CONDITION

Patent foramen ovale

A patent foramen ovale is a flap-like opening between the heart's upper chambers that did not seal after birth.

WHAT IT IS
Persistent flap-like opening between the heart's upper chambers

BODY SYSTEM
Heart and circulation

MAIN SYMPTOMS
Usually none, sudden weakness, speech trouble, vision loss

WHAT CAUSES IT
Incomplete sealing of a normal fetal heart opening

HOW IT IS DIAGNOSED
Bubble echocardiogram, sometimes transesophageal echocardiogram

MAIN TREATMENT
Observation, stroke-prevention medicine, or catheter closure

CAN IT BE CURED?
Sometimes - closure can seal the opening

IS IT AN EMERGENCY?
Sometimes - sudden stroke symptoms need emergency care

LONG-TERM OUTLOOK
Excellent for most; many never need treatment

Overview

A patent foramen ovale, or PFO, is a small flap-like opening between the two upper chambers of the heart. "Patent" means open. The foramen ovale is a normal part of the heart before birth, when it allows blood to bypass the developing lungs.

After birth, pressure changes in the heart normally push this flap closed. In some people, it does not seal completely. The flap may stay closed most of the time but open briefly when pressure rises on the right side of the heart, such as during coughing or straining.

A PFO is not the same as an atrial septal defect. An atrial septal defect is missing heart tissue, while a PFO is usually an overlap of tissue that has not sealed.

Most people with a PFO have no symptoms and never need treatment. It usually does not

weaken the heart or interfere with normal blood flow. It matters mainly because, in uncommon circumstances, a blood clot may cross through the opening and travel to the brain or another organ. This is called a paradoxical embolism.

A PFO is often found by chance during a heart scan or during tests after a stroke with no other clear cause.

Symptoms

A PFO itself usually causes no symptoms. It generally does not cause chest pain, palpitations, tiredness, a heart murmur, or breathlessness.

If a clot passes through a PFO and reaches the brain, it can cause a stroke or transient ischaemic attack, often called a TIA or "mini-stroke." Symptoms can include sudden:

A TIA causes temporary symptoms, but it must still be treated as an emergency because it can be a warning of a stroke.

PFO is also associated with migraine, especially migraine with aura. Aura can cause flashing lights, blind spots, tingling, or speech changes before or during a headache. However, an association does not prove that the PFO caused the migraine.

Very rarely, a PFO contributes to low blood oxygen that becomes worse while sitting or standing and improves when lying down. This is called platypnea-orthodeoxia syndrome.

- Weakness or numbness, especially on one side
- Trouble speaking or understanding speech
- Loss of vision or double vision
- Loss of balance, severe dizziness, or difficulty walking

Causes and risk factors

Everyone has a foramen ovale before birth. A PFO remains when the flap does not seal after birth. This is a difference in development rather than damage caused by lifestyle, infection, or heart disease.

Why the opening stays unsealed in one person and not another is often unclear. PFO can occur in families, but most cases do not follow a simple inherited pattern.

Having a PFO does not mean that a stroke will happen. A clot generally needs to form elsewhere, often in a deep vein in the leg or pelvis, before it could pass through the opening.

Factors that can increase the chance of a vein clot include prolonged immobility, major surgery, serious injury, pregnancy, some cancers, and certain blood-clotting conditions. A temporary rise in pressure on the right side of the heart may then allow the clot to cross the PFO.

A PFO can also allow small gas bubbles to enter the arterial circulation during decompression. This is relevant to scuba divers, particularly those with repeated or serious decompression illness.

Diagnosis

Most people are not routinely tested for PFO. Testing may be considered after an unexplained stroke, unusually low blood oxygen, or certain episodes of decompression illness.

The main test is an echocardiogram, which uses sound waves to create pictures of the heart. A "bubble study" is often added. During this test, agitated salt water is injected into a vein. If tiny bubbles appear in the left side of the heart, blood is crossing from right to left.

You may be asked to cough or bear down briefly during the test. This raises pressure on the right side of the heart and may make a small PFO easier to detect.

A standard echocardiogram is performed through the chest. If more detail is needed, a transesophageal echocardiogram may be used. A flexible probe is passed into the esophagus, or food pipe, after sedation and throat numbing. Because the esophagus lies close to the heart, this gives clearer pictures of the flap and nearby structures.

A transcranial Doppler ultrasound can detect bubbles reaching blood vessels in the brain. It can show that a right-to-left passage exists, but it may not identify whether that passage is in the heart or lungs.

Finding a PFO after a stroke does not prove that it caused the stroke. Because PFO is common, it may be an unrelated finding. A stroke assessment may also include brain imaging, scans of the head and neck arteries, heart-rhythm monitoring, and tests for other sources of blood clots.

Treatment and management

Most PFOs found by chance need no treatment or regular imaging. Treatment is considered when there is a specific problem linked to the opening.

After a stroke with no other clear cause, treatment may include an antiplatelet medicine, which

makes platelets less likely to form clots. Some people need an anticoagulant like warfarin or apixaban , which reduces the blood's ability to clot more broadly. The choice depends on the suspected cause of the stroke, bleeding risk, and whether another condition requires anticoagulation.

PFO closure may be offered to selected adults after a stroke thought likely to have been caused by the PFO. Before recommending closure, specialists usually look for other explanations such as narrowed arteries, atrial fibrillation, or small-vessel disease.

Closure is usually performed through a catheter rather than open-heart surgery. A thin tube is passed through a vein, usually near the groin, and guided to the heart. A device is placed across the PFO so that tissue can grow over it. Open surgery is rarely used solely for a PFO, although closure may be performed during surgery for another heart condition.

