CASE REPORT

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Pete Maravich's Incredible Heart

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ABSTRACT: Postmortem examination of a former professional basketball player revealed an abnormal heart, most notably a single coronary artery. The literature on single coronary arteries is briefly reviewed, and the possible mechanism which caused the patient's condition is considered. This case is particularly unusual because of the patient's profession, which is so physically demanding.

KEYWORDS: pathology and biology, cardiovascular system, coronary artery

"Pistol Pete" Maravich, the highest scorer in the history of college basketball and an NBA Hall of Famer, suddenly collapsed and died during a game of basketball. He was 40 years old. He was playing a pickup game at church with friends during the morning hours of 5 Jan. 1988. The news of his death stunned everyone. Even more astonishing was the condition of his heart, specifically the single coronary artery, which was revealed by the autopsy (Fig. 1). Therefore, we would like to report the cardiac findings of this case.

Postmortem Findings

The body was that of a well-developed, well-nourished white male appearing the stated age of 40 years. It measured 6 ft, 6 in. (198 cm) in length and weighed 199 lb (89.5 kg). The external surface of the body showed no injuries, congenital anomalies, abnormalities, or marks. A single, well-healed surgical scar was located on the lateral aspect of the left knee.

On internal examination, no abnormalities, injuries, evidence of disease, or other problems were found except for the heart. All of the internal organs and cavities were free of disease, congenital anomalies, or other abnormalities.

The heart was markedly enlarged and dilated (Fig. 2). It weighed 560 g. The great veins entering the heart were dilated and engorged with blood. No congenital anomalies were noted of the heart, cardiac chambers, valves, or great vessels. The epicardium was normal and was covered by a smooth glistening surface. The myocardium was soft and

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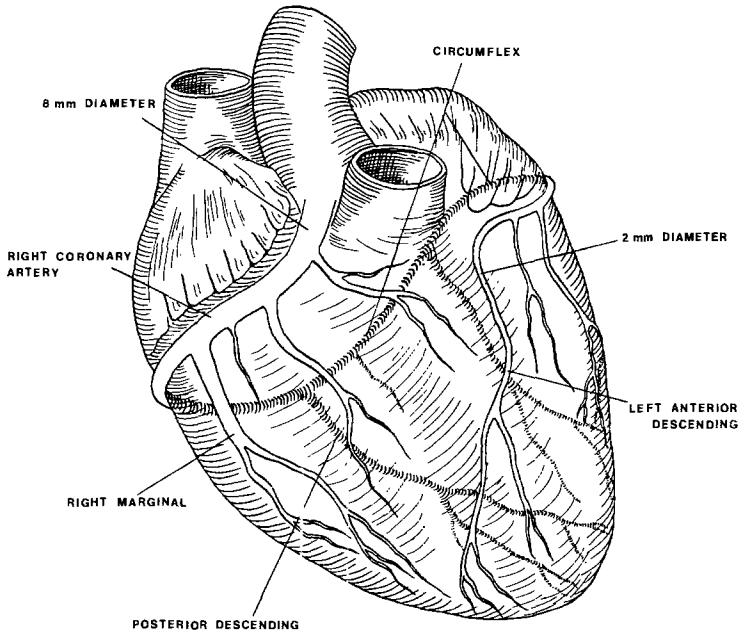

FIG. 1—*Schematic diagram of single right coronary artery supplying blood to the entire heart.*

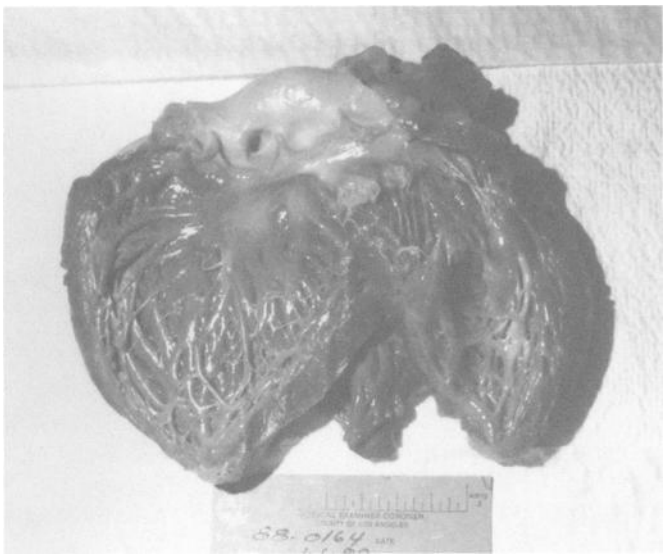

FIG. 2—*A large single coronary artery ostium at the right coronary cusp and no ostium for the left coronary artery. The heart is dilated and flabby with a focal fibrotic scar visible on the endocardial surface of the left ventricular wall.*

