

Importance of direct right-to-left shunt as high-risk patent foramen ovale associated with cryptogenic stroke

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Abstract

Background: Because transcatheter closure of patent foramen ovale (PFO) has become effective for preventing cryptogenic stroke (CS), it is necessary to determine high-risk PFO associated with CS. This study aimed to clarify the importance of direct right-to-left (RL) shunt through the PFO for identifying high-risk PFO. Methods: We analyzed 137 patients with and without CS who were confirmed to have PFO. The timing of RL shunt through the PFO was evaluated by cardiac cycles after right atrium (RA) opacification on saline contrast transesophageal echocardiography. Direct RL shunt was defined as microbubbles crossing the PFO before and at the same time of RA opacification. Results: Cardiac cycles of microbubbles crossing the PFO were shorter in patients with CS than in those without CS (2.0 ± 2.2 vs. 0.5 ± 1.1 , $P < .01$). Direct RL shunt was more frequently observed in patients with CS than in those without CS (77% vs. 29%, $P < .01$), with a sensitivity of 79% and a specificity of 71% for the association with CS. Multivariate analysis revealed that direct RL shunt was related to atrial septal aneurysm and low-angle PFO. Regarding functional features of PFO, the detection rate of CS was 50% for large RL shunt alone, and was increased to 83% when direct RL shunt was added. Conclusion: Direct RL shunt was associated with CS and had the incremental value in detecting PFO associated with CS for large RL shunt. The timing of RL shunt can be valuable for identifying high-risk PFO.

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