CLINICOPATHOLOGIC CORRELATIONS

Coronary Arterial Origin in Persistent Truncus Arteriosus

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SUMMARY Specimens of heart from 30 subjects with persistent truncus arteriosus were studied for the nature and sites of coronary arterial origin. These factors were related to the sinuses of the truncus valve. Bicuspid truncal valve was observed in six cases (20%) and tricuspid in 21 cases (70%).

Single coronary artery was observed in four cases (three with tricuspid and one with quadricuspid truncal valves). In three other cases the coronary arteries arose separately but near one another.

THE CURRENT PRACTICE of surgically applying "total correction" for persistent truncus arteriosus introduces, as a practical matter, the nature and sites of coronary arterial origin. This led us to study the necropsy specimens of heart from 30 patients with persistent truncus arteriosus, types 1-3 (Collett and Edwards). Twenty-two of the patients were under one year of age and seven were older, the oldest being 53 years of age. In one case the age was not known. Of the cases in which the sex was known, the ratio of female to male was 2:1.

Among 30 specimens with persistent truncus arteriosus, there were many variations both as to the sites of origin of the coronary arteries and as to the nature of the truncal valve.

A bicuspid truncal valve was observed in six cases (20%), a quadricuspid valve in three cases (10%), while a tricuspid truncal valve was present in 21 cases (70%). In 16 of the 21 cases with tricuspid valves, the orientation of the cusps was similar to that in the normal aorta, one cusp lying posteriorly while the other two occupied anterior positions. In five of the 21 cases with tricuspid truncal valves there was one anterior cusp and two posterior cusps.

The variations in origin of the coronary arteries observed are presented according to the patterns of the coronary arteries among the various types of truncal valve. As an adjunct to the text, we have elected to portray the various patterns of coronary arterial origin and truncal valve structure in a diagrammatic way. In each illustrated unit, the truncal valve and sites of coronary arterial origin are viewed from above, with the anterior aspect of the truncal valve being in the lower aspect of the illustration. Paired with this view is a longitudinal orientation of the truncus so as to show the level of origin of the coronary arteries with respect to the positions of the truncal valvular cusps. In this aspect of the illustration, the truncus has been "turned" into a position optimal to show the coronary arterial origins.

Bicuspid Truncal Valve

There was a strong tendency for the left coronary artery to arise from a more posterior level than it does normally from the aorta.

It was common for the posterior descending artery to arise from the left circumflex artery. This arrangement was noted in eight of 25 cases (32%) with single posterior descending coronary artery. In five other cases, two posterior descending arteries were present, one arising from the left circumflex and the other from the right coronary artery.

The six cases with bicuspid truncal valve showed left and right cusps in three instances and anterior and posterior cusps in three. Among the three cases with left and right cusps, one showed origin of the left coronary artery from the periphery of the left sinus and the right artery from the periphery of the right sinus (fig. 1a). In the other two cases, both coronary arteries arose from one sinus, the right in one (fig. 1b) and the left in the other (fig. 1c). In the latter case, the coronary arteries arose near each other. In two cases the posterior descending arose from the circumflex artery and in one case from the right coronary artery.

In the three cases with anterior and posterior cusps, two showed origin of the right coronary artery from the anterior sinus and the left from the posterior sinus (fig. 1d). In the third case, both coronary arteries arose from the opposite extremes of the anterior sinus (fig. 1e). In each case the posterior descending artery arose from the right coronary artery.

In cases with bicuspid truncal valve there was a tendency for high origin of the left coronary artery (fig. 1). No case of single coronary artery was observed among the six specimens with bicuspid truncal valve.

Tricuspid Truncal Valve

Among the 30 cases of truncus arteriosus, 21 cases (70%) showed tricuspid truncal valves. In 16 of these, the valves were oriented in the manner usually seen in the aortic valve, namely, one posterior cusp and two anterior cusps, while in five cases there were two posterior cusps and one anterior cusp.

Single Posterior and Two Anterior Cusps

Among the 16 cases with two anterior and one posterior cusp, there were five patterns, with some variation, of coronary arterial origin. In one pattern, involving six cases, the right and left coronary arteries arose from the right anterior...
and left anterior sinuses, respectively. In five of these, each coronary arterial origin was near the center of the sinus, while in the sixth case each coronary artery arose eccentrically with respect to its sinus of origin (figs. 2a and b).

