VIEWPOINT

Perioperative Stroke Risk Reduction in Patients With Patent Foramen Ovale

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The foramen ovale is a fetal connection between the right and left atria that typically closes within a few months of birth but remains patent in 25% to 30% of individuals.[1] A patent foramen ovale (PFO) is usually benign, but in some individuals, a PFO-related embolic stroke may occur. Proposed mechanisms of PFO-related embolism include in situ thrombosis and paradoxical embolism, ie, when venous thromboembolism (VTE) passes into the systemic arterial circulation through the PFO.

Several recent studies report that patients with a PFO are up to 16 times more likely to have an ischemic stroke within 30 days of noncardiac surgery compared with those without a PFO.[1-3] However, the exact increase in risk is unknown because the studies reported a wide range of perioperative ischemic stroke rates (3.2%-35.1% in patients with a PFO vs 0.02%-6.0% in patients without a PFO), likely as a result of observation and selection bias. Given the increased stroke risk during the perioperative period, it is important to consider what measures can be taken to minimize this risk in patients with a PFO who are scheduled to undergo noncardiac surgery.

When patients with a PFO and history of stroke or transient ischemic attack (TIA) are evaluated in the preoperative clinic, the cause of the prior stroke should be identified. This includes a workup for common causes of ischemic stroke, such as atrial fibrillation, carotid stenosis, and small vessel disease. In 10% to 25% of the patients, no cause for their prior stroke can be identified despite a complete workup. These strokes are referred to as cryptogenic strokes or embolic strokes of undetermined source (ESUS); up to 40% of patients with ESUS may have a PFO.

Patients younger than 60 years with an ESUS can benefit from PFO closure for secondary stroke prevention based on the results from several clinical trials.[4] A meta-analysis reported that, in this population, PFO closure reduces the risk of recurrent ischemic stroke compared with medical therapy alone during approximately 4 years of follow-up (2.0% vs 4.5%; risk ratio, 0.42 [95% CI, 0.20-0.91]).[4] Patent foramen ovale closure is not indicated in patients without a history of stroke because of the low risk of stroke in this population but may be considered in patients with a history of stroke or TIA.

To our knowledge, the efficacy and safety of PFO closure before noncardiac surgery has not been tested in clinical trials. Therefore, decisions regarding PFO closure should rely on data from secondary stroke prevention studies regarding the risk and benefits of PFO closure before noncardiac surgery as well as the patient's stroke risk, the procedural risks of closure, patient/caregiver preferences, and the local expertise.

The likelihood that a prior ESUS is attributable to the PFO should be considered when deciding whether to pursue PFO closure. To stratify the probability of an ESUS being attributable to a PFO, the risk of paradoxical embolism (RoPE) score has been proposed.[5] This score considers 6 characteristics that are associated with an increased likelihood that the ESUS is PFO-related (younger age; no history of hypertension, diabetes, or smoking; a history of stroke as opposed to TIA; and cortical infarct as opposed to a subcortical infarct on computed tomography or magnetic resonance imaging). Other factors that may increase the likelihood that an ESUS is associated with a PFO but are not included in the RoPE score include a history of VTE, hypercoagulable disorders, and PFO characteristics, such as shunt size or atrial septal aneurysm.[4] Although promising, the RoPE score has not been well validated and should be used in conjunction with other factors to determine if preoperative PFO closure is warranted.

For example, the risk of paradoxical embolism associated with the planned procedure should also be considered. Surgical procedures with a high risk of paradoxical embolism may include orthopedic surgeries (higher rates of fat embolism, postoperative immobility, and VTE), cesarean deliveries (higher risk of amniotic fluid embolism and VTE), endoscopic or laparoscopic procedures (higher risk of right-to-left shunting associated with elevated right atrial pressures), and cervical spine and posterior cranial fossa surgeries in the sitting or semisitting position (higher risk of venous air embolism).[6] Stroke prevention measures, including PFO closure, may be particularly important for patients undergoing these procedures.

The most frequent adverse event following PFO closure is atrial fibrillation, but most of these episodes are benign and occur during the first 45 days after PFO closure, and only 3.8% of postclosure atrial fibrillation episodes progress to permanent atrial fibrillation.[4] Endocarditis after PFO closure is rare, but perioperative antibiotic prophylaxis is recommended before any surgical procedure performed within 6 months of PFO closure.

All patients with a history of ischemic stroke and PFO should be receiving antithrombotic therapy unless the bleeding risk is prohibitive. This includes patients who have undergone PFO closure. Following PFO closure, a short course of dual antiplatelet therapy is generally recommended, with lifelong single antiplatelet therapy thereafter. Interdisciplinary discussions are encouraged to safely minimize the perioperative interruption of antithrombotic therapy based on the surgical bleeding risks.

While recent trials have focused on the benefits of PFO closure for secondary stroke prevention, antico-

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agulation may achieve a similar reduction in the risk of recurrent ischemic stroke, albeit with an increased risk of major bleeding.[4] However, because interruption of anticoagulation is typically required during the perioperative period of a major noncardiac surgery, a strategy based on anticoagulation alone is unlikely to mitigate the risk of stroke during the perioperative period.

Intraoperatively, for patients with a PFO, careful hemodynamic management could minimize right-to-left shunting and avoid perioperative paradoxical embolism. The risk of VTE and paradoxical embolism can be reduced by avoiding the use of central venous catheters, using infusion pumps with air-in-line detection, and tubing with in-line filters to avoid air in the tubing. Guideline-directed strategies for VTE prophylaxis, including mechanical compression devices, may further reduce the risk of paradoxical embolism in patients with a PFO.

Postoperatively, strategies for VTE prevention may include early mobilization, mechanical compression devices, and/or pharmacological prophylaxis based on the clinical situation.[7] Home antithrombotic therapy should be resumed as soon as the bleeding risk permits.

In conclusion, the risk of perioperative stroke after noncardiac surgery is increased in patients with a PFO. Clinical trials are needed to determine the optimal strategies to mitigate this risk. Proposed strategies include PFO closure and antithrombotic therapy for secondary stroke prevention among selected patients with a history of stroke or TIA that is likely attributable to a PFO. A multidisciplinary approach to determine the optimal treatment strategy to reduce the risk of perioperative stroke in patients with a PFO should include the patient/caregiver, cardiologist, neurologist, anesthesiologist, and surgeon.

ARTICLE INFORMATION

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