

IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

Party Balloon Inflation Maneuver During Saline Contrast Transthoracic Echocardiography to Detect Patent Foramen Ovale



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ABSTRACT

Saline contrast echocardiography requires an adequate provocation method for the detection of patent foramen ovale. The party balloon inflation maneuver during saline contrast transthoracic echocardiography is easy to explain to patients and objectively assesses the performance of provocative maneuvers by a clinician by watching balloon inflation. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2022;4:102-104) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

A 45-year-old woman with a history of cryptogenic stroke was referred to us for consultation. Transesophageal echocardiography (TEE) showed that the patent foramen ovale (PFO) had a left-to-right shunt (Figure 1A, yellow triangle, Video 1). However, there was no evidence of an obvious right-to-left shunt due to inadequate Valsalva maneuvers because the patient was sedated (Figure 1B, Video 2). Therefore, saline contrast transthoracic echocardiography (TTE) was performed on another day. However, repeated saline contrast TTEs with spontaneous and abdominal compression during Valsalva maneuver did not show microbubbles in the left chambers (Figure 1C, Video 3). Instead of conventional provocative maneuvers, a party balloon (Daiso Industries Co, Ltd) was inflated during saline contrast injection (Figure 1D). TTE results revealed a continued microbubble opacification in the left chambers on one cardiac cycle without balloon deflation (Figure 1E, Video 4), indicating the presence of a right-to-left shunt through the PFO. Therefore, the patient underwent transcatheter PFO closure without any residual shunts.

The experiment in the dry laboratory revealed that filling the party balloon with air added 20 to 25 mm Hg positive end-expiratory pressure to the patient's airway (Figure 1F), which increased the intrathoracic pressure and impeded the blood return. With inspiration to further inflate the party balloon, the intrathoracic pressure decreased to negative and there was an increased return of blood to the right atrium, and a right-to-left atrial pressure gradient was generated (1,2).

PFOs are dynamic entities. The proof of a right-to-left shunt is mandatory before transcatheter PFO closure. Saline contrast TEE remains the standard reference to detect right-to-left shunt, but TEE is semi-invasive and is not ideal for screening. In contrast, saline contrast TTE is noninvasive and can be used for screening (3).

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However, the optimal methodologies of saline contrast TTE for the detection of PFO, which requires an adequate provocation method, have not been established. In this case, the Valsalva maneuver was not correctly performed, but the use of the party balloon worked because it was simple to explain to the patient and it provided visual feedback that the maneuver had been performed correctly.

In conclusion, this maneuver is easy to explain to patients and objectively assesses the performance of provocative maneuvers by a clinician by observing balloon inflation. Hence, this may be beneficial over standard provocative methods and may be a potentially helpful addition to the workflow for busy echo labs using a simple tool.

**ABBREVIATIONS
AND ACRONYMS**

PFO = patent foramen ovale

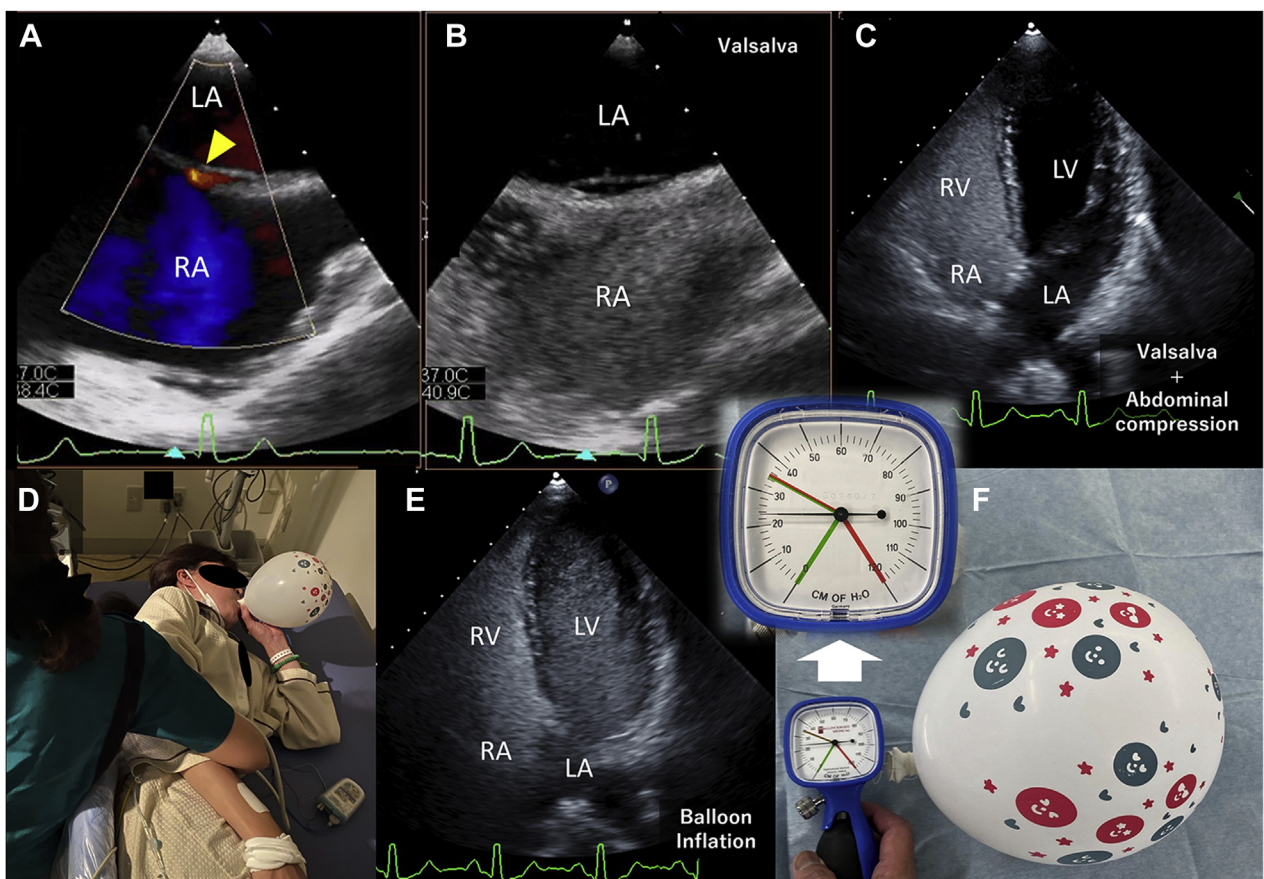
TEE = transesophageal echocardiography

TTE = transthoracic echocardiography

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FIGURE 1 Transesophageal Echocardiography and Transthoracic Echocardiography Images, Party Balloon Inflation Maneuver, and Pressure Measurement




Color Doppler transesophageal echocardiography images with an omniplane angle of 120° (A) and saline contrast transesophageal echocardiography with an omniplane angle of 120° (B) during spontaneous Valsalva maneuver. Saline contrast transthoracic echocardiography images during spontaneous and abdominal compression Valsalva maneuver (C) and balloon inflation maneuver (E). Patient performs balloon inflation maneuver (D). Pressure measurement in the dry laboratory (F). The white arrow shows an enlarged view of the face of the cuff manometer during balloon inflation. LA = left atrium; LV = left ventricle; RA = right atrium; RV = right left ventricle.

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KEY WORDS bubble echocardiography, congenital heart defect, echocardiography, stroke

 **APPENDIX** For supplemental videos, please see the online version of this paper.