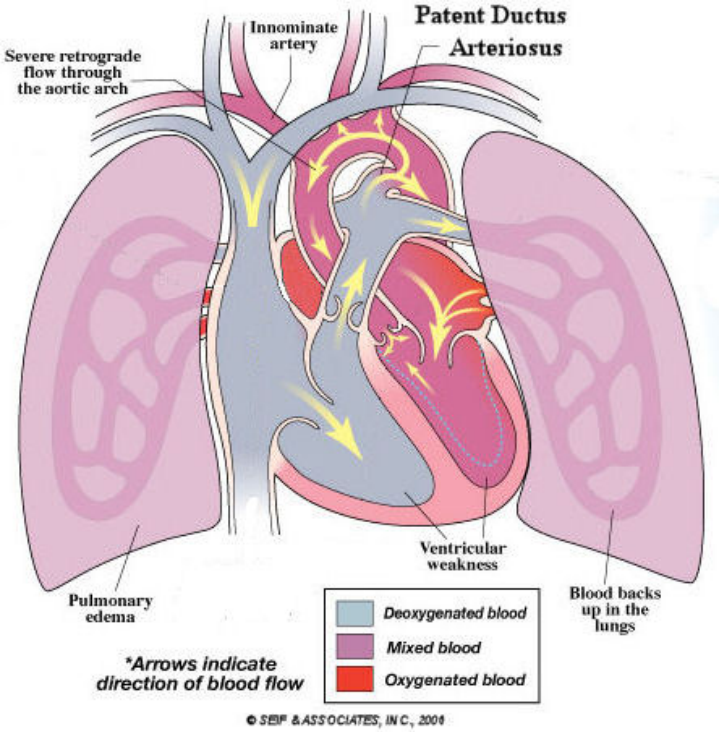
Patent Ductus Arteriosus, PDA

A ductus arteriosus is a blood vessel that is normal while a baby is developing in the womb. While in the womb, the mother provides oxygen to the baby because the baby's lungs are filled with fluid. Blood flow during this time skips (*bypasses*) the baby's lungs by going through the ductus arteriosus. The ductus arteriosus connects the artery going to the lungs (*pulmonary artery*) with the aorta. The aorta is the largest vessel in the body and carries blood away from the heart to the rest of the body. The ductus normally closes soon after birth because then the baby's lungs are able to get air into them. If the ductus does not close soon after the baby is born, it is called a open (*patent*) ductus arteriosus or PDA. This is a congenital condition, meaning the baby is born with it. In most babies, the ductus remains open for a short time after birth. Ninety percent close by 8 weeks of age. Sometimes the rest close during the first year of life without treatment.



CAUSES

- The cause of this is unknown.
- After birth, the lungs fill with oxygen so the pressure in lungs and the pulmonary artery goes down. At the same time, the umbilical cord is clamped and the pressure in the aorta increases. As a result, the pressure in the pulmonary artery is lower than the pressure in the aorta. This causes some of the blood in the aorta to flow through the ductus back to the lungs. This results in extra blood flow to the lungs.
- Problems from PDA depend on the size of the ductus.
  - If the ductus is small, the extra blood flow is minimal.
  - If the ductus is large, there can be a large amount of blood returning to the lungs. This causes increased work for the heart.
- Babies born very prematurely are more sensitive to the increased blood flow to the lungs, so they are more likely to have heart problems.
- If the extra blood flow is too hard on the heart, symptoms of congestive heart failure develop. This is common in premature infants, but uncommon in full term infants or older children.

THOSE AT RISK

- It affects 1 in 2000 babies each year.
- It is more common in girls and premature infants.
- It may also happen when other birth problems are present.
- It can happen in full term pregnancies.
- It occurs in infants with otherwise normal hearts.

SYMPTOMS

- Most children with PDA do not have heart related symptoms.
- A heart murmur is often the only clue that a child has a PDA.
- If the ductus is large in size, symptoms of congestive heart failure may develop at any time. However, the symptoms often show up in the first 2 to 3 months of life. The symptoms include:
  - Rapid breathing.
  - Feeding problems.
  - Slow weight gain.

