Successful Surgical Repair of Aortic Insufficiency Due to Valvular Fenestration

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Aortic valvular fenestration is a common anatomic finding that has been considered to be of little clinical importance. On occasion this defect may permit a major degree of regurgitation, however, with resultant dynamic aortic insufficiency. Until recently little consideration could be given to anatomic correction of aortic valvular insufficiency. However, with the advent of open-heart surgery it has become possible to devise surgical techniques for direct repair of this lesion. This report deals with the successful surgical repair of aortic valvular fenestration by use of complete cardiopulmonary bypass.

Case Report

H.M., a 29-year-old white man, had a heart murmur since birth. He was asymptomatic, however, until age 25 when he had a bout of bacterial endocarditis. Following this illness he developed dyspnea on exertion and increasing ease of fatigability; in April 1958 he began to note exertional angina pectoris which was relieved by rest and nitroglycerin. He did not complain of orthopnea, cough, syncope, or peripheral edema.

The pertinent physical findings were limited to the cardiovascular system. The blood pressure was 130/0. The peripheral pulses were bounding. The heart rate and rhythm were normal. A grade IV, rough aortic systolic murmur was widely transmitted over the precordium, followed by a grade-III blowing aortic diastolic murmur. The point of maximal apical impulse was visible in the sixth interspace along the anterior axillary line. There were no evidences of congestive failure.

The electrocardiogram revealed left ventricular hypertrophy and the chest x-ray showed 2- to 3-plus enlargement of the left ventricle. Suprasternal thoracic aortography demonstrated the presence of 3-plus aortic regurgitation (fig. 1).

On February 3, 1959, cardiac surgery was performed with use of complete cardiopulmonary bypass with cannulation and direct antegrade perfusion of the coronary arteries. A large central fenestration was found in the left aortic cusp and the commissural portion of the valve between the right and left coronary bearing cusps were thickened and calcified. The margin of the right cusp was thickened and retracted, and tended to become prolapsed. The none coronary cusp was normal (fig. 2).

A patch of formalized polyvinyl sponge (Ivalon) 3 mm. thick was tailored and utilized to repair the valvular fenestration by application into the concavity of the left cusp with circumferentially placed mattress sutures. The right and left coronary cusps were united to form a bicuspid valve (fig. 2).

The patient had an uncomplicated postoperative course. The blood pressure became stabilized at 130/60 and the aortic murmurs diminished in intensity to grade-II systolic and grade-I diastolic. Thoracic aortography by way of a catheter revealed a residual 1-plus regurgitation (fig. 1).

Discussion

Cardiac valvular fenestration has long been recorded as a common anatomic finding at postmortem examination. Friedman and Hathaway2 made observations on the appearance of the semilunar valves in 342 autopsies and recorded an incidence of fenestration of 72 per cent. Foxe3 studied 300 successively observed hearts, and found valvular fenestration in 82 per cent. The aortic and pulmonary valves were involved almost equally.

The exact cause of this lesion is not clear. It may be due to a congenital tissue defect, since Foxe found fenestrations to be present in fetal hearts. Usually there is no histologic evidence of inflammation. Friedman and Hathaway suggest that it is a form of atrophy that may begin in early childhood, or even in the fetus, and that aging, dilatation of the

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Fig. 1. Preoperatively, a 3-plus regurgitation was demonstrated by suprasternal thoracic aortography (middle). A striking reduction in the aortic insufficiency was demonstrated postoperatively by catheter thoracic aortography (right). Control study, before dye injection, is on left.

Fig. 2. Schematic representation of the valvular pathology before (left) and after (right) surgical repair.

ring, and increased intravascular pressure may be contributing factors.

In spite of the frequency of this defect it has not aroused very much attention among clinicians. Frequently, even at autopsy, this finding is left unrecorded, presumably because of the prevalent feeling that the lesion does not have any clinical significance.

Diastolic "functional" murmurs occurring at the base of the heart have been reported for many years. They have been associated with systemic and pulmonary hypertension, fever, anemia, and hyperthyroidism. Garvin found a diastolic aortic murmur in 7 per cent of hypertensive patients in a survey of 200 consecutive cases. The Graham Steell murmur has long been regarded as the classical murmur of functional pulmonic insufficiency.

Fenestration of the semilunar cusps may or may not give rise to basal diastolic murmurs; and even in the presence of murmurs, these valvular lesions generally are unimportant clinically. The presence or absence of an audible murmur in valvular fenestration depends primarily upon the location of the defect. When the lesion is located near to the cusp margins, the fenestration is closed off during diastole by apposition of the adjacent leaflets. Under ordinary circumstances regurgitation will occur only if the central portion of the cusp is involved. Under conditions of hypertension or dilatation of the ring, however, failure of the closing cusps to approximate with the usual margin of overlap may
permit the fenestration to become functional. Although these defects are generally not important clinically, dynamic aortic insufficiency may occur on occasion, perhaps as a result of rupture of connecting tissue bands separating smaller fenestrations, with consequent enlargement of the defect. Another cause for enlargement of the defect is acute inflammatory change involving the fenestration. It is believed that this latter mechanism, i.e., bacterial endocarditis engrafted upon a congenital defect was an important contributing factor to the dynamic aortic insufficiency in the present case.

The valvular regurgitation in this patient was adequately repaired by use of an Ivalon patch to close the fenestration plus surgical union of the right and left coronary cusps to form a conjoined aortic valve cusp. Thus, a bicuspid aortic valve was created. Although a minor degree of residual aortic insufficiency was demonstrated postoperatively by thoracic aortography, it is not expected to be significant clinically.

Summary
A case of dynamic aortic insufficiency due to valvular fenestration is described. The defect was successfully repaired with an Ivalon patch to close the fenestration plus the surgical creation of a bicuspid aortic valve.

Summario in Interlingua
Es describite un caso de dynamic insufficientia aortic causate per fenestration valvular. Le defecto esseva reparate a bon successo. Le fenestration esseva claudite per medio de un pittacio de Ivalon. Un bicuspid valve aortic esseva create chirurgicamente.

REFERENCES

Therefore from these, and many such things as these, it is clear, that those things which are before spoken by former Authors concerning the motion and use of the heart and the arteries do either seem inconvenient or obscure, or admit of no compossibility, if one do diligently consider them; therefore it will be profitable to search more deeply into the business, and to contemplate the motions of the arteries and heart, not only in man, but also in all other creatures that have a heart; as likewise by the frequent dissection of living things, and by much ocular testimony to discern and search the truth.—William Harvey. De Motu Cordis, 1628.
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