Successful Patent Foramen Ovale Closure in a 47-Year-Old Female Suffering from Migraines with Aura

Sidhi Laksono[1,2], Hillary Kusharsamita[3]

[1]Department of Cardiology and Vascular Medicine, Siloam Diagram Heart Hospital, Cinere, Indonesia
[2]Department of Cardiology and Vascular Medicine, Universitas Muhammadiyah Prof Dr Hamka, Faculty of Medicine, Tangerang, Indonesia
[3]Pertamina Central Hospital, South Jakarta, Indonesia

Cite this article as: Laksono S, Kusharsamita H. Successful patent foramen ovale closure in a 47-year-old female suffering from migraines with aura. *Cerrahpaşa Med J.* 2024;48(1):101-103.

Researchers have taken attention of the correlation between patent foramen ovale (PFO) and migraines, particularly migraines with aura. Multiple studies, especially in individuals with migraine with aura, have linked right-to-left shunt to migraine.[1] Migraine sufferers with aura had a greater incidence of PFO than migraine without aura and non migraine patients, and are 4.5 times more likely to experience a >50% decrease in migraine frequency following PFO closure.[2] Therefore, it has become crucial for cardiologists to focus on PFO diagnosis and therapy, 2 areas that have previously gotten limited attention. However, despite the fact that eliminating migraine's underlying cause may benefit these gradually pathological processes, there has been no clinical confirmation of the effectiveness of catheter closure of PFOs for migraine compared to medication therapy.[3,4] In this report, we discuss the case of a 47-year-old female who suffered from migraines with aura and was discovered to have a PFO, who was effectively treated with PFO closure and had satisfactory clinical results. Written informed consent was obtained from the patient who participated in this study.

A 47-year-old female who complained of recurrent headache before admission to the hospital. The headache was located at the right regions, pulsated, and aggravated by physical activity. The headache is described as throbbing, and outward expanding in nature. The headache is also accompanied by episodic syncope, and was not accompanied by disturbances in vision, sensation, or speech. These symptoms occurred twice in a month. The patient was then hospitalized for further examination and treatment.

The vital signs are all within normal range and the remaining physical examination was normal. The laboratory data showed no abnormalities. The patient then had further examinations. Brain magnetic resonance imaging (MRI) and magnetic resonance angiogram showed no abnormal findings. Considering that PFO has been linked to an increased risk of migraine, a transesophageal echocardiogram (TEE) was carried out. From the TEE examination there was a complete opacification of left heart chamber (classified as grade IV) which strongly suggest the presence of a PFO. In light of all the investigation results, this PFO was recognized as the culprit of the patient's headaches and syncope episodes. This led to the decision to perform a PFO closure for the patient. Detailed explanations of the patient's disease, treatment program, prognosis, and cost were given.

The PFO closure procedure was performed under general anesthesia, right femoral vein was punctured after 2% Lidocaine SC injection. Multipurpose angiographic (MPA) catheter was inserted to left atrium (LA) without difficulty, then inserted to left superior pulmonary vein (LSPV). Occlutech Guide Wire J3-FC was inserted to LSPV, Occlutech Delivery Set 9F was inserted to the LA. Patent foramen ovale occluder Occlutech Figulla Flex-II 18/16 9F was inserted to delivery set and LA disc was deployed in the LA side then the right atrium (RA) disc was deployed in RA side after pulling the deliver set gently. PFO was stable in the right position evaluated by fluoroscopy and TEE (Figure 1). The delivery cable was detached from PFO occluder. The procedure finished and catheter was pulled out. The patient was stable on return to inpatient for close observation.

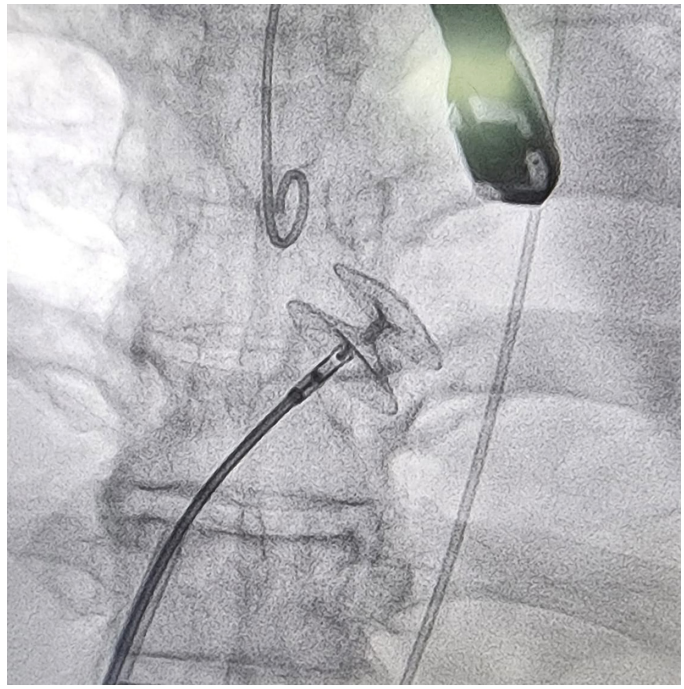

Figure 1. The fluoroscopic image during patent foramen ovale closure, both side disks in the appropriate locations.

