

Aorta and pulmonary trunk - comparison of wall structure in typical and atypical (Ross procedure) blood pressure conditions

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The ascending aorta and pulmonary trunk develop from the common *truncus arteriosus* that later becomes symmetrically divided by the aorticopulmonary septum. Normally, the systolic pressure value and the diastolic **pressure** gradient in the aorta is much higher than that in the **pulmonary artery**. In the Ross procedure, patient's diseased aortic valve is replaced with their own pulmonary valve and as a consequence the pulmonary trunk is placed in the aortic root position. Typically, a reinforcement of transposed pulmonary trunk is necessary to avoid vessel dilation. In order to investigate how the blood flow characteristics determine the vessel wall structure we examined by immunochemistry the wall of normal aorta (NA), normal pulmonary trunk (NPT), transposed pulmonary trunk (trPT) and transposed pulmonary trunk with reinforcement (trPT-R).

Throughout the tunica media of NA, elastic fibers form numerous, conspicuous and orderly arranged wavy lamellae that parallel thin layers of smooth muscle cells between the internal and external elastic membrane. In the NPT, smooth muscle cells run amid collagen fibers and form layers that are thicker and irregular, with elastic fibers arranged accordingly. In the trPT, intima denudation and media disruptions were observed. In the tunica media, smooth muscle cells were abundant, but muscle fibers, with irregular profiles and no discernible alignment, were widely spaced with intervening collagen fibers. In the trPA-R, the endothelial lining was preserved and elastic fibers formed a thick and highly organized layer of concentric lamellae in the middle third of tunica media.

The structure of normal aorta and pulmonary trunk, both elastic arteries, with common embryological origin, differs significantly in terms of smooth muscle and elastic sheets number and organization. The animal model of Ross procedure with pulmonary trunk in aorta position further underscores the role of blood pressure and mechanical stress in vessel wall modification.

Keywords

Aorta, pulmonary trunk, elastic arteries, Ross procedure, immunochemistry.