- Low energy.
- Feeling cold, clammy and sweaty.

DIAGNOSIS

- Medical tests may include checking the amount of oxygen in the blood (*electrocardiogram*) and a chest x-ray.
- The diagnosis is confirmed by an echocardiogram. Your caregiver can explain these tests to you.

TREATMENT

- Small PDAs do not usually cause problems, so generally treatment is not needed.
- Medications that kill germs *(antibiotics*) are often used to stop an infection from developing in the heart. This is called SBE or subacute bacterial endocarditis.
- If the child develops congestive heart failure, medications may be prescribed. These medications often control the symptoms until the child gets bigger and the PDA gets smaller or closes altogether.
- Closure of the ductus is usually needed if :
  - The patent ductus does not close on its own by one or two years of age.
  - There are symptoms of congestive heart failure not controlled by medication.
  - It was recommended by your caregiver to reduce the risk for bacterial endocarditis. Treatment options include closure through heart catheterization or surgical closure. A medicine called indomethacin is often used to close the ductus in premature infants.
- Catheter closure may be a good treatment choice for children with PDA.
  - This procedure uses light sedation.
  - It avoids the need for an open heart surgery.
  - Thin plastic tubes *(catheters*) are placed into the large blood vessels in the legs (*femoral arteries*) and gently guided to the heart.
  - The catheters are used to deposit small metal coils inside the ductus.
  - The coils block the blood flow through the vessel, partly by causing the development of a blood clot in the patent ductus.
  - This procedure gives good results in most patients. Complications are rare but may include bleeding, infection, and early dislodgement of the coil.
  - If the coil moves out of position, it can usually be repositioned or replaced with a larger size coil at the time of the procedure.
  - The procedure is done as an outpatient.
  - Children can resume all activities within 48 hours.
- Surgical closure may be needed for larger PDA's and if closure is required during infancy.
  - It is done through a small incision between the ribs on the left side.
  - The ductus is identified and either tied off or divided.
  - Surgical complications are uncommon but may include: hoarseness or paralyzed diaphragm, infection, bleeding, and gathering (*accumulation*) of fluid around the lungs. Most children go home within a few days.

PROGNOSIS

The outlook for these patients is great when treatment is started soon enough to prevent pulmonary vascular obstructive disease. Possible long-term complications include *coarctation* (narrowing of the aorta) or recurrence of the patent ductus or both. These problems are both uncommon.

If the PDA remains large, over time the extra blood flow damages the pulmonary artery and they become stiff and thickened. This condition, called pulmonary vascular disease, is a very serious problem for which there is no effective treatment at this time. Children with PDA have an increased risk for subacute bacterial endocarditis (SBE). This is an infection of the heart caused by *bacteria* (germs) in the blood stream. It can happen after a dental or other medical procedure, but can usually be prevented by use of *antibiotics* (medications which kill germs) if given before the procedure. Children with small PDA's are at even greater risk for SBE than children

with large PDA's. For this reason, many doctors recommend closure of even small PDA's.

- Sometimes a patent ductus is a good thing. Some babies have heart defects that require the PDA to remain open for them to survive. In some heart defects, such as *pulmonary atresia* (an underdeveloped or blocked pulmonary valve), the patient ductus arteriosus supplies the only source of blood flow to the lungs that is enough so that oxygen can be delivered to the blood. In these patients, the ductus arteriosus supplies blood to the lungs from the aorta.
- In some heart problems at birth, the PDA is necessary to allow enough blood flow to the body. In these patients, the ductus arteriosus supplies blood to the body from the pulmonary artery. One of these conditions is an underdeveloped or severely narrowed aorta, sometimes seen when the left side of the heart is small. Then medication may need to be given to keep the ductus open. This medication is given intravenously (IV) and requires the baby to be closely monitored in the intensive care unit. Keeping the patient ductus arteriosus open using this medication allows stabilization of the newborn until more treatment, usually surgical, can be carried out.

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