flabby, and the chambers were dilated and engorged with blood. The left ventricular wall of the myocardium measured 1.5 cm and the right 0.3 cm. The left ventricular wall of the myocardium was mottled, exhibiting dark and light brown streaks and patches interspersed with gray/white streaks and bands of a firm, fibrous nature. The anterior portion of the left ventricular wall showed the most mark mottling, and this included the apical portion. The endocardial surface of the left ventricle showed prominent trabeculae and gray-white fibrous scar tissue. The myocardium and endocardium of the right ventricle were unremarkable. The cardiac valves were delicate and pliable. A single, small yellow fat deposit was found on the posterior mitral valve leaflet. The valves were competent and showed no vegetation, fibrosis, calcification, or congenital anomalies. The valvular ring of the mitral valve was moderately dilated and measured 12 cm; the tricuspid valve measured 13 cm. The aortic and pulmonic valves were not remarkable.

The coronary artery distribution was abnormal in that there was no left coronary artery and no ostium was found in the sinus of Valsalva. A single enlarged coronary ostium arose from the right sinus of Valsalva and measured 0.8 cm in diameter. The vessel was dilated along its course and gradually tapered the further away it progressed from its origin. Mild atherosclerotic thickening of less than 20% was noted in the main right coronary artery. The artery followed its normal route, and none of the branches normally associated with the left coronary artery arose from the right coronary artery. No branches passed between the aorta and the pulmonary trunk. The enlarged right coronary artery circled the heart in a clockwise direction and gave off the marginal and posterior descending branches in the usual fashion. The vessel continued posteriorly and anastomosed with the circumflex branch of the left coronary artery. The diameter of the coronary system was narrowest at the origin of the left anterior descending branch, where it rose from a sharp curve of the circumflex. The route of the left anterior descending branch followed its normal course, and the vessel measured 0.2 cm in diameter. Minimal atherosclerotic thickening was seen in the wall of this vessel. It supplied the usual anterior and lateral walls of the left ventricle as well as the apex. The lumina of the coronary vessels were widely patent, the walls were elastic, and only a small focus of calcification was present in the right coronary artery.

Microscopic changes were seen in the myocardium, consisting of widespread interstitial fibrosis and patchy scarring (Fig. 3). No significant cellular infiltrate was seen. These changes were noted in the wall of the left ventricle and were consistent with either primary myocardial disease or myocardial ischemia of prolonged duration.

Discussion

A single coronary artery is an unusual finding. According to Sharbaugh and White, it is an uncommon finding of uncertain diagnostic and prognostic significance [*1*]. They state that prognosis is not affected by this phenomenon, and the finding is usually incidental at autopsy. The presence of only one coronary artery does not cause any significant disablement and is compatible with a long life [*2*]. Patients have lived into the eighth and ninth decades of life and finally succumbed to some other unrelated illness [*3*].

Other views suggest that a single coronary artery may or may not be a benign anomaly [*4*]. Sudden death following physical activity has been described in adolescents [*5–8*]. The Armed Forces Institute of Pathology reported 33 cases of a single right coronary artery out of 475 000 autopsies, of these, 9 died suddenly [*3*].

Congenital anomalies of the coronary arteries have been reviewed extensively [*9,10*]. Such anomalies appear infrequently and are subject to considerable anatomic variation. Most of the variations occur in the peripheral distribution of the vessels, while a single coronary artery is very rare [*11*].

Angiographic reports of anomalies of the coronary arteries have appeared recently

