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The Anatomical Components of the Cardiac Outflow Tract of the Bichir, *Polypterus senegalus*. Evolutionary Significance

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In chondrichthyans and actinopterygians, the outflow tract of the heart, namely, the cardiac portion intercalated between the ventricle and the ventral aorta, consists of two anatomical components: conus arteriosus and bulbus arteriosus. In chondrichthyans and extant representatives of phylogenetically ancient actinopterygian groups, the conus and bulbus are well-developed in size, whereas in most teleosts, the bulbus is markedly larger than the conus. Current knowledge about the cardiac outflow tract of the polypteriformes is scarce and highly contradictory, a fact that contrasts with their crucial phylogenetic position at the source of the actinopterygian lineage. In fact, it remains uncertain whether they have a bulbus at the arterial pole of the heart. The present study aimed to elucidate the anatomical arrangement of the cardiac outflow tract of the bichir in an attempt to improve our understanding of the evolution of the vertebrate heart. We examined the hearts from 12 bichirs using histochemical and immunohistochemical techniques. Our findings showed that the outflow tract of the bichir consists of two components, namely, a long conus arteriosus, largely composed of myocardial tissue and furnished with a variable number of valves at its luminal side, and a very short, elastin rich bulbus arteriosus, devoid of myocardium. The bulbus has an arterial-like histological composition. However, it differs from the aorta because it has a thicker wall, shows a different arrangement of the histological elements, is covered by the epicardium and is crossed by coronary arteries. The present observations are consistent with the notion that the conus arteriosus and the bulbus arteriosus have coexisted from the beginning of the jawed vertebrate radiation. This is of particular interest, because there is evidence that the bulbus arteriosus, which is a second heart field derivative, is homologous with the intrapericardial portions of the aorta and pulmonary artery of birds and mammals.

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