In two cases, a single coronary artery was present and arose from the posterior sinus, with minor difference in length of the single artery, but shortly after its origin the vessel branched into the right and left coronary arteries (fig. 2c). In six cases the right coronary artery arose from the right sinus, while the left coronary artery arose from the posterior sinus. Among this group there was variation as to the position in the sinus of coronary arterial origin, the most common variation involving the left coronary artery. In three cases, this vessel arose eccentrically from the posterior
sinus toward either the right or the left (fig. 2d). Among this group of six cases there were three in which there was an abnormal level of origin of the coronary arteries. In one case the left arose abnormally high, while in one the right did so. In one case, each coronary artery arose from the depths of the sinus of origin. In two other cases, both coronary arteries arose close together from one sinus, the posterior in one (fig. 2e) and the right in one (fig. 2f).

Among the 16 cases of tricuspid truncal valve with two anterior cusps and one posterior cusp, the circumflex artery gave rise to the posterior descending in three cases, while in two other cases there were two posterior descending coronary arteries, one arising from the right and the other from the left circumflex.

**Single Anterior and Two Posterior Sinuses**

Among the 21 cases with tricuspid truncal valve, there were five in which a single anterior cusp was present and two posterior. In two of these cases, the right coronary artery arose from the anterior sinus and the left eccentrically from the left posterior sinus (fig. 3a). In one case the right coronary artery arose from the right posterior sinus, while the left coronary artery arose eccentrically from the anterior sinus (fig. 3b). In the fourth case, the right coronary artery arose from the right posterior sinus and the left eccentrically from the left posterior sinus (fig. 3c). In the fifth case, there was a single coronary artery which arose just above the attachments of the right and left posterior cusps to the truncal wall. This vessel, shortly after its origin, branched into the right and left coronary arteries (fig. 3d). In the case with single coronary artery, the posterior descending was a branch of the circumflex artery and in the other four cases it arose from the right coronary artery.

**Quadricuspid Truncal Valve**

Among the 30 cases of persistent truncus arteriosus, there were three cases with quadricuspid valves. In two of these, two cusps were posterior and two were anterior. In the third case there were one right cusp and three left cusps. In one case, the right and left coronary arteries arose separately, the right from the right anterior cusp and the left from the left posterior sinus (fig. 4a). In the case with the irregular subdivisions of the cusps, the right coronary artery arose from the right sinus, while the left coronary artery arose from the posterior of the three left sinuses (fig. 4b). The third case of quadricuspid valve showed a single coronary artery arising above the commissure between the two posterior cusps. As in other cases of single coronary artery, the vessel, shortly after its origin, divided into the right and left coronary arteries (fig. 4c). In this case, the posterior descending was a branch of the circumflex artery. The other two showed the origin of the posterior descending from the right coronary artery.

**Comment**

From the present study, it is apparent that there is a great variability of the pattern of coronary arterial origin in persistent truncus arteriosus. Our findings conform, in general, to those reported by others but with a higher incidence of variations from the usual pattern of origin of the coronary arteries from the aorta. In our material, a single coronary

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**Figure 3.** Single anterior and two posterior truncal cusps (five cases). a) Two cases. The right coronary artery arises from the anterior sinus, while the left coronary artery arises, ectopically, from the left posterior sinus. b) One case. Origin of the right coronary artery from the right posterior sinus and the left coronary artery, ectopically, from the anterior sinus. c) One case. Origin of the right and left coronary arteries from the right and left posterior sinus, respectively. The site of origin of the left coronary artery is ectopic. d) One case. Single coronary arising above the commissure between the right and left posterior sinuses.
artery was present in four of 30 cases (13%). In each instance, the single vessel arose from the posterior aspect of the truncus. In three of these, the posterior descending artery was a branch of the circumflex and in one it arose from the right coronary artery. Three other cases, while showing two separate coronary ostia, exhibited the phenomenon of the two vessels arising near each other. Also, we observed in the presence of two coronary arteries, the tendency for the left coronary artery to arise from a position toward the posterior wall of the truncus. Other tendencies were for unusually high origin of a coronary artery, particularly the left, and for origin of a coronary artery above a posteriorly lying commissure.

In five of the 30 cases, there were two posterior descending coronary arteries, one arising from the left circumflex artery and the other from the right coronary artery.

Among the 25 cases with a single posterior descending coronary artery, it arose from the left circumflex artery in eight cases (32%), and from the right coronary artery in 17 (68%).

The uncommon origin of the posterior descending artery from the left circumflex noted in this study was particularly striking among the cases with single coronary artery. Such an origin for the posterior descending was noted in three of the four cases with single coronary artery.

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