PDA Pathophysiology and Anatomy

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PDA Incidence

Almost 1% of all births are complicated by congenital heart disease. The reported incidence of PDA in term neonates is only 1 in 2,000 births, accounting for 5%–10% of all congenital heart disease. The incidence of PDA in preterm neonates is far greater, with reports ranging from 20%–60% depending on population and diagnostic criteria.

PDA Anatomy

PDA is present during neonatal circulation as an essential while fetus in developing (during fetal development about 60% of the RV blood is diverted from the lungs through the ductus arteriosus). Usually closes within several hours to 3 days after birth, Closes in stages first constricts and then formation of connective tissue (can take up to 3 weeks). The precise mechanism of closure, is not completely understood but it is mediated by the release of vasoactive substances and also help by Oxygen (high Pao2).
Anatomic or Physiologic Problem

A vessel between the main pulmonary artery and descending thoracic aorta. Allowing blood to shunt from the aorta into the pulmonary artery due to the decreased PVR. The amount of left to right shunting depends on the size of the PDA- and the relative resistance of the systemic and pulmonary circulations. If it is big, it may lead to extensive aortic runoff, with low aortic diastolic pressures which can cause systemic organ hypo-perfusion.

Potential Stages of Disease

A large non-restrictive ductus with no other cardiac issues creates a left to right shunt with LA dilatation, LV volume overload and progressive heart failure. -if untreated a large PDA may lead to pulmonary arteriolar hypertension with the eventual development of right to left shunt and Eisenmenger physiology. High PVR may develop as early as 6 months of life resulting in supra-systemic pulmonary artery pressures.

Aorta and the Pulmonary Artery

A diagram of the Aorta and the Pulmonary Artery
Fetal Shunts

PDA Fetal shunts (slideshow)

Fetal Shunts

Fetal Shunts 1
Normal Physiology

Normal physiology – pulmonary artery changes after birth

A diagram of normal artery changes after birth.

PDA Morphologies

PDA Morphologies (slideshow)
At birth the increased in PAO2 is the most important stimulus for the ductus arteriosus to constrict: typically occurs within 24 hours of birth, permanent closure of the ductus arteriosus occurs over the first few weeks after birth. In premature infants the ductal tissue is less reactive to oxygen, post ductal closure is less common. Left to Right shunting leading to an increased pulmonary blood flow (PVR is less than SVR, resulting in increased pulmonary blood flow). If restrictive, the amount of shunt is determined by the size of the defect.
Normal Heart with PDA

Normal heart with PDA (Left to Right-Shunt)

- **PDA**—large non-restrictive PDA with left to right shunt of low velocity

- **Non-cyanotic condition**

- **Normal Heart with PDA**

Eisenmenger PDA

Eisenmenger PDA (slideshow)
Eisenmenger PDA 1

Resources

PDA Pathophysiology and Anatomy slide presentation