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CLINICAL VIGNETTE

Patent Foramen Ovale: A Common Cardiovascular Finding in The Adult Population

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Case Report

The patient is a 51-year-old male with a history of CVA in 2012, hyperlipidemia, and kidney stones who presented recently to establish as a new patient. He reports that in August 2012, he noticed some difficulties in speech associated with right arm clumsiness and headache. These symptoms resolved but a few hours later the symptoms recurred in association with visual symptoms including diplopia. He was eventually taken to the emergency room where an MRI noted a left temporal/occipital CVA. Work-up eventually revealed a patent foramen ovale on transesophageal echo with bubble study. He is being followed closely by a neurologist and cardiologist.

Past medical history includes:

1. CVA involving the temporal/occipital cortex. MRI/MRA of the head and neck were negative except for the CVA.
2. Patent foramen ovale measured at 6 mm in size. 24 hour holter monitor was negative.
3. Migraine
4. Kidney stones
5. Appendectomy

Medications include atorvastatin 20 mg daily, clopidogrel 75 mg daily. No known medication allergies other than GI intolerance to aspirin.

The patient is a non-smoking writer who drinks socially, averaging about 3-4 drinks per week.

Family history is significant for migraines and hyperlipidemia but no coronary artery disease or cancer.

His physical examination revealed a height of 5 foot 6 inches, weight 142 pounds, BP 110/60, pulse 76 and regular, and temperature 97.8 F. Physical exam was noncontributory with a normal neurological examination except for slight difficulty with speech (difficulty finding words) and a normal cardiovascular examination.

Laboratory evaluation revealed a normal CBC, chemistries, thyroid function, and lipid panel. Hypercoagulability work-up was negative.

General Discussion and Epidemiology

A patent foramen ovale is a congenital opening between the right and left atria persisting after the age of 1 year and which can be associated with various conditions including paradoxical embolic strokes¹. A PFO is present in approximately 10-15% of patients although it is much more common on autopsy studies where it can be found in 20-25% of patients². Nearly 50% of patients with cryptogenic strokes are noted to have a PFO on echocardiogram³. Males and females tend to have approximately equal risk of having a PFO³. PFO's were first described by Leonardi Botali in Italy in the 16th century whereas embolic events related to PFO's were first described three hundred years later⁴. Fortunately, most patients with patent foramen ovale's remain asymptomatic during their lifetime although there is an increased incidence of various conditions including CVA, TIA, and migraines⁵. There is also an increased incidence of fat embolism, right atrial tumors, and myocardial infarction⁶.

Etiology and Pathophysiology

The foramen ovale is an opening between the atrial septa primum and the atrial septal secundum that has the appearance of a flap and usually closes by the age of two. Early in life, the foramen ovale serves a physiologic function but typically closes shortly after birth (most by age two) as normal pulmonary and circulatory pathways are established⁷. In some patients, the foramen ovale does not close properly and remains open and can facilitate right to left shunting of blood through the heart. Genetic and environmental factors appear to play a part in the pathogenesis of patent foramen ovale although genetics appears to be a significant factor in female patients⁸. The size of the PFO can increase over time

with the mean during the first decade of life being about 3.4 mm while the mean during the 10th decade being about 5.8 mm¹. A patent foramen ovale, along with increased right atrial pressure, can predispose to clot formation and embolic strokes⁹.

Clinical Symptoms

Most patients with PFO are asymptomatic although there is an increased incidence of migraines, embolic CVA, carcinoid syndrome, and MI. PFO's are also associated with other cardiac conditions such as atrial septal aneurisms, Chiari network, Ebstein anomaly, and Eustachian valve disorders^{10,11}. Although migraines appear to be more common in patients with a patent foramen ovale, screening for PFO's is not recommended in the management of migraines¹². PFO's are also an issue for scuba divers where air embolism through the patent foramen ovale can be problematic¹³. The risk is increased with increasing size of the PFO and if patients travel within 48 hours of scuba diving¹³.

