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CASE IMAGE IN CARDIOVASCULAR ULTRASOUND

Echocardiographic signs of successful thrombolysis in a pulmonary embolism and COVID-19 pneumonia

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Case

A 78-year-old woman presented to the emergency department with two weeks of weakness, cough and progressive dyspnea. Her past medical history included diabetes mellitus. On presentation, she reported increasing levels of dyspnea in the previous 48 h. Upon presentation, the patient had a temperature of 97.7˚F (36.5˚C), heart rate of 105 beats/minute, respiratory rate of 24 beats/minute, and blood pressure of 117/65 mmHg, her arterial oxygen saturation was 64%. Physical examination demonstrated crackles in bilateral lower lung fields. Admission blood work showed leukocytes 14 270/µL, creatinine 1.51 mg/dL, pH 7.43, pCO_2 25.1 mm Hg, pO_2 84.8 mm Hg, HCO_3 17 mmol/L, lactate 4.52 mmol/L, C-reactive protein of 29.3 mg/L, D-dimer level of 39,805.62 ng/mL, NT pro-BNP 15,171 pg/mL, hs-Troponine I 295.7 ng/mL, ferritin 2990 ng/mL and positive RT-PCR test for coronavirus disease 2019 (COVID-19). The electrocardiogram showed sinus tachycardia, right axis deviation and systolic overload of the right ventricle. Transthoracic echocardiogram showed dilation of right cavities and right ventricle dysfunction (Fig. 1a, Video 2), severe tricuspid regurgitation and normal left ventricular function (Ejection Fraction 66%). Computed tomography of the chest revealed a bilateral extensive *crazy paving* pattern consistent with an infectious or inflammatory process and pulmonary embolism (PE) with extension into bilateral pulmonary arteries (Fig. 1b).

Management involved initial airway stabilization with supplementary oxygen, fractional heparin for anticoagulation and intravenous levosimendan for acute right ventricle failure. However, according to the high risk of deterioration conditioned by organ dysfunction (acute kidney failure), ICU admission, high O_2 requirement, hypoperfusion and RVOT VTI < 9.5 cm, intermediate or half-dose systemic fibrinolysis consisting of intravenous alteplase 10 mg bolus followed by 40 mg over two hours. The patient experienced less supplemental oxygen requirements in the next hours. During the following 24 h she presented gastrointestinal bleeding requiring transfusion of two blood packs. At 48 h of fibrinolysis her right ventricular size and function normalized (Fig. 1c, Video 2) with tricuspid regurgitation. Due to the poor economic situation, the patient was transferred to another hospital after determining her being in better conditions and able to be moved. Unfortunately, the patient died after the transfer to the other hospital secondary to septic shock.

Discussion

In patients with pneumonia secondary to COVID-19 the principal etiology of hypoxemia is acute respiratory distress syndrome. However, when present PE plays a significant role, adding an extra point of complexity to the management of the hypoxic state. Correct selection of patients undergoing fibrinolysis therapy may therefore be the key to success or failure in the therapy of patients with COVID-19.

We evaluated the risk of decompensation based on several clinical, laboratory and echocardiographic markers to make

