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Intercoronary connection with bidirectional blood flow and concentric left ventricular hypertrophy

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Cardiac catheterization in a 55-year-old man, with a 6-month history of atypical chest pain and Q-waves in D_{II}, D_{III} and AVF, showed concentric left ventricular (LV) hypertrophy and a large intercoronary connection between right coronary artery (RCA) and circumflex artery (CX), with bidirectional blood flow. Although the RCA and CX were normal, selective injection of CX filled RCA retrogradely and in the same way selective injection of RCA filled CX. Possible mechanisms and literature are reviewed.

UNITERMS: Anomalous coronary artery, LVH

Post-mortem studies have shown that multiple small connections (which are not visible > 100m diameter) exist between the major coronary arteries, since they cannot be reached by the present angiographic techniques (17, 9).

The presence of intercoronary anastomosis is commonly related to mechanic obstruction, severe anemia and cardiac hypertrophy (17), and is hardly seen in the absence of severe obstructive atherosclerotic coronary artery disease (7, 10).

The first case of intercoronary connection in a patient with bidirectional flow, associated with concentric left ventricular hypertrophy and absence of coronary arterial disease is reported.

Case report

White man, 55 years old, bricklayer, with a 6 month history of atypical chest pain.

He had a mild systemic hypertension, smoking one pack of cigarettes per day. His medication at the time of

the coronary arteriogram included nifedipine (10 mg every 6 hours), propranolol (40 mg/day) and acetylsalicylic acid. The blood pressure was 140/100 mm Hg in both arms, without postural changes. The pulse rate was 78 beats/min.

There were no abnormal heart sounds, murmurs or friction rubs. Examination of lungs, abdomen and limbs were normal. Electrocardiogram at rest showed Q-waves in leads D_{II}, D_{III} and AVF. The echocardiogram showed moderate concentric hypertrophy of the left ventricle. In the treadmill exercise test, with the Ellestad protocol, the heart rate did not reach the required levels (133 beats/min.) and blood pressure was 230/140 mm Hg. There was no evidence of myocardial ischemia when the ST-segment was analyzed and compared to test.

Coronary arteriography and left ventriculography were performed using the Sones technique from the right branchial artery. The left ventricular pressure was 170/20 mm Hg, and the aortic pressure was 170/120 mm Hg. The left ventriculogram in the 30° right anterior oblique projection showed normal segmental wall motion and concentric hypertrophy. Selective left coronary cineangiography did not reveal obstructive lesions in coronary arteries. There was no pressure dumping during selective placement of the catheter tip in both coronary ostia. Se-

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lective injection of right coronary artery (RCA) demonstrated retrograde filling of the distal segment of circumflex artery (CX) as far as the medium segment by, intercoronary connections (Fig. 1). In the same way selective injection of left coronary artery (LCA), demonstrated retrograde filling of distal segment of RCA by intercoronary connections from CX to RCA (Fig. 2)

DISCUSSION

The normal human heart contains a profusion of small interconnecting vessels which, due to their small size, (less than 40 μ m in normal conditions) and low flow are hardly ever seen in present imaging systems for coronary

