CONDITION

Atrial septal defect

Learn how an atrial septal defect affects the heart, possible symptoms and complications, and how ASD is diagnosed, treated, and monitored.

WHAT IT IS
Congenital opening between the heart's upper chambers

BODY SYSTEM
Heart and circulation

MAIN SYMPTOMS
Shortness of breath, tiredness, palpitations, swelling

WHAT CAUSES IT
Usually unknown, sometimes genetic

HOW IT IS DIAGNOSED
Echocardiogram

MAIN TREATMENT
Monitoring or defect closure

CAN IT BE CURED?
Sometimes - closes naturally or is repaired

IS IT AN EMERGENCY?
Sometimes - severe breathing difficulty or collapse

LONG-TERM OUTLOOK
Often good, but complications can develop

Overview

An atrial septal defect, or ASD, is an opening in the wall between the heart's two upper chambers. This wall is called the atrial septum. An ASD is congenital, meaning it is present at birth.

Normally, the right side of the heart sends oxygen-poor blood to the lungs, while the left side sends oxygen-rich blood to the body. With an ASD, blood usually flows through the opening from the left atrium to the right atrium. This sends extra blood through the right side of the heart and into the lungs.

A small ASD may cause no health problems. Some small defects, especially certain defects found in infancy, may become smaller or close naturally. A larger ASD can gradually enlarge the right side of the heart and increase blood flow through the lungs. Over time, this may lead to

abnormal heart rhythms, reduced heart function, or high blood pressure in the lung arteries.

Several types of ASD can occur:

A patent foramen ovale, or PFO, is different from an ASD. A PFO is a flap-like connection left over from fetal circulation rather than missing septal tissue. Its evaluation and treatment are not the same as for an ASD.

- Secundum ASD: An opening near the center of the atrial septum. This is the most common type and may be suitable for closure with a catheter-based device.
- Primum ASD: An opening in the lower part of the septum, often associated with an abnormal heart valve.
- Sinus venosus ASD: An opening near the veins that bring blood from the body or lungs into the heart. Some pulmonary veins may also connect abnormally.
- Coronary sinus defect: A rare opening involving a vein that drains blood from the heart muscle.

Symptoms

Many babies and children with an ASD have no clear symptoms. The defect may be found when a clinician hears a heart murmur or performs an echocardiogram for another reason. A heart murmur is an extra sound caused by blood moving through the heart.

When symptoms occur in children, they may include tiring during feeding or activity, slow weight gain, frequent respiratory infections, or faster breathing. These symptoms can have many causes and do not confirm an ASD.

Some people do not develop noticeable symptoms until adulthood. Possible symptoms include:

Symptoms may become more noticeable if the right side of the heart begins to weaken, pressure rises in the lung arteries, or an abnormal rhythm develops. Atrial fibrillation and atrial flutter are rapid or irregular rhythms that can occur more often as people with a significant ASD get older.

- Shortness of breath, especially during activity
- Reduced stamina or unusual tiredness
- A sensation that the heart is racing, fluttering, or skipping beats
- Swelling in the feet, ankles, legs, or abdomen
- Fainting or feeling lightheaded

- More frequent chest or respiratory infections

Causes and risk factors

An ASD forms while the heart is developing early in pregnancy. In most cases, there is no single identifiable cause. Changes in genes and other developmental factors may contribute.

Some ASDs occur as part of a genetic condition or alongside other congenital heart problems. A family history of congenital heart disease may increase the chance of having a heart defect, although most children born with an ASD do not have an affected parent.

Certain exposures or health conditions during pregnancy may increase the risk of congenital heart defects in general. These can include smoking, uncontrolled diabetes, rubella infection, and exposure to some medicines or substances. Having a risk factor does not mean that a baby will develop an ASD, and an ASD is not usually caused by anything a parent did or did not do.

ASDs are sometimes detected before birth, but many are difficult to see during routine prenatal ultrasound. Some are identified in infancy or childhood, while others remain undetected until adulthood.

Diagnosis

A clinician may suspect an ASD after hearing a characteristic heart murmur or noticing signs that the right side of the heart is handling extra blood. Because many people have few symptoms, imaging is needed to confirm the diagnosis.

An echocardiogram is the main test. It uses sound waves to create moving pictures of the heart. It can show the defect's location and size, the direction of blood flow, the condition of the heart valves, and whether the right atrium or right ventricle is enlarged.

A standard echocardiogram is performed by moving a probe over the chest. In some cases, a transesophageal echocardiogram provides more detailed images. For this test, a thin ultrasound probe is passed into the esophagus after sedation. The esophagus lies close to the heart.

Other tests may include:

Cardiac catheterization involves guiding a thin tube through a blood vessel to the heart. It is not required for every ASD. It may be used when pulmonary hypertension is suspected or when the defect is being closed with a device.

Evaluation focuses on more than the width of the opening. The clinician also considers how much blood is crossing the defect, whether the right side of the heart is enlarged, lung artery pressure, symptoms, age, and other heart conditions.