Closure can reduce the risk of another stroke in carefully selected people, but it cannot remove every stroke risk. It also has possible complications, including bleeding, injury to a blood vessel, and a new irregular rhythm called atrial fibrillation. Device-related problems are uncommon.

PFO closure is not routinely recommended solely to treat migraine. Some people report improvement after closure, while others do not, and clinical trials have not supported closure as standard migraine treatment.

Complications

Most people with a PFO never develop complications. Possible problems include:

Closure procedures also carry risks. Atrial fibrillation can occur after closure, particularly around the time of the procedure. Other possible problems include bleeding, infection, movement of the device, or a clot forming on it. Your procedural team should explain these risks in the context of the expected benefit.

- Stroke: A clot crossing the PFO may block an artery in the brain
- TIA: A brief interruption of brain blood flow can cause temporary stroke-like symptoms
- Embolism elsewhere: Rarely, a clot may travel to another organ or limb
- Decompression illness: Gas bubbles may cross the PFO after diving
- Low blood oxygen: Rarely, blood bypasses the lungs through the opening

Prevention

A PFO itself cannot usually be prevented. It develops before birth and remains because the normal fetal opening does not fully seal. Diet, exercise, or medication cannot make an unclosed PFO seal naturally in adulthood.

You can reduce some causes of blood clots and stroke even if the PFO remains. This may include staying active, avoiding tobacco, and managing blood pressure, cholesterol, diabetes, and atrial fibrillation when present.

During long periods of sitting, such as a long journey, regular movement may help reduce the chance of a deep vein clot. People with a previous clot or a known clotting condition may need specific preventive advice before travel, surgery, or pregnancy.

If you scuba dive, a PFO does not automatically mean you must stop. However, repeated or serious decompression illness deserves assessment by a clinician experienced in diving medicine. Changes to diving practices or PFO closure may be considered in some circumstances.

Living with it and what to expect

For most people, a PFO remains quiet throughout life. It usually does not grow, damage the heart, or limit exercise. Many people only learn that they have one after a scan performed for another reason.

If the PFO was found by chance and you have not had a related complication, you may not need treatment or long-term cardiology follow-up. Routine care should still focus on your overall heart and stroke risk.

After an unexplained stroke, follow-up may involve neurology and cardiology teams. Further heart-rhythm monitoring may be needed because atrial fibrillation can occur only occasionally and may be missed on a short heart tracing.

If you have catheter closure, recovery is usually much shorter than after heart surgery. Follow-up commonly checks the device position, heart rhythm, and whether blood still crosses between the chambers. You may need temporary activity limits and medicines to reduce clot formation while the device heals into place. Follow the plan given by your procedural team rather than stopping medicine on your own.

A previous stroke may have lasting effects even after PFO closure. Rehabilitation, control of other stroke risks, and prescribed stroke-prevention medicine can remain important. Closure prevents a potential route for a clot; it does not reverse existing brain injury or prevent strokes from unrelated causes.

When to get medical help

Call emergency services immediately for possible stroke symptoms, even if they improve within minutes. These include sudden facial drooping, arm or leg weakness, speech trouble, vision loss, severe imbalance, or confusion.

Emergency assessment is also needed for sudden severe breathlessness, chest pain, coughing up blood, or fainting. These can be signs of a clot in the lungs or another serious condition.

After a closure procedure, seek urgent advice for increasing swelling or bleeding at the catheter site, fever, worsening chest discomfort, fainting, or a new fast or irregular heartbeat. Use emergency services for severe symptoms.

Routine follow-up is appropriate if you have questions about an incidentally discovered PFO, migraines without new neurological symptoms, planned pregnancy, long-distance travel, or scuba diving. Arrange a review if you are unsure whether prescribed stroke-prevention medicine should continue; do not stop it without medical guidance.

Common questions

Is a PFO a hole in my heart?

It is often described that way, but it is more accurately a flap that did not seal. Unlike some other heart defects, it usually is not an area of missing tissue and does not normally strain the heart.

Can a PFO cause a stroke?

It can provide a route for a vein clot to reach the brain, but most PFOs never cause a stroke. When a PFO is found after a stroke, other possible causes must be investigated before deciding that the opening was responsible.

Does every PFO need to be closed?

No. An incidental PFO usually needs no treatment. Closure is mainly considered after certain unexplained strokes or for a small number of people with other PFO-related problems.

Will closing a PFO stop my migraines?

Not reliably. Migraine with aura is more common among people with PFO, but the reason is uncertain. Closure is not standard treatment for migraine alone because improvement cannot be predicted.

Can I exercise or fly with a PFO?

Most people can exercise and fly normally. Long journeys can increase the risk of a leg clot in anyone, so movement is sensible. Different advice may apply after a recent stroke, blood clot, or closure procedure.

Can I scuba dive with a PFO?

Some people with a PFO continue to dive, but it may increase the risk that decompression bubbles reach the arterial circulation. A diving-medicine assessment is especially important after repeated, neurological, or otherwise serious decompression illness.

Sources

- American Heart Association. Patent Foramen Ovale (PFO)
- Kavinsky CJ, Szerlip M, Goldsweig AM, and colleagues. SCAI Guidelines for the Management of Patent Foramen Ovale . Journal of the Society for Cardiovascular Angiography & Interventions . 2022;1(4):100039
- Messé SR, Gronseth GS, Kent DM, and colleagues. Practice advisory update summary: Patent foramen ovale and secondary stroke prevention . Neurology . 2020;94(20):876-885
- Kleindorfer DO, Towfighi A, Chaturvedi S, and colleagues. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack . Stroke . 2021;52(7):e364-e467
- Silvestry FE, Cohen MS, Armsby LB, and colleagues. Guidelines for the Echocardiographic Assessment of Atrial Septal Defect and Patent Foramen Ovale . Journal of the American Society of Echocardiography . 2015;28(8):910-958