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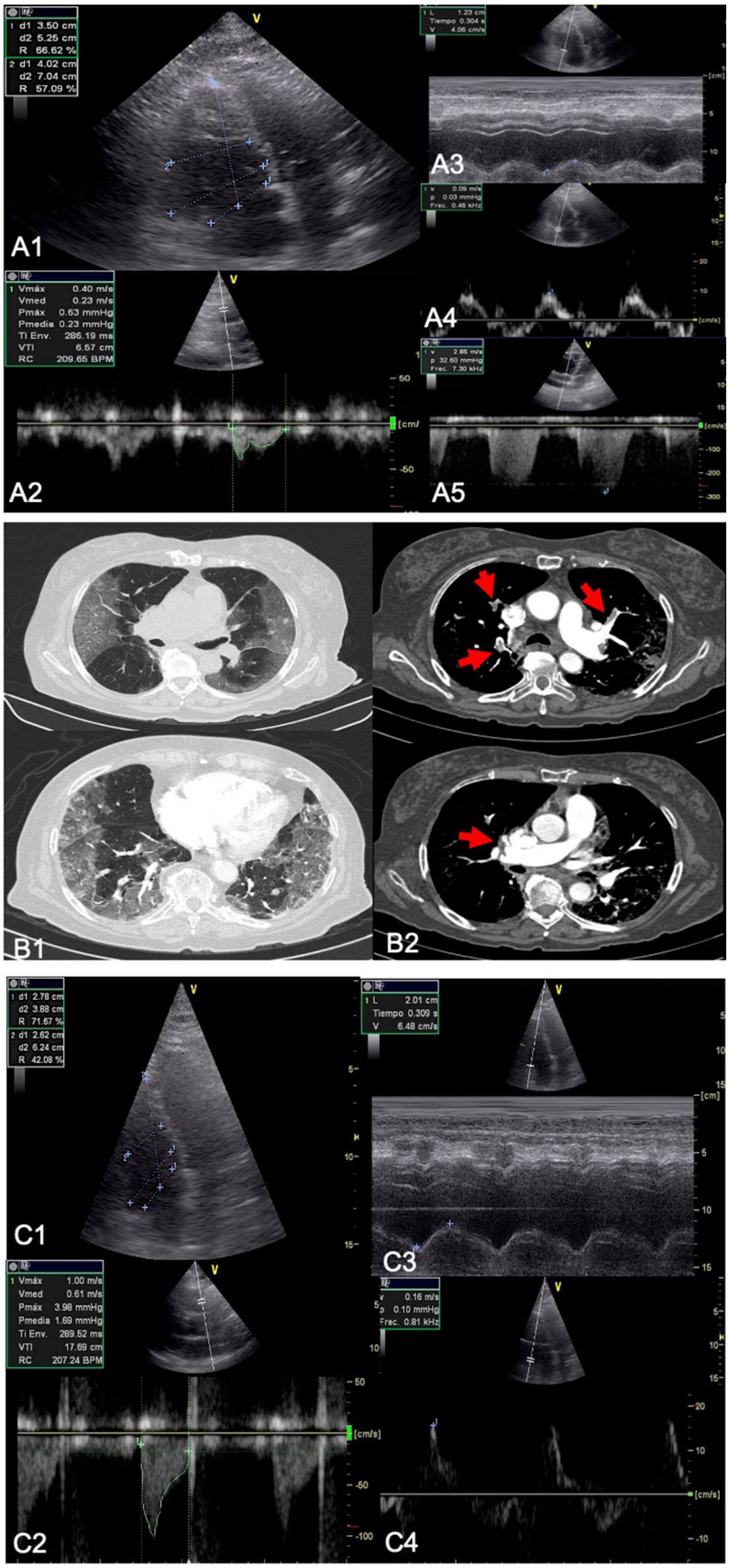

Fig. 1 **a** Transthoracic echocardiogram shows (A1) right ventricle dilatation (A2) RVOT VTI 6.57 cm (A3) TAPSE 12 mm (A4) DTI S wave 9 cm/s (A5) TR Vmax 2.85 m/s. **b** Computed tomography shows (B1) extensive bilateral extensive crazy paving pattern (B2) bilateral filling defect diagnostic for pulmonary embolism (red arrows). **c** Transthoracic echocardiogram shows (C1) normal dimensions of right ventricle (C2) RVOT VTI 17.69 cm (C3) TAPSE 20 mm (C4) DTI S wave 16 cm/s. *RVOT VTI* Right Ventricle Outflow Tract velocity–time integral, *TAPSE* Tricuspid Annular Plane Systolic Excursion, *DTI S Wave* Doppler Tissue Imaging S wave, *TR* Vmax: Maximal Tricuspid Regurgitation Velocity

the decision of starting fibrinolytic therapy, as has been done in other hospitalization centers [1–3]. Half-dose systemic thrombolysis in intermediate-high risk PE has shown lower mortality rate, lower bleeding rate and less required vasopressor therapy and invasive ventilation [4, 5] that has recently been used in other patients with COVID-19 [3].

Conclusions

Half-dose systemic thrombolysis should be considered as a therapeutic treatment in patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) complicated with PE. Thrombolytic therapeutic interventions can improve right-sided heart failure, hypoxemia and the supplemental oxygen requirements in patients with SARS-CoV-2.

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Compliance with ethical standards

Conflict of Interest Sauza-Sosa JC, Mendoza-Ramirez J, Velazquez-Gutierrez CN, de la Cruz-Reyna EL and Fernandez-Tapia J declare that they have no conflict of interest.

Human rights statements and informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964 and later revisions. Informed consent was obtained from all patients for being included in the study.

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