Diagnosis and Testing

Various methods can be used to detect a patent foramen ovale. Color flow Doppler imaging with a transthoracic echocardiogram can sometimes detect a small signal in the region of the atrial septum¹⁴. Transthoracic echocardiography, transesophageal echocardiography, transcranial Doppler, and transmitral Doppler have been used to diagnose PFO's usually in conjunction with agitated saline contrast¹⁵. This is often referred to as a "bubble test" where a bolus of injected saline is injected and appears in the left atrium as microbubbles within three cardiac cycles¹⁵. Transesophageal echocardiography (with or without contrast) can often provide an excellent visualization of the atrial septum and surrounding structures and is generally a more sensitive test than transthoracic echocardiography¹⁵. Transmitral Doppler appears to be an effective diagnostic tool although clinical experience is limited¹⁶. Transcranial Doppler also appears to be a useful test although experience is also limited¹⁷. Laboratory and EKG findings are usually normal in patients with an uncomplicated situations and patent foramen ovals do not usually cause a murmur. It is important to remember that patent foramen ovals are generally common so finding a PFO doesn't always prove a causal relationship to an embolic event. Imaging of the lower extremities should also be considered as part of the work-up for an embolic CVA especially in the context of a known PFO.

Treatment

Most patients with a patent foramen ovale without an associated event require no further medical or surgical treatment⁹. Patients with PFO's who suffer an otherwise unexplained cardiovascular or neurologic event are considered for antiplatelet therapy¹⁸. Warfarin is sometimes also used in high-risk patients with a goal international normalized ratio (INR) of 2-3¹. Other cardiovascular risk factors (hyperlipidemia, hypertension, etc.) should be addressed and treated appropriately. Closure of the PFO is considered in patients whose course has been complicated by an associated event¹⁹. Typically this is considered for patients with a known PFO in the setting of a presumed embolic CVA, presumed coronary embolism, contraindications to medical management, posttraumatic fat embolism syndrome with cerebral embolism, and/or a concomitant hypercoagulability state²⁰. PFO's can be closed either percutaneously or surgically¹⁸. Surgical closure is usually preferred if the PFO is larger than 2.5 cm, if percutaneous efforts have failed, or if the defect appears more amenable to surgical techniques¹⁹. Percutaneous repair typically requires at least six months of post-procedure anti-coagulation²⁰.

Clinical Course and Follow-Up

The patient has continued to do well on medical management with anti-platelet therapy and a statin. At the current time, he is considering surgical and percutaneous options.

Teaching Pearls

1. A patent foramen ovale is common in the general population being found in approximately 10-25% of patients.
2. PFO's are even more common in patients with cryptogenic strokes being found in approximately 50% of such patients.
3. Most patients with a PFO are asymptomatic.
4. Patients noted to have a cerebral ischemic event should be considered for PFO screening.
5. Screening is usually performed with transesophageal or transthoracic echocardiography with "bubble study".