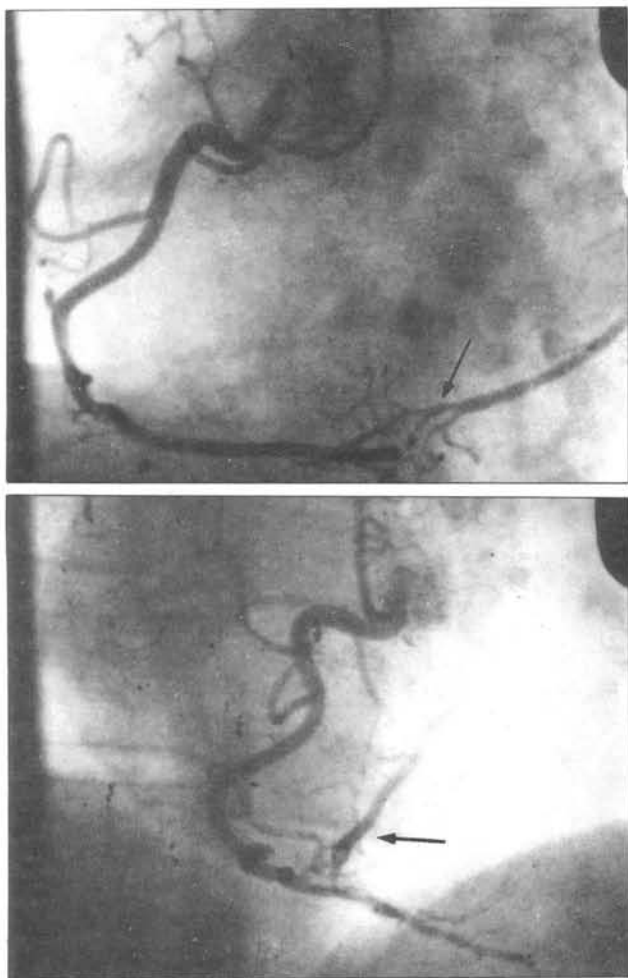


Figure 1 – Selective angiography of right coronary artery (left anterior oblique: A, right anterior oblique: B) showing retrograde filling of CX through intercoronary connections between RCA and medium CX (arrow).

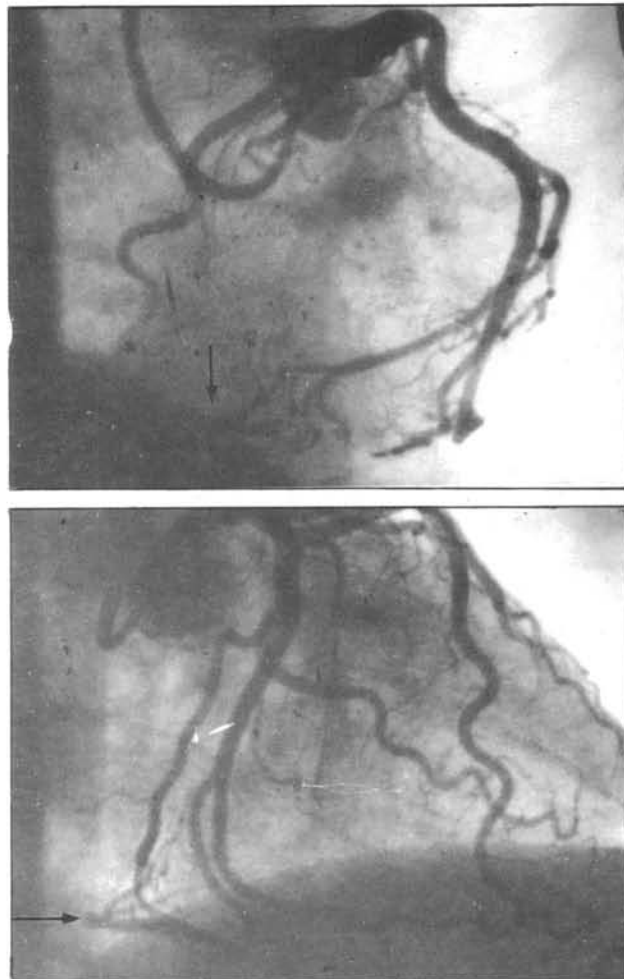


Figure 2 – Selective angiography of left coronary (left anterior oblique: A; right anterior oblique: B) showing retrograde filling of RCA through intercoronary connections between CX and distal RCA (arrow)

arteriography (10, 2) Collateral circulation development is reported when there are conditions of absolute or relative ischemia or hypoxia. The most common stimulus observed is the presence of severe obstructive coronary atherosclerotic disease, usually the narrowing of luminal diameter is equal or greater than 90% (10).

