

# <sup>99m</sup>Tc-Vitamin C SPECT/CT imaging in SARS-CoV-2 associated pneumonia

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## Abstract

We present the first <sup>99m</sup>Tc-Vitamin C single-photon emission computed tomography/computed tomography (SPECT/CT) images obtained in patients with SARS-CoV-2 (COVID-19) infection. The CT portion of SPECT/CT images showed mostly peripheral patchy and ground-glass opacities in both lungs, which are consistent with a diagnosis of SARS-CoV-2-associated pneumonia in both patients. <sup>99m</sup>Tc-Vitamin C SPECT images showed increased tracer uptake corresponding to abnormal lung findings seen on CT in patient 1 who was newly diagnosed and treatment naïve. However, no abnormal uptake corresponding to lung CT findings was seen in patient 2 who received anti-SARS-CoV-2 treatment.

**KEY words:** <sup>99m</sup>Tc-Vitamin C; SPECT/CT; SARS-Cov-2, pneumonia

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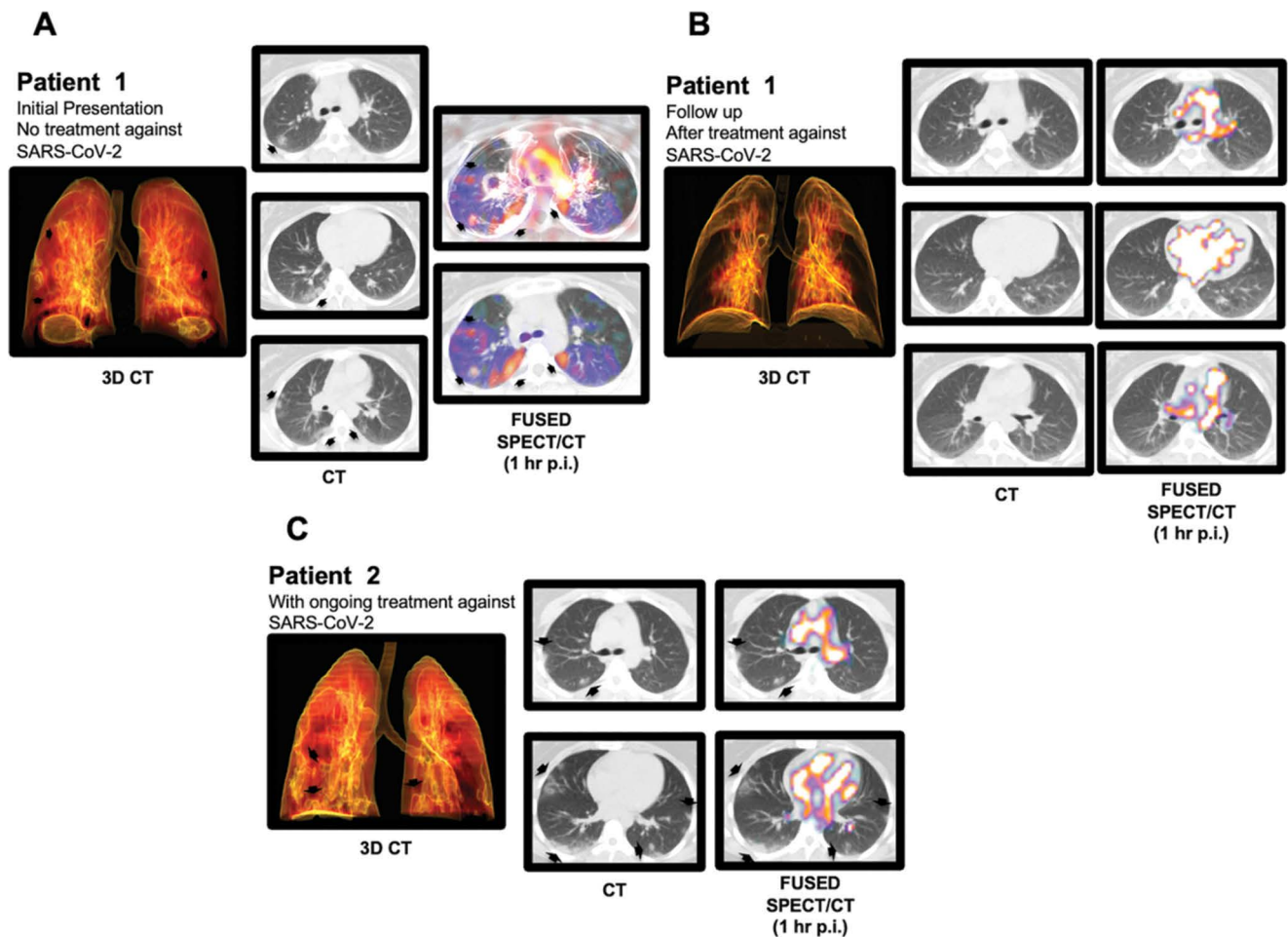
High-dose intravenous vitamin C may reduce systemic inflammation by decreasing cytokine surge and preventing lung injury in severe sepsis and acute respiratory distress syndrome [1]. It may also be beneficial in patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; COVID-19) infection; we present the first lung <sup>99m</sup>Tc-Vitamin C SPECT/CT images in these patients [2]. Patient 1, a 31-year-old woman, was diagnosed with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection based on a nasopharyngeal and oropharyngeal swab taken for SARS-CoV-2 during a screening, which was performed due to close contact with a positive case. She was mildly symptomatic, complaining of chest pain and cough without fever, cyanosis, clubbing, pursed lips expiration, use of accessory respiratory muscles, and nasal flaring. The patient was admitted and monitored. Results of the physical examination, including the chest examination, were unremarkable. On day 1 of admission, CT images showed mostly peripheral patchy and ground-glass opacities in both lungs (Fig. 1A: 3D colored volume-rendered images of CT, lung findings on CT, black arrows), consistent with SARS-CoV-2-associated pneumonia. <sup>99m</sup>Tc-Vitamin C SPECT images showed increased tracer uptake corresponding to abnormal