Received: December 12, 2022 **Revision requested:** January 14, 2023
Last revision received: January 18, 2023 **Accepted:** January 13, 2024
Publication Date: April 26, 2024
Corresponding author: Sidhi Laksono, Department of Cardiology and Vascular Medicine, Siloam Diagram Heart Hospital, Cinere, Indonesia
e-mail: sidhilaksono@uhamka.ac.id
DOI: 10.5152/cjm.2024.22122

The PFO closure was successful, another evaluation with TEE showed a good result. There was also significant improvement of headache without any episodic migraine, the patient was then discharged. At an active 1-month follow-up, the patient reported no more migraine attacks or symptoms. No changes in medication were made throughout the follow-up.

Migraine is not just a severe headache but also a functional handicap that impedes a person's ability to work and engage in regular social activities. We described a case of a female who suffered from migraine with aura and diagnosed later with PFO, and treated with PFO closure, which significantly reduced her migraine severity. Studies have shown that individuals with PFOs had a 3.2 times greater risk of experiencing migraine with aura than those without PFO, and that PFOs are present in around 50% of patients with migraine with aura.[5] The headache reported as throbbing or pulsatile, followed by episodes of syncope, led to the diagnosis of migraine with aura in this patient. Aura is experienced in around 25% of migraine patients. Aura may precede or accompany a headache. Auras may be perceived in a variety of ways, including visually, auditorily, somatically, and motorically. [6]

Transesophageal echocardiogram was the diagnostic tool that confirmed the PFO. Based on TEE, PFO grades are divided into 4 categories: grade 1 (fewer than 5 bubbles), grade 2 (6-25 bubbles), grade 3 (25 or more), and grade 4. (visualization of the entire heart chamber).[3] Based on the TEE examination, we discovered a grade IV of PFO in this patient. Transthoracic echocardiogram, TEE, and transcranial Doppler ultrasonography are all echocardiographic procedures that may be used to diagnose a PFO shunt. Transesophageal echocardiogram is most typically utilized for PFO diagnosis because to its greater picture quality and ability to distinguish the site of shunting.[7]

In a recent meta-analysis, researchers identified many potential pathways which people with PFO may be predisposed to developing migraines. First, right-to-left shunt may let serotonin or other vasoactive substances like neurotransmitters or endothelin go across the lungs instead of being broken down by lung monoamine oxidase and enter the cerebral circulation directly.[8] Because significant levels of serotonin are accessible to the brain, this may result in trigeminal and cerebrovascular activation. Furthermore, subclinical emboli across a PFO might be the cause of migraine, particularly migraine with aura. In addition, the visual aura and accompanying headache were caused by paradoxical emboli deposited into the occipital region.[9] In addition, the lower blood oxygen saturation and hypoxia caused by a right-to-left shunt enhance the production of plasminogen activator 1, which in turn inhibits fibrinolysis and raises the risk of microembolization. Migraines are not the only thing that may happen when your brain does not get enough oxygen. Seventy-five percent of those with PFO who get migraines also have a large shunt, whereas 25% have a small shunt. A higher prevalence of persistent PFO and large PFO was seen in migraine patients who also had aura.[10]

A polling done by the American Headache Society found that almost 50% of respondents were in favor of using invasive procedures (PFO closure or neurostimulator) to alleviate persistent headache.[11] Moreover, a combined analysis of the PRIMA and PREMIUM studies indicated that PFO closure led to statistically significant decreases in monthly migraine days, monthly migraine attacks, also increase the amount of patients who experienced a complete omission of migraines.[12,13]

A percutaneous PFO closure employs atrial septal occlusion devices and is performed via catheter. Here, we employ a PFO occluder called the Occlutech Figulla Flex-II. The Occlutech Figulla Flex-II, a PFO closure device, has been shown to be safe for use in clinical settings and to have high structural effectiveness in the OPPOSE research.[14] Significant adverse events were rare, and the 6-month closure rate was comparable to those of other devices available. Significant vascular complications and major adverse device events are 2 types of problems that may arise as a result adverse events of using a medical device. Possible major vascular complications related to the closure devices include >5 cm access site hematoma, false aneurysm, arteriovenous fistula, retroperitoneal hemorrhage, peripheral ischemia, procedure-related transfusion, or necessary for vascular surgical repair. However, the studies showed that none of these problems were severe enough to result in permanent morbidity for any of the patients.[15] Our patient had no complications from the PFO closure treatment and was in a stable condition afterward.

