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Letter to the Editor

The origin and course of coronary vessels: embryological considerations

I HAVE READ WITH GREAT INTEREST THE REPORT of Ho et al.[1] on an unusual course of a coronary artery arising from the pulmonary trunk. This is interesting not only because of the fascinating course of the distal main stem of the anomalous artery through the musculature of the left atrial wall, but especially because of its free course across the pericardial cavity. The latter finding might be of minor relevance for clinicians, but is interesting for anatomists and embryologists because it possibly offers the key to understanding the embryology of anomalies in origin and course of coronary vessels.

A free, trans-pericardial course of the main stems of coronary vessels within a ligament-like structure is an uncommon finding in man and other mammals. It is a frequent and normal finding, however, in non-mammalian vertebrates. In reptiles, for example, two different "cardiac ligaments" are described within the pericardial cavity.[2–6] The first, or the "sinu-ventricular ligament",[6] traverses the pericardial cavity between the dorsal base of the ventricles and the systemic venous sinus ("sinus venosus"). It contains the terminal portion of the coronary veins. The second, the apical ligament[5,6] or the "gubernaculum cordis",[2] connects the cardiac apex to the ventral pericardial wall. It contains a coronary artery and vein, originating from and raining to the left internal mammary vessels.[5]

Embryological studies have shown that the sinu-ventricular and apical ligaments are secondary structures, formed during the embryonic period by the attachment of villous protrusions of the pericardial mesothelium to the developing ventricles.[3,7,8] The formation of the two ligaments occurs prior to formation of the coronary vasculature, so that they can serve as pathways for developing coronary vessels.

Pericardial villuses are found in nearly all vertebrate embryos, including man.[9] The vast majority are usually found at the bottom of the pericardial cavity near the systemic venous sinus (Fig.). This accumulation of villous pericardial material is called the proepicardial organ,[10] and it represents the source of the epicardium, the subepicardial mesenchyme, and the cells of the coronary vasculature.[8,9,10] In human embryos, the mechanism of the transfer of cells from the proepicardial organ to the developing heart has not been clarified. It could be performed either in the form of free floating vesicles that detach from the villous mass,[11] or by the formation of a temporary sinu-ventricular ligament, which disappears by fusion with the epicardium of the coronary groove.[8] Both mechanisms could explain the normal absence of cardiac ligaments in human hearts.

Besides the proepicardial organ, small accumulations of pericardial villuses can be found at the pericardial wall facing the cardiac apex[3,7] and at the roof of the pericardial cavity near to the arterial trunk[12] (Fig.). Excessive formation and growth of pericardial villuses at these two locations, and their subsequent attachment to the developing human heart, might account for cases of abberrant coronary arteries traversing the free pericardial cavity. This explanation might be especially striking in the rare human cases of anomalous coronary vessels originating from the left internal mammary vessels and traversing the pericardial cavity in an apical ligament.[13,14]

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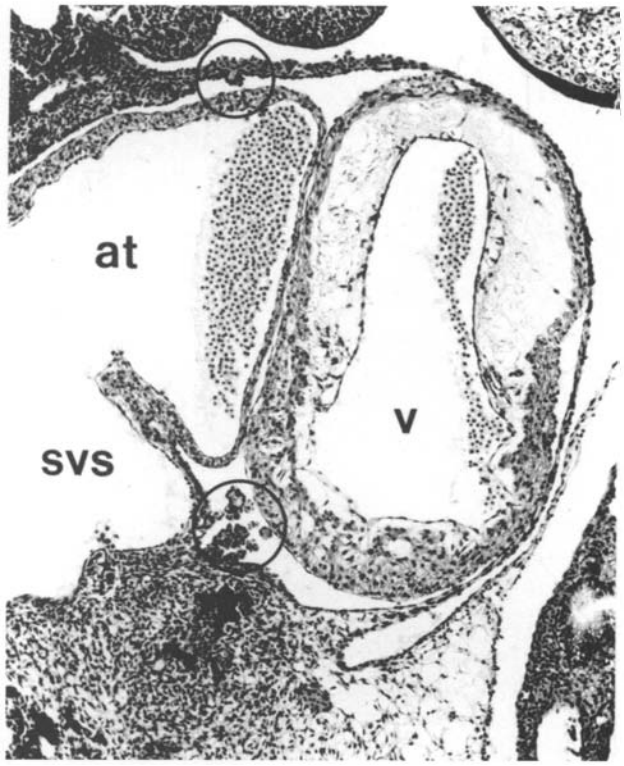

Figure.
Sagittal section showing the heart and pericardial cavity of a human embryo of 4.2 mm (crown rump length) from the Blechschmidt Collection. Pericardial villuses (marked by circles) are found near the systemic venous sinus (proepicardial organ) and at the roof of the pericardial cavity. 70 X. Abbreviations: svs: systemic venous sinus; at: atrium; v: ventricle.

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