Ultrasound For Critical Care Physicians: Where Did the Bubbles Go?

A 35-year-old woman with factor V Leiden deficiency on chronic anticoagulation therapy and a history of multiple deep vein thrombosis, pulmonary embolism and transient ischemic attacks presented for an evaluation of dyspnea. An echocardiogram with agitated saline contrast (bubble study) was performed (Figure 1).

Figure 1. Static apical 4 chamber image taken from bubble study.

What is the **best explanation for the findings** in the video?

1. Intra-atrial right to left shunting
2. Normal bubble study
3. Pulmonary arterial-venous malformation
4. Ventricular septal defect

Correct!

1. Intra-atrial right to left shunting

She had an echocardiogram performed (Image shown), which revealed a patent foramen ovale (PFO) and significant right to left shunting (Figure 2).

Figure 2. Apical four-chamber view: saline micro-bubbles filling the right atrium and right ventricle with dense opacification of the left atrium within one cardiac cycle (red arrow), confirming severe right to left shunt at the atrial level. In the case of a pulmonary arterial-venous malformation, the appearance of bubbles is more gradual, and is often seen within the pulmonary veins. In a normal bubble study, three or less microbubbles pass into the left side of the heart.

She was referred to an interventional cardiologist to discuss the option of percutaneous closure of PFO. In view of successful anticoagulation, after explanation of risks and benefits, the patient deferred the procedure.

Foramen ovale is a flap-like valve at the atrial septum, which allows shunting from the right atrium to the left atrium and bypassing the uninflated lungs in the fetus. Changes

in left atrial pressures after birth close the flap. The foramen ovale remains patent in approximately 25% of adults and can, under certain circumstances, allow right to left shunting at the atrial level (1). Although most adults with a PFO are asymptomatic, an increased incidence of PFO in patients with a stroke has been documented. The optimal treatment of PFO in the context of a cryptogenic stroke remains undetermined. Possible treatment options include medical, systemic anticoagulation, and closure of the PFO with one of the several available percutaneous devices at catheterization (2).

Although none of the recently published randomized controlled trials, RESPECT (3), CLOSURE 1 (4), PC Trial (5) have shown differences between medical and device-closure treatments, it has been proposed that high risk individuals undergo percutaneous device-closure of the PFO. Characteristics of high risk individuals include: less than 55 years of age, known circulating pro-coagulant, and PFO anatomy that could predispose to neurological events such as a large PFO, large right to left shunt, highly mobile PFO valve and presence of atrial septal aneurysm (6). Our patient highlights the importance of individualized treatment and the need for detailed discussion of the risks and benefits of each treatment option in complex situations.

Bhupinder Natt M.D., Linda Snyder, M.D. and Daniela Lax, M.D.
Division of Pulmonary, Allergy, Critical Care and Sleep Medicine
Division of Pediatric Cardiology
University of Arizona Medical Center
Tucson, AZ

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