Postnatal Circulation

Postnatal circulation begins when the infant breathes. There is decreased pressure in pulmonary vasculature, which leads to decreased right heart pressure. There is a relatively increased left atrial pressure, which causes the foramen ovale to close. Increased oxygen circulation in the infant leads to decreased prostaglandins, and these two factors result in a closed ductus arteriosus. A PDA can be closed with indomethacin, and the ductus arteriosus can be maintained with prostaglandin administration.



PLAY PICMONIC

Infant Breathes

Infant Breathing

Immediately after delivery, the infant begins to breathe and cry, leading to lung expansion. It is for this reason mucous/fluid is suctioned from the oral cavity at birth, in order to prevent aspiration.

Decreased Pressure in Pulmonary Vasculature

Down-arrow Pressure-gauge in Lung Vessels

As the lungs expand with inhaled air, pulmonary vascular pressure decreases. This allows more blood flow to the lungs to promote gas exchange.

Decreased Right Heart Pressure

Down-arrow Right Heart Pressure-gauge

As pulmonary vascular pressure decreases, the right heart is no longer pumping against a high pressure system. Thus, right heart pressure is decreased compared to the left heart.

Increased Left Atrial Pressure

Up-arrow Left A-tree Pressure-gauge

As right heart pressure decreases, a disparity in right vs. left heart pressure is created. Comparatively, the left atrial pressure is now of higher pressure than the right atrium. Because of this, there is no longer a gradient for blood to pass into the left heart through the foramen ovale as it used to in the fetus.

Closes Foramen Ovale

Foreman Closing Oval-door

A disparity in atrial pressure leads to increased pressure in the left atrium vs. the right, halting the right-to-left atrial shunting which occured in the fetus. This forces the septum primum against the septum secundum, functionally closing the foramen ovale. In time the septa eventually fuse, leaving a remnant of the foramen ovale, the fossa ovalis.

Increased O2

Up-arrow O2-tank

Inhalation leads to increased oxygen content in left sided cardiac vessels. As the infant is now capable of creating its own oxygen supply, flow from the ductus arteriosus is no longer paramount for supplying the aorta with oxygenated blood. Furthermore, vasoconstriction is induced as higher arterial oxygen content releases endothelin, a local vasoconstrictor.

Decreased Prostaglandins

Down-arrow P-rasta-man

The placenta produces prostaglandins, which maintain prenatal patency of the ductus and, in early gestation, inhibit the ability of the ductus to contract in response to oxygen. The ductus arteriosus itself also produces prostaglandins and nitric oxide-like vasodilators. Postnatally, removal of placental prostaglandin and a decrease in the number of prostaglandin E2 receptors in the ductal wall occurs.

Sign up for FREE at picmonic.com

Closed Ductus Arteriosus

Closed-door on Duck Archer

During the postnatal period, final closure of the ductus arteriosus results from increased production of local vasoconstrictors (like endothelin) in response to higher arterial oxygen and decreased prostaglandins.

Pharmacologic Intervention of Ductus Arteriosus

Open with Prostaglandins

P-rasta-man Opening-door

As prostaglandins are used for maintaining the ductus arteriosus, these are often used in patients with congenital heart defects. In severe congenital defects, the ductus arteriosus is the only way for the fetus to oxygenate tissues postnatally.

Closed with Indomethacin

Indigo-moth-man Closing-door

Indomethacin is an inhibitor of prostaglandin synthesis and is used to close a clinically significant PDA.

Sign up for FREE at picmonic.com