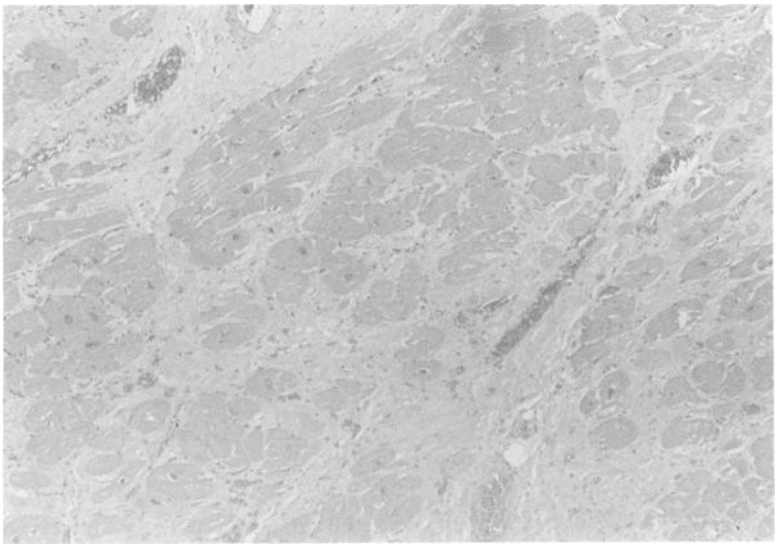

FIG. 3—*Microscopic appearance of the left lateral ventricular wall showing diffuse interstitial and perivascular fibrosis.*

[*12,13*]. The widespread application of this technique has resulted in more frequent detection of this abnormality. Kafrouni et al. reviewed 102 cases of a single right coronary artery in 1981; of these, 86 were found at autopsy, while 16 were discovered angiographically [*14*]. Engel et al. reported 51 cases or 1.2% of 4250 patients studied angiographically who had an anomalous or ectopic origin of a coronary artery [*15*]. In a study of 31 cases found by angiography, 0.83% showed anomalies of the coronary artery system; of these, 0.19% consisted of the left coronary artery arising in the sinus of Valsalva [*12*]. An incidence of 0.9% was reported by Baltaxe and Wixson [*13*].

A single case report appeared in 1987 of congenital absence of the left coronary artery. This case was also discovered angiographically [*16*]. The coronary artery pattern appears to be very similar, if not the same, as the case reported here.

A single coronary artery can be defined as one in which the entire coronary system arises from a solitary ostium and no evidence, even rudimentary, of a second coronary ostium can be found [*1*]. The entire myocardium is nourished by this single vessel and its branches; no other congenital anomalies of the heart, vascular system, or body are found. Smith [*17*] divided this definition into three subtypes. In the first, the single artery follows the course of only the normal right or left coronary artery. This is the situation in the present case. The second category has a single artery arising from one ostium but which then divides so that the branches follow the normal pattern of distribution of the right and left coronary arteries. In the last category, there is a single vessel with a distribution pattern so atypical that it cannot be compared to either the normal right or normal left coronary pattern.

The coronary arteries make their first appearance as anlagen or thickenings in the aortic endothelium in the embryo of 10-mm length or about 14 week's gestation. The anlage of the left appears just before that of the right. They show up just before the division of the truncus arteriosus by the spiral septum into the aorta and pulmonary arteries. These rudiments consist at first of a solid column of cells which later develop a lumen. The vessels then grow outward and course through the myocardium [*17*].

Speculation as to the possible mechanisms by which anomalies of the coronary arteries

arise has been advanced by Roberts and Loube [*10*]: these include absence of the anlage for one coronary artery; displacement of an anlage of one vessel so that it fuses with the anlage of the other; and occlusion by thrombosis, infection, or maldevelopment of one coronary vessel soon after its formation, with subsequent failure of canalization and compensatory dilation of the remaining vessel. A fourth possibility mentioned is an aberration in the site of division of the truncus arteriosus by the spiral septum, which may account for the origin of coronary arteries from the pulmonary artery.

One of the more unusual aspects of this case is Mr. Maravich's achievements during his college and professional basketball career. He evidently was not aware of his heart condition, because if it had been known he would probably not have been allowed to participate in such a demanding physical sport. The fact that he did play basketball so well for so long supports the view that a single coronary artery is not necessarily disabling and can be compatible with a long life.

His heart also showed extensive interstitial fibrosis and scarring, which brings up the question of how long this condition had been present. The heart was enlarged and dilated, but there was no clinical evidence available to us to suggest that he suffered from congestive heart failure before his death.

Was the fibrosis and scarring caused by his coronary artery condition, or was it caused by some other factor? Since the scarring was found in the anterior wall of the left ventricle and was more pronounced in the subendocardial region, the pattern seems to be more consistent with chronic ischemia in the distribution of the left anterior descending coronary artery. This branch was the farthest away from the aorta and also arose after a sharp curve from the circumflex branch. The blood supply would have been most vulnerable in this region. The fibrosis, although severe, was not localized or patchy as would be found in an old myocardial infarction. Therefore, the conclusion reached by the authors is that this portion of the heart suffered from a combined ischemic blood supply, coupled with an excessive demand on the limited circulation. Though it is conceivable that he may have had silent myocarditis, which may have contributed to his myocardial disease, the morphology and location of the lesion do not support this theory.

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