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Case Report

How to Evaluate the Pulmonary Valve and Right Ventricular Outflow Tract in Prone Position during Invasive Mechanical Ventilation

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ABSTRACT

In the COVID-19 pandemic, we performed a series of echocardiograms using subcostal views. After placing a patient in a prone position during invasive mechanical ventilation, the echocardiogram transducer was placed under the patient in the left subcostal position. This performance allowed us to evaluate the function of the pulmonary valve and estimate pulmonary pressure. This is a complement to the monitoring with a transthoracic echocardiogram in the prone position.

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Case Description

During the COVID-19 pandemic, we performed a series of transthoracic echocardiograms (TTE) using subcostal view and observed that the evaluation of the pulmonary valve (PV) and the right ventricular outflow tract (RVOT) was possible in the prone position (PP) [1]. After placing in PP during invasive mechanical ventilation (IMV), the patient's left arm was extended overhead, and a pillow was placed only under the left hemithorax to elevate it and facilitate a subcostal view (Figure 1). The transducer was placed under the patient in the left subcostal position, and an orientation index marker pointing towards the patient's left shoulder was used to observe the four cardiac chambers (Figure 1B). Subsequent subtle upward movement of the transducer tail permitted us to view the PV and a small portion of the RVOT (Figures 1C, 2A & 2B). A further counter-clockwise rotation of the transducer allowed us to view the short axis of the RVOT (Figures 1D & 2C). This approach allowed us to observe the opening of the PV by 2D visualization and the transpulmonary flow by colour Doppler (Figure 2D). Continuous Doppler allowed us to calculate the gradients of the PV (Figure 2E), and

pulsed Doppler at RVOT level helped us estimate the pulmonary pressure based on the shape of its curve and by measuring the acceleration time (Figure 2F). In addition, after getting the velocity time integral from both right and left ventricular outflow tract, we were able to calculate Qp/Qs.

Discussion

TTE has emerged as an alternative for monitoring patients in the PP during IMV, with adequate images achieved because of the proximity of the heart to the chest wall in PP [2]. Previous studies have reported that apical views allow evaluation of ventricular and valve function and that of the inferior vena cava [3]. Recently, a study has reported the performance of a subcostal view examination in PP and briefly described the PV [1]. However, it is not described a detailed evaluation of the PV or RVOT. Our technique has the advantage of allowing evaluation of the PV function and the presence of pulmonary hypertension [4]. This is a novel possibility to perform TTE in the PP, where we could discard the PV disease, evaluate the pulmonary pressure by a different approach and the relation between both pulmonary and systemic flow by Qp/Qs.

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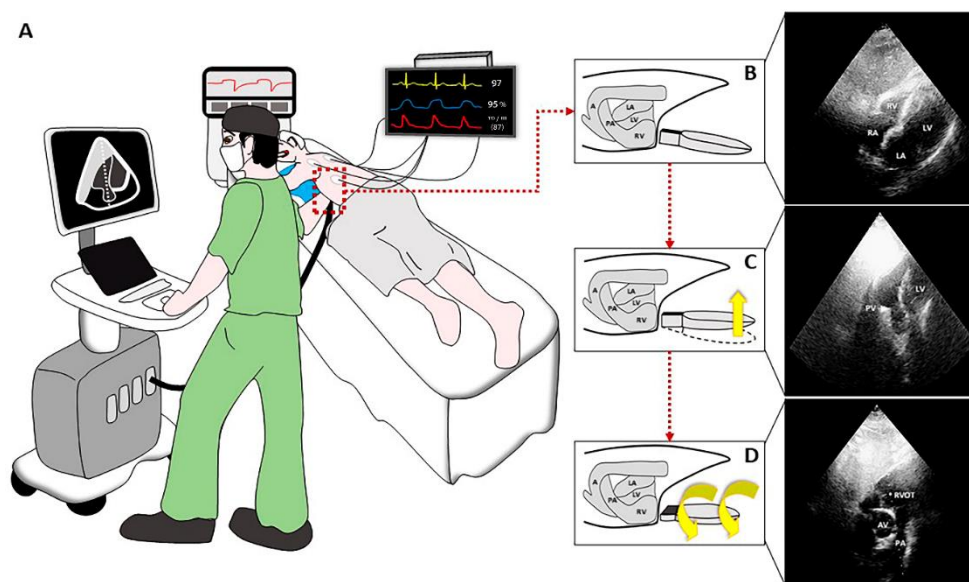


