

Dear parent,

Premature babies frequently suffer from what is called a patent ductus arteriosus, or PDA for short, which often needs treatment. A PDA occurs because the baby's blood vessels have not gone through all the changes that normally occur after birth when a baby is born full term. A PDA in a premature baby is therefore *not* a complicated heart condition.

In my experience, it can be difficult for parents to understand what a PDA is and what it means and why it can cause the baby problems. The information presented here is meant for the parents of premature babies, and is intended to answer some of these questions.

The following pages include a picture of the heart and its main blood vessels. The numbers in the text refer to the numbers in the pictures. In medicine, we generally draw images of the body as if looking at the body from the front (like looking in a mirror) so that the right side of the heart is shown on the left and vice-versa.

When you have read through this information, you might still have questions about your baby. Contact the doctor who is responsible for your baby and direct your questions to him/her.

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This text has been written for PDA.se by Dr Stefan Johansson, who is also responsible for the content of this text. The information provided here is intentionally generalised, since each neonatal clinic will have their own strategies for treating a PDA. In addition, there are often specific factors that need to be weighed in in determining how to treat a PDA in an individual infant. If you have any questions about your baby's condition after having read through this information, you should direct them to the doctor who is responsible for the treatment of your baby.

The premature baby with a PDA

The ductus arteriosus is a blood vessel that links the pulmonary artery to the aorta when the baby is in its mother's womb. In babies born at full term, this blood vessel closes off shortly after birth and withers away.

In premature babies however, this blood vessel sometimes remains open, so that blood continues to flow between the aorta and the pulmonary artery even after birth. This condition is called patent ductus arteriosus ('patent' here is a medical term meaning 'open'), and can affect the baby's circulation of blood to its lungs and other organs.

The diagnosis is established by an ultrasound scan of the baby's heart.

If the baby appears to be healthy and happy and not bothered by the PDA, it is generally OK to just wait until the PDA closes by itself. But if the PDA is causing the baby problems, it can be closed either by medication or surgery.

The following contains more detailed information.

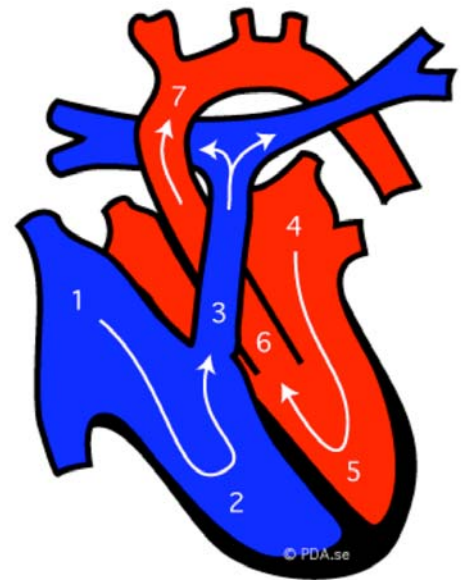
How the blood circulates in humans

To understand why a PDA can cause problems for premature babies, you first need to understand a bit about how the blood circulates through the heart.

Basically, the heart can be divided into two halves – one on the right, and one on the left. In the adjacent pictures, the right half is colored blue and the left half is colored red.

The blood that has been circulating around the body comes first to the right half of the heart. It comes into the right atrium (1), and runs down into the right ventricle (2) before it is pumped out into the pulmonary artery (3) which takes the blood to the lungs.

The blood then returns from the lungs to the left half of the heart. The blood comes into the left atrium (4), continues down into the left ventricle (5) and is pumped out via the aorta (6-7) to all the organs of the body before it returns again to the right half of the heart (1).

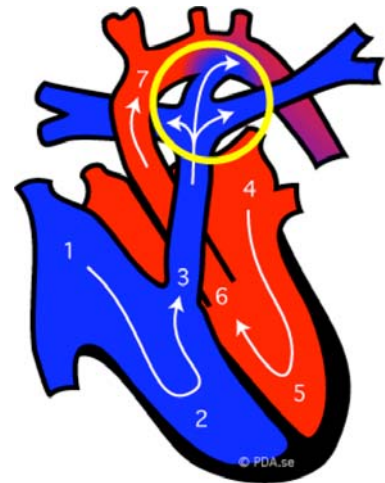


How the blood circulates in a fetus (the unborn baby)

While the baby is still in its mother's womb, it has an extra blood vessel, the ductus arteriosus (circled in yellow in the picture), that links the pulmonary artery (3) directly to the aorta (7).

This is because while the baby is in the womb, its blood is not oxygenated by its lungs, but via the placenta in its mother's womb. For this reason, the flow of blood to the fetus's lungs is low.

