

The Proper Conduct of Valsalva Maneuver in the Detection of Patent Foramen Ovale

The role of patent foramen ovale (PFO) in cryptogenic stroke has received increasing attention in recent times (1). Cryptogenic stroke via PFO is a form of paradoxical embolism. Formerly diagnosable during life only by cardiac catheterization (2), PFO-associated paradoxical embolism can nowadays be diagnosed non-invasively by echocardiography. Performance of a Valsalva maneuver is an integral part of the echocardiographic examination. Unfortunately, in most of the textbooks on echocardiography and published literature on the detection of PFO by echocardiography, the use of the Valsalva maneuver was either not mentioned or not specified as to which phase should be imaged.

Under normal conditions, a PFO does not allow an interatrial shunt to occur from either left to right or from right to left. However, in cases of increased right atrial pressure, as in pulmonary embolism or during a Valsalva maneuver such as when straining during defecation or childbirth, a right-to-left interatrial shunt will occur through a PFO. It should be noted that it is not during the strain phase but during the release phase of the Valsalva maneuver that imaging of the interatrial septum should be performed.

To illustrate this point, there is the case of a 50-year-old woman with cerebral embolism accompanying pulmonary embolism, in whom indicator dilution curves using ascorbate as an indicator and polarographic technique for detection (Fig. 1) (3) were performed. In each panel, the platinum electrode placed percutaneously in the femoral artery (FA) was the sensing side following right atrial (RA) injection of 300 mg ascorbate; recordings at a slow paper speed were made simultaneously with electrocardiographic lead II (L_2) and right atrial pressure (RAp), except in the 2nd and 4th panels (Fig. 1) where connection with the strain gauge was turned off. There was apparently no evidence of a right-to-left interatrial shunt both before and during the strain phase of the Valsalva maneuver. However, following release of the Valsalva maneuver, as shown in panel 3, of Figure 1, there was a small right-to-left (R→L)

interatrial shunt, which became larger, as depicted in the 4th panel, following release of a more strenuous Valsalva maneuver.

Therefore, it is extremely important to continue echocardiographic imaging not only during the strain phase but also the release phase of the Valsalva maneuver so as not to miss the diagnosis of paradoxical embolism (2). Furthermore, clinicians should not just write on the request form “to rule out cardiogenic emboli” when sending a patient with cryptogenic stroke to the echocardiographic laboratory. What the echocardiographic technician or even the echocardiographer usually does is concentrate on ruling out a left atrial thrombus, a left atrial myxoma, mitral valve prolapse, vegetations on the mitral or aortic valve, a left ventricular thrombus or ventricular aneurysm, dilated cardiomyopathy, or atherosclerotic plaques in the ascending aorta. Of course, it is also possible to detect an interatrial septal defect or an atrial septal aneurysm or a PFO, the last usually only on transesophageal echocardiography. To rule out paradoxical embolism, one needs to reverse the interatrial pressure gradient, because normally left atrial pressure is higher than right atrial and therefore no right-to-left shunt will occur, unless we artificially reverse this gradient by raising the right atrial pressure above the left atrial, such as by performance of a Valsalva maneuver. Therefore, it is very important to put on the requisition form to the echocardiographic laboratory not just “to rule out cardiogenic emboli” but also to “rule out paradoxical embolism.” For the latter it is not only necessary during echocardiography to perform a Valsalva maneuver following the intravenous injection of agitated saline or contrast medium but also to obtain images during both the strain phase and the release phase of the Valsalva maneuver (2–14).

That underdiagnosis of PFO by echocardiography in patients with paradoxical embolism can result when appropriate technique is not used has been demonstrated in the past (15, 16). But it is not so much of a question of transesophageal versus transthoracic approach that is important in the echocardiographic diagnosis of paradoxical embolism as is the proper conduct of the Valsalva maneuver during the echocardiographic examination. As a matter of fact, the sedated state of the patient necessary for the trans-

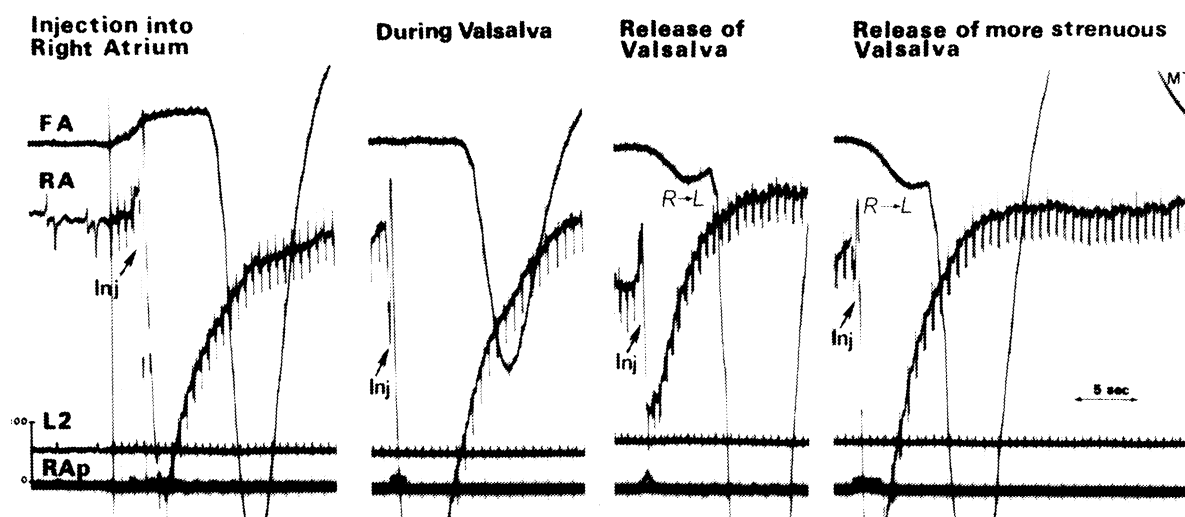


Figure 1. Indicator dilution curves using ascorbate as an indicator and polarographic technique for detection of paradoxical embolism were performed before, during, and after the Valsalva maneuver in a 50-year-old female patient with cerebral embolism accompanying pulmonary embolism. A platinum electrode placed in the femoral artery (FA) was the sensing side after right atrial (RA) injection (Inj) of 300 mg ascorbate. L_2 = ECG lead II; RAp = right atrial pressure. See text for details.

esophageal examination often prevents the patient from performing an effective or adequate Valsalva maneuver, which is the essential part of the examination.

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