A SINGLE CORONARY ARTERY

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Many different anomalies of the coronary vessels have been observed. The minor varieties are quite common, but the more gross forms are relatively rare. An example of one of these gross forms is given in this paper.

The variations may be divided into a number of groups : (1) in origin, (2) in number, and (3) in distribution and size.

Anomalies in origin are due to the vessel starting abnormally : (a) from the common arterial trunk, and this is often found where there are other associated disturbances of development ; (b) from the pulmonary artery, when changes develop secondarily both in the artery and in the myocardium, changes that depend directly on this aberrant origin of the vessel ; and (c) from the aorta, at a variable distance above the level of the cusps.

Anomalies in the number of vessels are rather more common and may be unusual by a reduction or by an increase in the number ; thus on the one hand there may be only one artery arising from the aorta, or on the other hand there may be three, four, or more vessels. As far as their supply to the myocardium is concerned they merely take the place of the normally occurring vessels in most instances. Thus a single artery is usually much larger and gives a supply to the whole of the heart, whereas an increased number of vessels are individually smaller and correspond in their distribution to one or more of the branches of the normal arteries.

Anomalies in distribution and size depend to a considerable extent on, and run *pari passu* with, anomalies in the number of main trunks.

CASE REPORT

A man, aged 45 years, died from a lobar pneumonia after six days' illness. There was consolidation of the lung, affecting the basal and middle portion of the left lung and the basal lobe of the right lung. There were toxic changes in the liver, spleen, and kidneys. The pericardium contained about 2 oz. of straw-coloured fluid. The heart weighed 16 oz. and showed a thickened left ventricle, which was somewhat dilated also. The valves were normal. There were some atheromatous patches on the proximal part of the aorta.

The coronary vessels presented an unusual distribution in that there was only one main orifice, which arose from the right sinus (Fig. 1). This opening was large, being 9 mm. in diameter. There was no suggestion of an orifice in the left sinus. In the depths of the orifice there could be seen three openings, of which one was large and the other two, lying in front of this, were small (Fig. 2). On the exterior three vessels arose from the main region of the

FIG. 1.—Photograph of the heart, opened to show the left ventricle and aorta. The large orifice of the right coronary artery is visible in the right sinus, but there is no corresponding opening in the left sinus.

aorta, at a position corresponding to that usually occupied by the right coronary artery.

The *first* and largest trunk corresponded to a right coronary artery and ran, in the usual manner, in the coronary sulcus, but differed from the usual course in that it passed round the heart to terminate on the anterior aspect, near the anterior longitudinal sulcus (Fig. 3). In its proximal part it was 6 mm. in diameter and much more tortuous than usual, but its walls were of normal thickness. At the right border of the heart it gave a large marginal branch

which passed down the margo acutus to supply this portion of the right ventricular wall. On the posterior aspect of the heart there was another large branch, passing distally and supplying the posterior aspect of the right ventricle. In the region of the posterior inter-ventricular sulcus a large branch

FIG. 2.—A closer view of the coronary artery, showing a large orifice in its depths and two smaller openings to its right, one above the other.

FIG. 3.—Diagram to show the distribution of the vessels. Arising from a common origin on the right side of the aorta are three trunks: a large vessel, corresponding to the right coronary artery, passing right round the heart in the coronary sulcus; a small intermediate branch running down on the front of the right ventricle; and a large vessel running across in front of the aorta and pulmonary artery, and turning down to occupy the anterior inter-ventricular sulcus. There is an anastomosis between this and the termination of the first vessel mentioned.

(corresponding to the posterior descending branch) passed down the sulcus, giving branches to both ventricles and terminating in the region of the apex. In that part of the course of the main artery just described there were smaller branches distributed to the adjacent arterial and ventricular walls.

