available; symptomatic medical treatment, fluid resuscitation, bowel rest, management of pain and nausea; USA, United States of America; VV-ECMO, veno-venous extra-corporeal membrane oxygenation.
this first case in sub-Saharan Africa of SARS-CoV-2 infection induced AP, to show the possibility of this association in the black African population. The association between COVID-19 and AP had already been reported by many North African authors (2 cases in Egypt, 4 cases in Morocco, 6 cases in Algeria). 7,8,27,34,39

The revised Atlanta criteria defines AP if at least 2 of the following 3 criteria are met: (1) severe abdominal pain; (2) serum lipase level (or amylase) more than 3 times the upper limit of normal (ULN); (3) radiological features compatible with AP. 40 Our case fulfilled all 3 criteria, allowing us to definitely retain the diagnosis of AP.

The causes of AP are dominated by lithiasis and alcoholic causes (>80%). 40,41 But, about 10% of AP cases are directly caused by infectious microorganisms such as parasites, bacteria, and viruses. 41 Viral AP has been widely reported in the medical literature. The main viruses reported were cytomegalovirus, Epstein Barr virus, mumps, hepatitis A, B and E viruses, herpes simplex virus, varicella zona virus, coxsackie viruses, echo viruses and human immunodeficiency virus (HIV). 7,9,12,14 Recently, COVID-19 has been identified as a possible viral cause of AP. The mechanism of the relationship between pancreatitis and COVID-19 infection remains unknown and multifactorial. Pancreatic injury could be explained by the expression of angiotensin-converting enzyme-2 (ACE-2) receptors on the pancreas, with subsequent injury to the islet of the pancreas with an elevation of serum amylase and lipase enzymes and risk of development of acute diabetes, as in our case. 42 Several case reports on SARS-CoV-2 infection induced AP have been reported by numerous authors confirming this relationship between COVID-19 and AP. 1,7–36 The description of these numerous case reports of COVID-19 induced AP is reported in Table 2.

However, in our clinical practice, further investigations should be conducted to exclude other causes in order to establish a correlation between the virus and AP, to avoid misdiagnosis and subsequent mismanagement of the disease. In addition, a retrospective cohort study conducted in 6 US centers had shown that approximately 48% of patients with lipase elevation above 3 x ULN were due to non-pancreatic etiologies. 43 Hence the importance of a radiological features in favor of AP and the elimination of all other possible causes of AP. In our case, the other causes of AP (gallstones, alcohol, hypercalcemia, hypertriglyceridemia, trauma, surgery, drugs, comorbidities) were ruled out, in order to retain COVID-19 as a possible origin of AP.

Abdominal pain is a classic gastrointestinal symptom of COVID-19, which may not alert clinicians to a possible AP. 3–6 However, all reported cases of COVID-19-induced AP have reported the almost constant presence of abdominal pain, either concomitant or remote from the acute respiratory episode. 1,7–36 Hence, the importance of routine pancreatic enzyme testing (Serum lipase and/or amylase level) in COVID-19 patients with abdominal pain.

The management of viral AP is no different from the treatment of AP due to other causes. Because COVID-19 AP is moderate in 70% of reported cases (23/33 of the cases described in Table 2), symptomatic medical treatment (fluid resuscitation, bowel rest, management of pain and vomiting, and early oral feeding) combined with adequate COVID-19 management was usually sufficient, such as our case. 1,7–36

The prognosis of COVID-19-related AP was favorable in the majority of reported cases, including our patient. 1,7–36 Of the 33 case reports described in Table 2, we had listed 4 deaths, which were concomitantly related to the severity of the AP and the respiratory involvement of COVID-19. 1,7–36

In conclusion, SARS-CoV-2 infection is a possible etiology of AP. AP should be routinely ruled out in the presence of concomitant or delayed onset of acute abdominal pain in COVID-19 patients. The prognosis of COVID-19-induced AP remains favorable in the majority of cases.

Ethical Approval and Consent for Publication
Written informed consent was obtained from the patient for publication of this case report and accompanying images. The publication of this case has been approved by the University Hospital Joseph Raseta Befelatanana Antananarivo Ethics Committee.

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Author Contributions
All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Disclosure
The authors declare that they have no conflicts of interest.

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