REFERENCES

1. **Hara H, Virmani R, Ladich E, Mackey-Bojack S, Titus J, Reisman M, Gray W, Nakamura M, Mooney M, Poulouse A, Schwartz RS.** Patent foramen ovale: current pathology, pathophysiology, and clinical status. *J Am Coll Cardiol.* 2005 Nov 1;46(9):1768-76. Epub 2005 Sep 29. Review. PubMed PMID: 16256883.
2. **Hagen PT, Scholz DG, Edwards WD.** Incidence and size of patent foramen ovale during the first 10 decades of life: an autopsy study of 965 normal hearts. *Mayo Clin Proc.* 1984 Jan;59(1):17-20. PubMed PMID: 6694427.
3. **Lamy C, Giannesini C, Zuber M, Arquizan C, Meder JF, Trystram D, Coste J, Mas JL.** Clinical and imaging findings in cryptogenic stroke patients with and without patent foramen ovale: the PFO-ASA Study. Atrial Septal Aneurysm. *Stroke.* 2002 Mar;33(3):706-11. PubMed PMID: 11872892.
4. **Aslam F, Shirani J, Haque AA.** Patent foramen ovale: assessment, clinical significance and therapeutic options. *South Med J.* 2006 Dec;99(12):1367-72. Review. PubMed PMID: 17233193.
5. **Kizer JR, Devereux RB.** Clinical practice. Patent foramen ovale in young adults with unexplained stroke. *N Engl J Med.* 2005 Dec 1;353(22):2361-72. Review. Erratum in: *N Engl J Med.* 2006 Jun 1;354(22):2401. PubMed PMID: 16319385.
6. **Agostoni P, Gasparini G, Destro G.** Acute myocardial infarction probably caused by paradoxical embolus in a pregnant woman. *Heart.* 2004 Mar;90(3):e12. PubMed PMID: 14966073; PubMed Central PMCID: PMC1768105.
7. **Kerut EK, Norfleet WT, Plotnick GD, Giles TD.** Patent foramen ovale: a review of associated conditions and the impact of physiological size. *J Am Coll Cardiol.* 2001 Sep;38(3):613-23. Review. PubMed PMID: 11527606.
8. **Arquizan C, Coste J, Touboul PJ, Mas JL.** Is patent foramen ovale a family trait? A transcranial Doppler sonographic study. *Stroke.* 2001 Jul;32(7):1563-6. PubMed PMID: 11441202.
9. **Landzberg MJ, Khairy P.** Indications for the closure of patent foramen ovale. *Heart.* 2004 Feb;90(2):219-24. Review. PubMed PMID: 14729808; PubMed Central PMCID: PMC1768084.
10. **Schneider B, Hofmann T, Justen MH, Meinertz T.** Chiari's network: normal anatomic variant or risk factor for arterial embolic events? *J Am Coll Cardiol.* 1995 Jul;26(1):203-10. PubMed PMID: 7797753.
11. **Attenhofer Jost CH, Connolly HM, O'Leary PW, Warnes CA, Tajik AJ, Seward JB.** Left heart lesions in patients with Ebstein anomaly. *Mayo Clin Proc.* 2005 Mar;80(3):361-8. PubMed PMID: 15757018.
12. **Silberstein SD, Holland S, Freitag F, Dodick DW, Argoff C, Ashman E;** Quality Standards Subcommittee of the American Academy of Neurology and the American Headache Society. Evidence-based guideline update: pharmacologic treatment for episodic migraine prevention in adults: report of the Quality Standards Subcommittee of the American Academy of Neurology and the American Headache Society. *Neurology.* 2012 Apr 24;78(17):1337-45. doi: 10.1212/WNL.0b013e3182535d20. Review. Erratum in: *Neurology.* 2013 Feb 26;80(9):871. PubMed PMID: 22529202; PubMed Central PMCID: PMC3335452.
13. **Schwerzmann M, Seiler C, Lipp E, Guzman R, Lövblad KO, Kraus M, Kucher N.** Relation between directly detected patent foramen ovale and ischemic brain lesions in sport divers. *Ann Intern Med.* 2001 Jan 2;134(1):21-4. PubMed PMID: 11187416.
14. **Maffè S, Dellavesa P, Zenone F, Paino AM, Paffoni P, Perucca A, Kozel D, Signorotti F, Bielli M, Parravicini U, Pardo NF, Cucchi L, Aymele AG, Zanetta M.** Transthoracic second harmonic two- and three-dimensional echocardiography for detection of patent foramen ovale. *Eur J Echocardiogr.* 2010 Jan;11(1):57-63. doi: 10.1093/ejehocardi/jep165. Epub 2009 Nov 12. PubMed PMID: 19910318.
15. **Meissner I, Whisnant JP, Khandheria BK, Spittell PC, O'Fallon WM, Pascoe RD, Enriquez-Sarano M, Seward JB, Covatt JL, Sicks JD, Wiebers DO.** Prevalence of potential risk factors for stroke assessed by transesophageal echocardiography and carotid ultrasonography: the SPARC study. Stroke Prevention: Assessment of Risk in a Community. *Mayo Clin Proc.* 1999 Sep;74(9):862-9. PubMed PMID: 10488786.
16. **Kerr AJ, Buck T, Chia K, Chow CM, Fox E, Levine RA, Picard MH.** Transmitral Doppler: a new transthoracic contrast method for patent foramen ovale detection and quantification. *J Am Coll Cardiol.* 2000 Nov 15;36(6):1959-66. PubMed PMID: 11092671.
17. **Droste DW, Lakemeier S, Wichter T, Stypmann J, Dittrich R, Ritter M, Moeller M, Freund M, Ringelstein EB.** Optimizing the technique of contrast transcranial Doppler ultrasound in the detection of right-to-left shunts. *Stroke.* 2002 Sep;33(9):2211-6. PubMed PMID: 12215589.
18. **Meier B, Lock JE.** Contemporary management of patent foramen ovale. *Circulation.* 2003 Jan 7;107(1):5-9. PubMed PMID: 12515733.
19. **Khairy P, O'Donnell CP, Landzberg MJ.** Transcatheter closure versus medical therapy of patent foramen ovale and presumed paradoxical thromboemboli: a systematic review. *Ann Intern Med.* 2003 Nov 4;139(9):753-60. Review. PubMed PMID:14597460.
20. **Slavin L, Tobis JM, Rangarajan K, Dao C, Krivokapich J, Liebeskind DS.** Five-year experience with percutaneous closure of patent foramen ovale. *Am J Cardiol.* 2007 May 1;99(9):1316-20. Epub 2007 Mar 20. PubMed PMID: 17478165.

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