

## Editor's Note

### Are “Paradoxical Emboli” Really Paradoxical?



**Key words:** paradoxical emboli

When the term “paradoxical embolus” is used, physicians immediately think of an embolus originating on the right side of the heart or venous circulation that somehow embolizes the central nervous system in the absence of a left-sided cardiac or proximal arterial source. Obviously, this is a

devastating event in any individual, particularly a young person without any obvious cardiovascular disease. When it happens, a search immediately begins for the reason for this stroke in an apparently healthy individual.

Autopsy studies in patients dying of any cause but with “normal” hearts reveal a patent foramen ovale in 22–34% of patients. The higher percentage is found in the early decades of life.<sup>1</sup> Although this is not a common event in any single cardiologist’s experience, I can recall a 58-year-old airline pilot who had a mild stroke while landing his airplane (he later told me that this was one of the best landings he ever made). He recovered fully and a small ischemic infarction was documented by magnetic resonance imaging. It turned out that this patient had a patent foramen ovale and no other cardiac disease. The source of the embolus was never found.

Right-sided thrombi can enter the systemic circulation by several routes other than a patent foramen ovale—for example, a classic atrial septal defect (ASD), a ventricular septal defect (VSD), patent ductus arteriosus, or even a pulmonary arteriovenous fistula. Except for the pulmonary arteriovenous fistula, these defects generally are associated with a left to right shunt rather than a right to left shunt. However, certain conditions, for instance, raising right above left atrial pressure, right above left ventricular pressure, and pulmonary artery pressure above systemic arterial pressure, reverse the shunt at atrial level, ventricular level, and pulmonary artery level, respectively. The classic physiologic events that can reverse flow from right to left atrium across an ASD or a patent foramen ovale are the Valsalva maneuver or coughing.

Pulmonary hypertension of any etiology can reverse flow across a patent ductus arteriosus or a VSD, but this condition generally is obvious to the clinician since this is infrequently a transient phenomenon and the patient is cyanotic.

Although the so-called paradoxical systemic embolism can occur in a perfectly healthy young individual, one still should investigate for the possibility of paroxysmal atrial fibrillation. Under these circumstances, thrombi can embolize from the left atrium. Other conditions in which anticoagulants are required but the patient is not fully anticoagulated need to be investigated.

Although it is not often thought of by the individual physician caring for the patient, the presence of a systemic embolus of unknown cause may be associated with pulmonary emboli. The obvious catastrophe resulting from a small cerebral embolus or an arterial occlusion elsewhere is not always seen in patients who have small pulmonary emboli. In contrast, large pulmonary emboli are generally obvious since the patient usually has hypoxia, tachypnea, and tachycardia, and there may be an acute elevation of right ventricular and atrial pressures, thus directing flow from the right atrium to the left atrium across a patent foramen ovale.

I suspect that the foregoing is not new to most readers. However, what prompted this discussion relates to my curiosity about why we use certain words in medicine. So, I looked up the word “paradox” in various standard dictionaries and one medical dictionary. I found the following definitions: (1) inconsistency; (2) illogical truth; (3) absurdity; (4) a statement that may be true but seems to say two opposite things; (5) a statement that is false because it says two opposite things; (6) a statement contrary to perceived opinion or belief; (7) any inconsistent or contradictory fact, action, or condition; (8) a tenet contrary to perceived opinion; (9) a statement that is seemingly contradictory or opposed to common sense and yet is perhaps true. *Stedman’s Medical Dictionary*, 25th edition, indicates that paradox is derived from the Greek *paradoxos*, meaning incredible, beyond belief; that which is apparently, though not actually, inconsistent with or opposed to the known facts in any case.<sup>2</sup>

To me, “paradoxical embolus” is not an absurdity, an illogical truth, incredible, or beyond belief. It seems perfectly logical that if there is communication between the right and left sides of the circulation, that under certain conditions the blood clot—whether originating in the peripheral veins, the pelvic veins, the right atrium during atrial fibrillation, in patients with abnormal clotting situations, (e.g., patients who smoke and take contraceptives)—can cross the atrial septum and embolize the systemic circulation.

To me the term “jumbo shrimp” is a paradox. Perhaps oxymoron is a more appropriate term.

Maybe I am missing the point, but I do not understand how an embolus originating as a thrombus in the venous circulation and winding up in the brain or other organs in the systemic circulation can be considered paradoxical if a defect in the atrial septum is present. Thus, my answer to the question posed in the title of this editorial is no.

In any case, this subject is of great clinical interest, since the options for preventing such an event in a patient with a patent foramen ovale include chronic anticoagulation, a percutaneous closure device of some sort, or surgical closure. Which is the best therapy is still a matter of debate. My preference is surgical closure: risk is minimal and chronic anticoagulation is not required. A really sticky clinical issue is whether all patent foramen ovals should be closed or all patients anticoagulated. I know of no data to answer that question.

In view of all this, it is interesting that the airline pilot with the small stroke and a patent foramen ovale told me that the Federal Aviation Association would not allow him to fly unless he had the patent foramen ovale closed. He opted for chronic anticoagulation and retired.

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## References

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