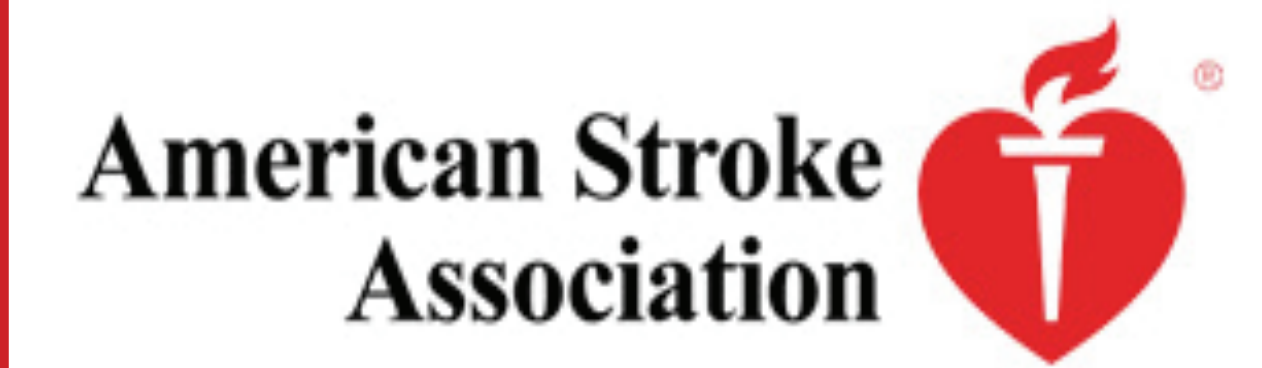




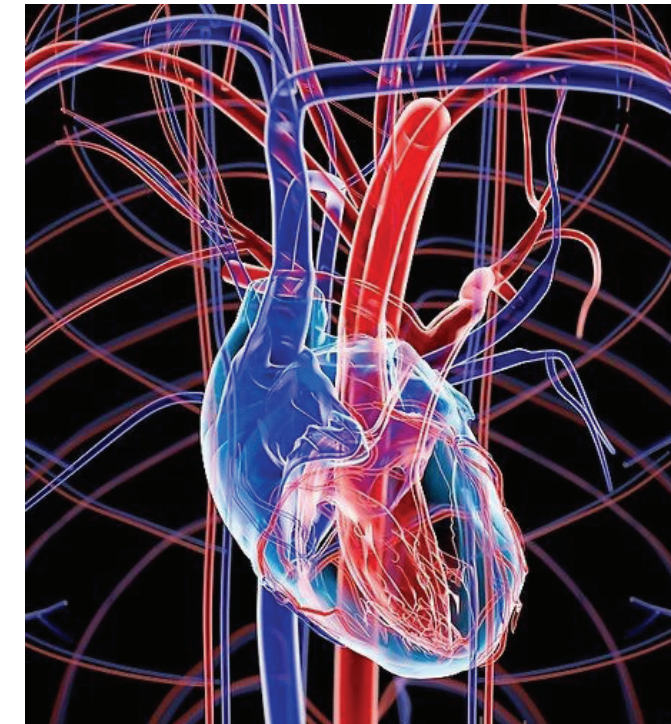
The Relationship between Atrial Septal Defect, Patent Foramen Ovale and Cryptogenic Stroke: What is the Evidence?

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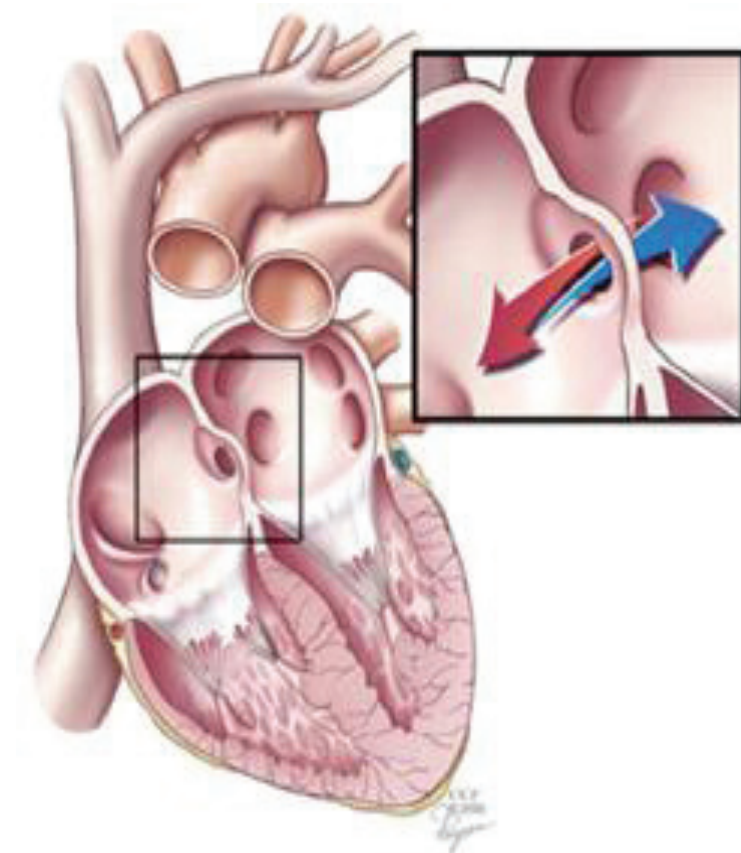
INTRODUCTION