In addition, some studies have shown the effects of antiplatelet as an alternative medications on PFO linked with migraine, which makes sense given that an impaired coagulation mechanism, leading to the production of "micro-embolisms," may also be one of the primary causes of migraine. Migraine patients benefited similarly from antiplatelet medication and PFO closure, leading researchers to hypothesize that venous platelet activation or aggregation, in which small emboli trigger migraines, plays a role in migraine pathophysiology. The subsequent prospective trial confirmed that Ticagrelor treatment decreased migraine frequency in certain PFO patients.[10]

Reducing migraine severity and functional impairment are the desired outcomes of PFO closure. It is also important to consider the potential therapeutic benefits of closure, which may include a decrease in paradoxical embolic sequelae such ischemic stroke, myocardial infarction, and cognitive impairment.[16] Our patient's functional activity and quality of life both increased as her headaches subsided, and she no longer had any episodes of migraine.

The risk of migraine with aura was higher in PFO patients, which can safely treated with PFO closure. Cardiologists should prioritize PFO screening and therapy for migraine sufferers. Transesophageal echocardiogram is commonly performed for PFO diagnosis because to its superior image quality and ability to identify the shunting location. Patent foramen ovale closure has the potential therapeutic advantages of reducing paradoxical embolic sequelae such ischemic stroke, myocardial infarction, and cognitive impairment.

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.L., H.K.; Design – H.K.; Supervision – S.L.; Resource – H.K.; Materials – S.L.; Data Collection and/or Processing – S.L., H.K.; Analysis and/or Interpretation – H.K.; Literature Search – S.L.; Writing – S.L., H.K.; Critical Review – S.L.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

References

1. Wang YL, Wang FZ, Zhang Y, et al. Association of migraine with patent foramen ovale closure: a systematic review and meta-analysis. *Int J Cardiol Heart Vasc*. 2022;39:100992. [CrossRef]
2. Jesurum JT, Fuller CJ, Kim CJ, et al. Frequency of migraine headache relief following patent foramen ovale "closure" despite residual right-to-left shunt. *Am J Cardiol*. 2008;102(7):916-920. [CrossRef]

3. Akagi T. Transcatheter closure of patent foramen ovale: current evidence and future perspectives. *J Cardiol*. 2021;77(1):3-9. [CrossRef]
4. Reisman M, Fuller CJ. Is patent foramen ovale closure indicated for migraine?: Patent foramen ovale closure for Migraine. *Circ Cardiovasc Interv*. 2009;2(5):468-474. [CrossRef]
5. Kurth T, Rist PM, Ridker PM, Kotler G, Bubes V, Buring JE. Association of migraine with aura and other risk factors with incident cardiovascular disease in women. *JAMA*. 2020;323(22):2281-2289. [CrossRef]
6. Kikkeri NS, Nagalli S. *Migraine with aura*. PubMed. Accessed November 26, 2022. Available at: https://www.ncbi.nlm.nih.gov/books/NBK554611/
7. Rana BS, Thomas MR, Calvert PA, Monaghan MJ, Hildick-Smith D. Echocardiographic evaluation of patent foramen ovale prior to device closure. *JACC Cardiovasc Imaging*. 2010;3(7):749-760. [CrossRef]
8. Lopez MF, Sarracino DA, Vogelsang M, et al. Heart – brain signaling in PFO related stroke: differential plasma proteomic expression patterns revealed with a Two-Pass LC-MS/MS discovery workflow. *J Investig Med*. 2012;60(8):1122. [CrossRef]
9. Diener HC, Kurth T, Dodick D. Patent foramen ovale and migraine. *Curr Pain Headache Rep*. 2007;11(3):236-240. [CrossRef]
10. Li K, Romoli M, Carotenuto M, Song S, Pan M. The correlation between migraine and patent foramen ovale. *Front Neurol*. 2020;11:543485. [CrossRef]
11. Schulman EA, Peterlin BL, Lake AE, et al. Defining refractory migraine: results of the RHSIS Survey of American Headache Society members. *Headache*. 2009;49(4):509-518. [CrossRef]
12. Mattle HP, Evers S, Hildick-Smith D, et al. Percutaneous closure of patent foramen ovale in migraine with aura, a randomized controlled trial. *Eur Heart J*. 2016;37(26):2029-2036. [CrossRef]
13. Tobis JM, Charles A, Silberstein SD, et al. Percutaneous closure of patent foramen ovale in patients with migraine: the PREMIUM trial. *J Am Coll Cardiol*. 2017;70(22):2766-2774. [CrossRef]
14. Hildick-Smith D, Williams T, MacCarthy P, et al. Occlutech percutaneous patent foramen ovale closure: safety and efficacy registry (OPPOSE). *Int J Cardiol*. 2017;245:99-104. [CrossRef]
15. Reza A, Karim A, Khan MH, et al. Patent foramen ovale device closure in a 27 years old young lady with cryptogenic ischaemic stroke - first case report from Bangladesh. *Cardiovasc J*. 2021;13(2):227-234. [CrossRef]
16. Meier B. Stroke and migraine: a cardiologist's headache. *Heart*. 2009;95(7):595-602. [CrossRef]