- An electrocardiogram, or ECG, to assess the heart rhythm and electrical activity
- A chest X-ray to look at heart size and blood vessels in the lungs
- Cardiac MRI or CT to define heart anatomy, blood flow, or pulmonary vein connections
- An exercise test to measure symptoms and heart function during activity
- A heart monitor to look for intermittent abnormal rhythms
- Cardiac catheterization to measure pressures and blood flow when noninvasive tests do not provide enough information

Treatment and management

Treatment depends on the ASD's type, size, effects on the heart, and the person's overall health. A small defect that does not enlarge the right side of the heart may only need periodic monitoring. In young children, some small secundum ASDs close or become smaller without treatment.

Closure may be considered when an ASD causes substantial extra blood flow and enlargement of the right side of the heart, even if symptoms are mild. Closing the opening can reduce the extra workload on the heart and help prevent later complications. Closure may not be appropriate when severe, irreversible disease has developed in the blood vessels of the lungs, because the opening may then serve as a pressure outlet. Specialist assessment is essential in this situation.

There are two main ways to close an ASD.

Catheter-based device closure may be used for a secundum ASD with suitable size and surrounding tissue. A cardiologist guides a catheter through a vein, usually from the groin, into the heart. A closure device is placed across the opening and remains there. Heart tissue gradually grows over it. This approach avoids open-heart surgery, but it is not suitable for every defect.

Surgical closure is generally used for primum, sinus venosus, and coronary sinus defects. It may also be needed for a large or unusually shaped secundum ASD, an ASD without enough tissue to hold a device, or an ASD found with another heart problem requiring surgery. The surgeon closes the opening with stitches or a patch and may repair abnormal valves or pulmonary veins at the same time.

Medicines do not close an ASD. They may be used to manage related problems such as fluid buildup, high blood pressure in the lung arteries, or an abnormal heart rhythm. After device or surgical closure, the care team may prescribe medicine to reduce the risk of blood clots while healing occurs. Patients should follow their own cardiology team's instructions rather than starting or stopping aspirin, blood thinners like warfarin or apixaban , or heart medicines on their own.

Most people can take part in regular physical activity. Activity limits may be needed when there is pulmonary hypertension, an important rhythm problem, reduced heart function, or a recent procedure. A cardiologist can advise when it is safe to return to sports, work, or strenuous exercise.

Pregnancy is often well tolerated with a small or successfully repaired ASD. Risks may be higher with pulmonary hypertension, abnormal rhythms, heart failure, or an unrepaired defect with significant effects on the heart. Pre-pregnancy review with an adult congenital heart disease specialist can help clarify personal risks and plan care.

Complications

Many people with a small ASD never develop complications. Larger or long-standing defects may cause problems because of years of increased blood flow through the right side of the heart and lungs.

Possible complications include enlargement and weakening of the right side of the heart, heart failure, atrial fibrillation or flutter, and pulmonary hypertension. Pulmonary hypertension means that pressure in the arteries carrying blood from the heart to the lungs is abnormally high.

Rarely, severe pulmonary vascular disease can reverse the direction of blood flow through the ASD. Oxygen-poor blood then enters the body's circulation, causing low oxygen levels and a bluish or gray color of the lips or skin. This is called Eisenmenger syndrome and requires specialist care.

An ASD may also allow a blood clot from a vein to cross into the left side of the heart and travel to the brain or another organ. This is called a paradoxical embolism and may cause a stroke. The overall treatment decision is based on the full heart assessment, not on this possibility alone.

Closure reduces many long-term risks, particularly when performed before major heart or lung changes develop. It may not completely remove the risk of abnormal rhythms, especially when closure occurs later in adulthood.

Follow up

Follow-up needs differ according to the type of ASD, whether it was repaired, and whether there are ongoing effects on the heart. Monitoring may include clinic visits, echocardiograms, ECGs, exercise testing, or heart rhythm monitoring.

People with a repaired ASD may still need periodic cardiology review. Longer-term specialist care is especially important after repair of a primum or sinus venosus defect, or when there is a residual opening, valve disease, pulmonary hypertension, an abnormal rhythm, or reduced heart function. Adults with a complex or significant ASD may benefit from an adult congenital heart disease center.

Routine dental care is important for general heart health. Antibiotics like amoxicillin or doxycycline before dental procedures are not routinely required for everyone with an ASD. They may be advised for a limited time after repair involving prosthetic material or when a residual defect remains next to a patch or device. A cardiologist or dentist can give situation-specific advice.

Arrange routine medical review if exercise tolerance gradually decreases, swelling develops, or palpitations become more frequent. Seek prompt medical advice for a sustained rapid or irregular heartbeat, new fainting, or a meaningful increase in shortness of breath.

Call emergency services for severe breathing difficulty, persistent chest pressure, collapse, blue or gray lips, or signs of stroke such as sudden facial drooping, arm weakness, trouble speaking, or loss of balance. These symptoms have several possible causes and require immediate assessment.

Sources

- Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC Guideline for the Management of Adults With Congenital Heart Disease. Circulation . 2019;139(14):e698-e800.
- Baumgartner H, De Backer J, Babu-Narayan SV, et al. 2020 ESC Guidelines for the Management of Adult Congenital Heart Disease. European Heart Journal . 2021;42(6):563-645.
- Geva T, Martins JD, Wald RM. Atrial septal defects. The Lancet . 2014;383(9932):1921-1932.
- American Heart Association. Atrial Septal Defect. Patient information on congenital heart defects.

- Centers for Disease Control and Prevention. About Atrial Septal Defect. Congenital Heart Defects.