- A stroke occurs on average of about every 40 seconds in our society¹.
- According to the American Stroke Association (ASA), 795,000 Americans suffer stroke each year¹.
- Strokes are the fourth highest cause of death within the United States¹.
- An estimated \$73.7 billion was spent by Americans in 2010 for medical costs and disability related to stroke¹. 50-75% of all stroke survivors have residual cognitive and/or motor disabilities which prevent them from living independently at home³.
- Strokes can affect any portion of the brain and result in a number of different impairments and disabilities; some of which may never be completely recovered¹.
 - Paralysis or hemiparesis
 - Vision disability
 - Memory loss
 - Impulsiveness
 - Clumsiness
 - Speech problems
- Cryptogenic strokes are strokes which can not be attributed to any specific cause, yet by some estimates, account for approximately 30-40% of all ischemic strokes².
- Two congenital defects in the atrial septum form an irregular communication between the right and left atria of the heart. A patent foramen ovale (PFO) is a defect where the natural foramen ovale opening in the fetal atrial septum allowing blood flow between the atria does not appropriately close after birth. Similarly, an atrial septal defect (ASD) manifests itself as a hole anywhere along the wall of the right and left atria of the heart, yet is frequently found at the site of the PFO.



Some literature suggests that in adults, cryptogenic stroke is related to congenital heart defects such as an atrial septal defect (ASD) and patent foramen ovale (PFO). Following the onset of adult cryptogenic stroke, surgical interventions routinely occur to repair these congenital structural cardiac defects stroke.

However, controversy exists as to whether this aggressive surgical repair mitigates the risk of a second stroke or improves stroke-related disability. Because of the medical risks associated with surgical intervention after stroke and the economic impact of potentially unnecessary intervention, it is important to investigate the scientific research behind this practice. ***Apriori, I reasoned that ASD and PFO in adults may be positively correlated with cryptogenic stroke.***



Purpose: 1) To assess the evidence within the medical literature of the relationship between cryptogenic stroke, ASD and PFO. 2) Determine the frequency of an ASD or PFO in the adult population aged 40-80 years old who have not experienced stroke. 3) Determine how ASD and PFO are diagnosed.

- Does the evidence support a decrease in the overall long-term health of patients with ASD or PFO and their risk of having a stroke?
- What is the functional outcome associated with cardiac repair following cryptogenic stroke?
- Do these repairs alter the patient's overall longevity and functional capabilities when compared to strokes of other etiologies?
- Is it viable to determine the efficacy of devoting research dollars to studying the relationship between ASD, PFO and cryptogenic stroke?

METHODS

We performed a comprehensive database search for medical articles and journals describing studies which have been carried out evaluating the relationship between ASD, PFO and cryptogenic stroke. We were also interested in fully describing diagnosis of ASD and PFO after cryptogenic stroke.

- Research data will be pulled from all medical databases via Washburn University's Mabee Library to include:
 - Scientific studies
 - Clinical reviews

The studies include stroke patients of all ages, however most focus has been put on patients less than 55 years of age. This is partially due to the common presence of a PFO found in that particular age group as opposed to those 55 years and older⁴. After the age of 55, a person's risk of having a stroke doubles each year as a result of additional pathologies and biomarkers¹.

Two diagnostic procedures common in a typical protocol for diagnosing strokes include transthoracic echocardiogram (TTE) or Echo and a transesophageal echocardiogram (TEE). Both exams look at the structure and function of the heart and are read by cardiologists.