lung findings (fused images of SPECT/CT: top image, with physiologic blood pool uptake; bottom image, with digitally suppressed blood pool). After treatment, findings resolved with no abnormal uptake on follow-up SPECT/CT at 3 months (Fig. 1B). Patient 2, a 20-year-old woman with dry cough, and chest and muscle pain, was found positive for SARS-CoV-2 based on real-time RT-PCR testing of a nasopharyngeal swab specimen obtained on the day of admission. She had similar lung findings on CT as patient 1 although she had already been receiving standard anti-viral and anti-inflammatory treatment; however, on the 5<sup>th</sup> day of hospitalization, <sup>99m</sup>Tc-Vitamin C SPECT images showed no abnormal uptake corresponding to lung CT findings (Fig. 1C), indicating that anti-SARS-CoV-2 treatment inhibited Vitamin C uptake.

There are several cases reported of SARS-CoV-2 pneumonia and the accumulation of different nuclear medicine tracers, including <sup>18</sup>F-FDG, <sup>18</sup>F-Fluorocholine, <sup>68</sup>Gal PSMA, <sup>68</sup>Ga-DOTANOC, <sup>99m</sup>Tc-leukocyte, and <sup>99m</sup>Tc-MAA [3–8].

Vitamin C could be beneficial as a supportive treatment of sepsis and septic shock, which are common complications associated with SARS-CoV-2, by suppressing the excessive cytokine release which leads to sepsis-induced organ dysfunction and by protecting the lungs against oxidative stress. The results from these cases suggest that it could also have a detrimental effect on the SARS CoV-2 virus given its local uptake in lung lesions that are typical of SARS CoV-2 induced pneumonitis. Therefore, these cases suggest that <sup>99m</sup>Tc-Vitamin C imaging is a promising non-invasive approach to identify the presence of lung damage as well as to potentially monitor the persistence and progression of lung damage.

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**Figure 1.** 3D and axial CT images showed pulmonary findings consistent with SARS-CoV-2-associated pneumonia in patient 1 and  $^{99m}\text{Tc}$ -Vitamin C SPECT images showed increased tracer uptake corresponding to abnormal lung findings (A) and resolution of both CT and SPECT imaging findings on the follow-up study (B). In patient 2, 3D and axial CT images showed similar lung findings as patient 1; however,  $^{99m}\text{Tc}$ -Vitamin C SPECT images showed no abnormal uptake corresponding to lung CT findings in patient 2 (C)

## Conflict of interest

The authors declare no competing interests.

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