Other causes include anemia and cardiac hypertrophy. In both conditions relative ischemia exists. Contributing factors are size and condition of the distal segmental lumen, coronary vascular resistance, blood viscosity, and physical activity of the individual (2).

Besides the intercoronary circulation mentioned above, alternate pathways were described such as endomural (arterioluminal and Thebesian vessels), retrocardiac and transepical. With the exception of the transepical surgical variety (myocardium revascu-

larization), the others have no significant collateral function (1).

The case of intercoronary communication mentioned above depicts an extremely rare variety, with bidirectional flow, not associated with an obstructive lesion. Thirteen cases of intercoronary communication have been reported without coronary obstructive lesions: 9 between the distal segment of RCA and CX, 1 between the cone artery and left anterior descending (LAD), and 3 between posterior descending artery and LAD (3,4,6,8,11,12,13,14,15).

Some authors believe that the origin of such large intercoronary communications in the absence of severe obstructive coronary artery is related to persistence of congenital anastomosis that fails to recede by the eighth post-natal month. Unlike true collaterals, which are tortuous and intramyocardial intercoronary connections tend to be straight and extra-mural. In hearts of dogs or guinea pigs, an extensive epicardial network of collateral vessels is common, however, epicardial collateral vessels are not prominent in the human heart (2). Recent histologic data suggest that these large connections resemble to epicardial coronary arteries rather than to arterioles which are typical of collaterals (5). Although the words collateral and intercoronary connection have been used as synonyms, there are probably enough angiographic and histologic differences to warrant specific usage of these terms.

The history of systemic hypertension, echocardiographic and electrocardiographic findings of left ventricular concentric hypertrophy may have stimulated growth and enlargement of pre-existing intercoronary channels. Large collaterals are not often seen in angiograms of patients with cardiac hypertrophy, as reported by Zoll et al. in 26% of post-mortem heart studies (9% in control group without cardiac hypertrophy) (17). Of the 13 previously reported cases, only in 9, blood pressure levels were mentioned; hypertension was present in 5, and pulmonary hypertension in one. Prominent left ventricular hypertrophy in the apical segment was reported by Panayioton et al. (12), associated with a 40% obstructive lesion, no cases were mentioned with left ventricular concentric hypertrophy. In the case presented by Ching et al. there was clinical, electrocardiographic and hemodynamic evidence of right ventricular hypertrophy (4).

It is tempting to speculate that hypertrophy may have induced or contributed to the development of large intercoronary connections in the reported case where hypertension was present.

Another possible cause could be coronary spasm, in which there is evidence of development of permanent or transient circulation (16). In our case, the characteristics of pain do not suggest coronary spasm and during coronary arteriography there was no evidence of it.

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RESUMO

Homem de cor branca, 54 anos, com histórias de dor esternal atípica para insuficiência coronária, iniciada há 6 meses. Antecedentes: HAS e tabagismo. O exame do aparelho cardiovascular era normal. PA = 140/100mmHg (ambos os braços).

O E.C.G. de repouso revelou onda T negativa em D₂, D₃ e AVF. O ecocardiograma bidimensional demonstrou hipertrofia concêntrica do VE de grau moderado. No TE, protocolo de Ellestad, a frequência cardíaca não atingiu os níveis preconizados e ocorreu aumento acentuado da PA (230/140 mm Hg). Não apresentou alterações expressivas do segmento ST em relação ao repouso.

No cateterismo cardíaco, a pressão do VE foi de 170/20 mm HG. O VE apresentava aspecto hipertrófico. Cinecoronariografia esquerda e direita não revelaram lesões obstrutivas. Injeção seletiva de contraste na ACD demonstrou enchimento retrógrado da porção distal da ACX até sua porção média através de conexões intercoronárias. Da mesma forma injeção seletiva na ACE demonstrou enchimento retrógrado da porção distal da ACD por conexões intercoronárias da ACX para a ACD. Revisão da literatura e possíveis mecanismos foram apresentados.