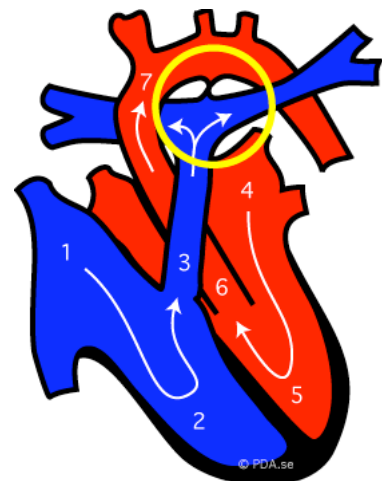
The blood that comes into the right half of the fetus's heart (1-2) is pumped out via the pulmonary artery (3). But instead of continuing to the lungs, most of the blood flows via the duct directly out via the aorta (7). The duct thus creates a bypass for the blood away from the lungs.



After birth

Directly after birth, the baby starts to breathe by itself and its blood needs to be oxygenated by its lungs. All the blood pumped out of the right ventricle (2) into the pulmonary artery (3) should now go to the lungs. The bypass created by the duct is no longer needed, and it starts to close and then shrivel up.

In babies born full term, the blood usually stops flowing via the duct during the first 24 hours after birth. Eventually, the duct withers away entirely.



The ductus arteriosus in the premature baby

In premature babies however, the process by which the duct closes off sometimes does not function effectively. The bypass can remain open after birth which means that some of the blood will continue to flow through the duct. This condition is referred to as a 'patent' (meaning open) ductus arteriosus (PDA).

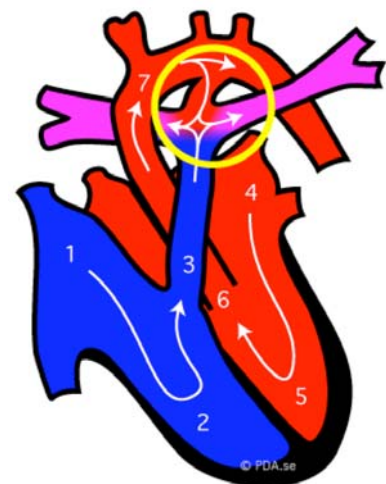
The more premature the baby is, the higher the risk of a PDA occurring.

What are the consequences of a PDA?

If the duct remains open after birth, the blood will flow from the aorta (7) to the pulmonary artery (3).

This may give rise to two situations:

1. Blood is 'stolen' from the aorta – which means that circulation to the body's other organs is affected negatively.
2. The lungs will have blood flowing from the pulmonary artery and 'extra' blood from the aorta – so that the flow to the lungs will be too great.



How do you know if a baby has a PDA?

The most common symptom is some kind of respiratory (breathing) difficulty. Because the lungs are getting too much blood, the blood may 'stagnate' in the lungs. This can lead to problems of varying degrees of seriousness – ranging from slightly labored breathing to major problems that require a ventilator to help the baby breathe.

However, it is not always so obvious that the duct has remained open. This applies particularly to babies that have lung problems with other causes after having been born prematurely.

How is the condition diagnosed?

Doctors may suspect a PDA if they hear a heart murmur or feel a very strong pulse. To confirm the diagnosis however, the baby's heart and its circulation of blood must be examined using ultrasound.

Associated problems

If the opening in the duct is large, in general the treatment is to close it. Since it affects the circulation of the blood to the lungs and to the body's organs, a PDA that is large can be contributory factor in lung, kidney and intestinal problems in premature babies.

Treatment

There are three main options for treatment – wait and see, give medication, or operate.

Wait and see (the conservative option)

If the circulation of the blood is not being greatly affected by the PDA and the baby is not showing any signs of distress, in general you can just wait until the PDA closes by itself. In the case of a small PDA, it will generally close itself during the first weeks after birth.

Medication

If the circulation of the blood is clearly being affected or the baby is showing clear signs of distress as a result of the PDA, you can often close it by giving the baby medication (either *ibuprofen* or *indomethacin*). Both of these drugs reduce the levels of prostaglandin, a hormone that keeps the duct open.

Surgery

It's also an option to close the PDA surgically. An operation is generally only a last resort if the medication has not had the desired effect, or if there are other special reasons meaning that treatment with these drugs is unsuitable for the baby. It is relatively rare that this kind of operation is needed. After an operation, the PDA cannot open itself again.

If the PDA returns

If the PDA has closed itself or has closed after treatment with medication, there is still a risk that it might open itself again. This risk is greatest in conjunction with infections. In some cases, repeated treatments with medication or surgery may be needed.