Criteria

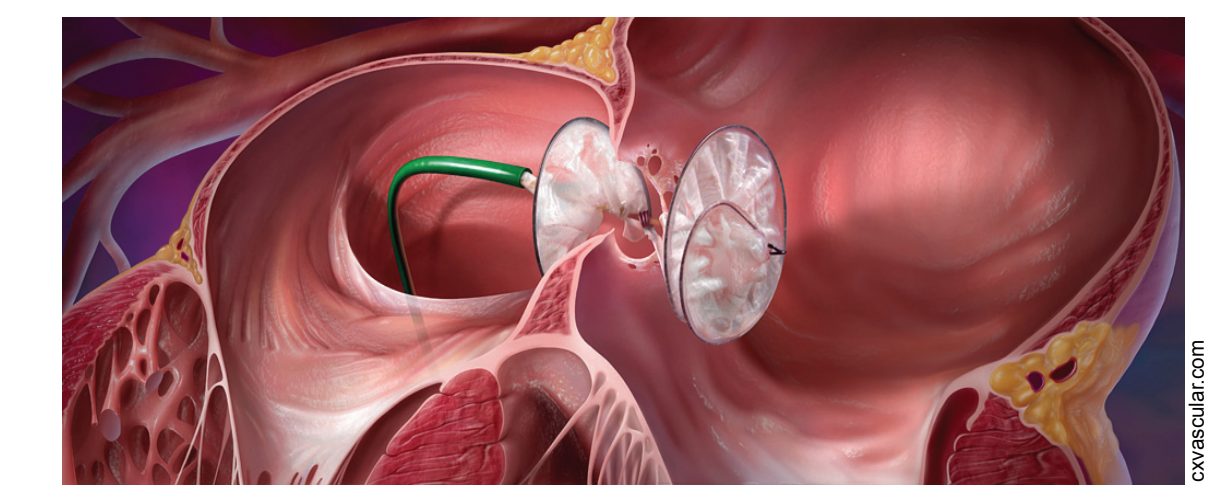
- Studies focusing on ASD and/or PFO and their relationship with patients who had experienced a stroke with no other observed etiology.
- Articles reviewing multiple studies on the relationship between the two malformations.
- Exclusions included those pieces of literature that were purely informational rather than scientific studies.

RESULTS

- 55 studies were examined. Of these, 25 (45%) met the criteria for inclusion.
- 11 (44%) of the eligible pieces of literature reviewed revealed that cryptogenic strokes often have a coinciding ASD or PFO, particularly in patients under the age of 55; However of those, only 8 (32%) studies were deemed valid for the inclusion of the results. Five of those (62%) concluded that there is not enough evidence to support the affirmation of a correlation.
- It has been noted in 52% of the studies that surgical fixation of the ASD or PFO may decrease the likelihood of a recurrent stroke, but more evidence is needed to prove it's certain effectiveness.

DISCUSSION

- 40% of total studies reveal that there is a frequent incidence between patients who experienced a cryptogenic stroke also have an ASD or PFO. However, the methods used and limitations within some of the studies cause us to question their accuracy. Such factors include:
 - Lack of scientific method
 - Data unadjusted for age and comorbidity
 - Poor selection of controls
 - Small sample base
 - Retrospective and circumstantial nature of analyses⁵
- It is evident that of the 40% of studies revealing an incidence between the presence of an ASD or PFO in the occurrence of a cryptogenic stroke, only 30% found the occurrence to be significant which suggests that the occurrence of the two are likely coincidental. As a result, more thorough studies with a much wider sample base should be carried out before a more confident conclusion can be made regarding their association. **Therefore, due to the evidence we are unable to conclude that having an ASD or PFO does indeed show clinical relevance in the association with cryptogenic stroke.**
- Surgical closure of a PFO may decrease recurrence of cryptogenic stroke in some cases, **however these statistics are often from observational studies rather than randomized, controlled trials supporting the efficacy.**
- We are unable to pin the congenital malformations ASD and PFO as being considered biomarkers of strokes because of the lack of efficacious scientific studies to prove this theory. However, it is too early to completely rule this out because a widely sampled, randomized and controlled study has not yet been executed.



REFERENCES

1. American Stroke Association. (n.d.). *Stroke Association*. <http://www.strokeassociation.org/STROKEORG/>.
2. Prabhakaran, S. *et al.* (n.d.). *Cryptogenic stroke*. *UpToDate Inc.*. <http://www.uptodate.com/contents/cryptogenic-stroke>.
3. Boyd, LA and Quaney *et al.* *Aerobic Exercise Training in Chronic Stroke Patients Facilitates Implicit Motor Sequence Learning*. (2009).
4. American Journal of Cardiology. *Morphology of the Patent Foramen Ovale in Asymptomatic Versus Symptomatic (Stroke of Transient Ischemic Attack) Patients*. *American Journal of Cardiology* 103, 124-129 (2009).
5. Meissner, I. *et al.* *Patent Foramen Ovale: Innocent or Guilty? Evidence From a Prospective Population-Based Study*. *Journal of the American College of Cardiology* 47, 440-445 (2006).

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