Figure 1: How to perform the evaluation of pulmonary valve and right ventricular outflow tract: **A)** Position to perform echocardiogram by subcostal view in the prone position, with a pillow placed under left hemithorax (light blue). **B)** The echocardiogram transducer was placed under the patient in the left subcostal position and orientation index marker pointing towards the patient's left shoulder to view the 4 cardiac chambers. **C)** Subtle upward movement of the transducer tail to view the pulmonary valve and a small portion of the RVOT. **D)** Counter-clockwise rotation of the transducer to view the short axis of the RVOT. Abbreviations - A: Aorta; AV: Aortic Valve; LA: Left Atrium; LV: Left Ventricle; PA: Pulmonary Artery; PV: Pulmonary Valve; RA: Right Atrium; RV: Right Ventricle; RVOT: Right Ventricle Outflow Tract. Illustration by Cesar del Castillo Gordillo.

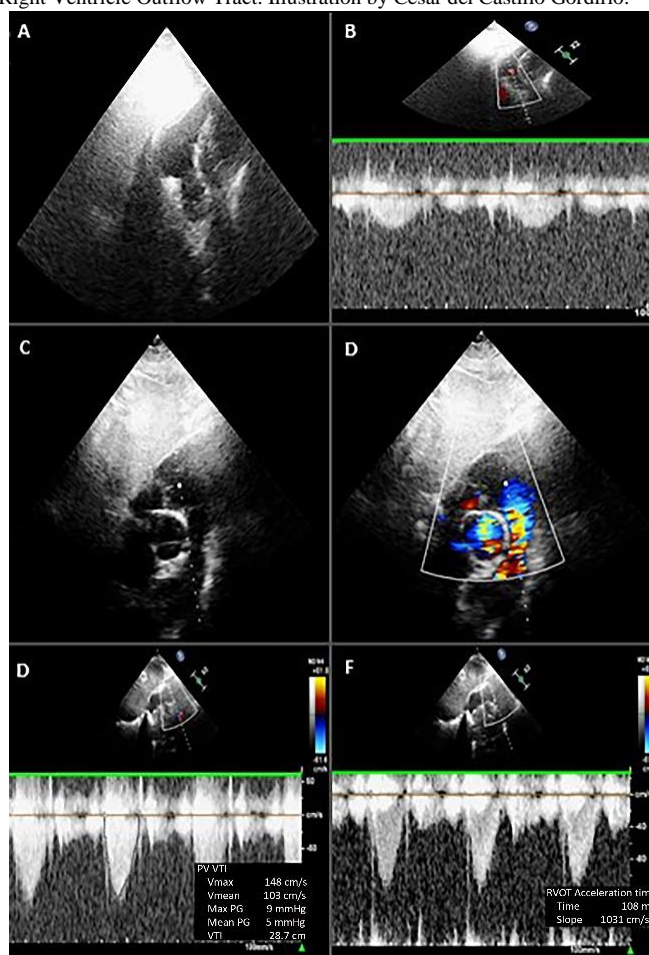


Figure 2: Images obtained: **A)** Visualization of the pulmonary valve and right ventricular outflow tract. **B)** Continuous Doppler of pulmonary valve. **C)** Short axis of the right ventricular outflow tract. **D)** Colour Doppler of the short axis of the right ventricular outflow tract. **E)** Continuous Doppler of pulmonary valve. **F)** Pulsed Doppler at right ventricular outflow tract level.

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Conflicts of Interest

None.

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