After giving off the posterior descending branch, the main artery continued

in the coronary sulcus, and gave further branches to the ventricles (rami collaterales), to the atrium, and a left marginal branch which ran down the margo obtusus. It then passed round on to the anterior aspect of the heart and anastomosed with an anterior artery (to be described). From all the vessels described small branches passed into the myocardium, and some larger arteries passed into the region of the septum from the main artery and the posterior descending branch.

The *second* trunk, arising from the common opening in the sinus, passed down over the front of the right ventricular wall and divided into numerous small branches about half way down this wall.

The *third* trunk, arising in the common orifice on the left side of the two just mentioned, ran across the upper part of the right ventricle in front of the aorta and pulmonary artery. On reaching the anterior longitudinal sulcus it passed downwards in this to the apex. It gave numerous branches—to the pulmonary artery (infundibular branch), atrial rami, and deep muscular branches, the largest being in the region of the septum. At the apex of the heart this anterior descending branch appeared to anastomose with the terminal rami of the posterior descending branch. At the point where the vessels entered the anterior longitudinal sulcus, there was a small anastomosis with the terminal part of the large right coronary vessels.

DISCUSSION

Several classical cases of “absence” of the left coronary artery have been recorded, notably those of Bockdalek (1867), Gallavardin and Ravault (1925), Smith and Graber (1926), Grätzer (1926), Kintner (1931), Born (1933), and Sanes (1937).

The origin from the aorta is very variable and usually consists of one orifice and one main trunk that divides into two (Gallavardin and Ravault) or three (Bockdalek) branches. On the other hand two (Kintner) or three (Grätzer) separate openings have been found in the same sinus.

The course of the vessels is also subject to considerable variation. In most of the cases (Bockdalek, Gallavardin, and Ravault, Kintner, Born, and Sanes) one vessel passes from the origin deeply into the interventricular septum and after traversing this appears at some point on the anterior longitudinal sulcus where it continues as an anterior descending branch.

In the case described by Smith and Graber, as in that recorded here, the anterior descending branch arises from a vessel running in front of the conus; the distribution of the vessels, however, is different.

From consideration of these various cases the explanation of the anomalies is simple. Thus various anastomotic vessels become enlarged and, as in other parts of the body, become sufficiently important to replace the ordinary vessels. This is easily seen by comparison of the two diagrams shown in Fig. 4.

In the present case there is a great enlargement of the right coronary artery, which replaces the circumflex branch of the left coronary artery. In addition

the anastomotic vessels between the right and left coronary vessels in front of the conus (Konus-anastomose) have become the significant supply of the area usually supplied by the anterior descending branch of the left coronary.

The reason for such aberrant development cannot be known accurately and the various hypotheses—in the absence of definite evidence of vascular disturbance in foetal life—do not warrant discussion. The blood supply to the myocardium in these cases is, in the absence of acquired disease of the

FIG. 4.—Diagram to show the relationship of the vascular distribution in a normal case (A) and in this case (B).

(A) The two vessels, right and left coronary arteries, are shown with their principle branches. The dotted line indicates a small anastomosis in front of the pulmonary artery—the conus anastomosis.

(B) The large vessel that arises from the right sinus and immediately divides into three is shown. The main vessel corresponds to the right coronary artery and most of the left circumflex branch. The intermediate vessel corresponds to an anterior branch of the right coronary artery. The left vessel occupies the position of the conus anastomosis and corresponds in distribution to the anterior descending branch and a small part of the left circumflex branch.

vessels, sufficient for the supply of the myocardium, and the actual route taken by the blood is of little consequence.

The blood supply to the myocardium is thus merely a variant of the normal arrangement, “absent” vessels being replaced by branches of other arteries that follow much the same course as the “absent” vessels would.

SUMMARY

A case of a "single" right coronary artery has been described and also its distribution to the myocardium. The large artery immediately divided into three branches. The main vessel took the usual place of the right coronary artery and of most of the circumflex branch of the left coronary artery. The intermediate vessel took the place of an anterior branch of the right coronary artery. The third, passing along the usual site of the small conus anastomosis, took the place of the anterior descending branch of the left coronary artery.

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