Highlights on Aortic Valve Repair Surgery

Essay

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List of Abbreviation

ACC	American Collage Of Cardiolgest
AHA	American Heart Association
AR	Aortic Regurgitation
AS	Aortic Stenosis
BAV	Bicuspid Aortic Valve
ECG	Electrocardiogram
ESPVTR	End Systolic Pressure Volum Relationship
LAD	Left Anterior Descending
MRI	Magnetic Resonant Image
S2	Second Heart Sound
S4	Fourth Heart Sound
TEE	Transoesophageal Echo
TTE	Transthoracic Echo

INTRODUCTION

The first attempts at surgical treatment of valvular heart diseases were directed toward repair of mitral stenosis in the early 1920s by Elliot Carr Cutler in Boston and Sir Henry Souttar in London [1].

Under a historical perspective, aortic surgery started with conservative procedures that fell into disuse when reliable valve prostheses became available [2].

Aortic valve repair is an attractive concept because it offers the possibility of valve competence without structural deterioration due to viability and they preclude the need for anticoagulation. Enthusiasm for aortic valve repair has waxed and waned over the past 45 years due in part to the inherent technical difficulties and poor mid-term results. Renewed interest in the concept of aortic valve repair appeared over the last 20 years [3].

The surgical techniques for aortic valve repair are designed to repair the following alterations: 1) dilation of the aortic ring; 2) prolapse of the sinuses (frequently the right coronary) into the left ventricle; 3) faulty mobility of the cusps due to thickening, or calcification, or both; 4) fibrotic retraction, perforation and laceration of the cusps caused by infectious, or inflammatory processes, or both 5) congenital defects and 6) traumatic lesions. From a didactic point of view, reconstructive aortic valve surgery can be applied to three different lesion categories: (A) Stenosis; (B) Insufficiency and; (C) Combined lesions, aortic stenosis and insufficiency [4].

Most surgical techniques used nowadays were described many years ago. It remains however, that the single most important factor of aortic valve repair is the quality of the aortic valve leaflets. There must be enough leaflet tissue of good quality to satisfactorily restore normal valve function. Generally, multiple techniques are required in repairing the aortic valve and probably no single technique can be expected to achieve satisfactory results [5].

For aortic stenosis, valve commissurotomy plus debridement of fibrotic areas and decalcifications is the rule [4]. Recently, it is suggested that aortic valve repair is a viable alternative to current valve treatments in patients with early to mid-stage calcific aortic valve disease [6].

Congenital valvular aortic stenosis in young patients is a subgroup where conservative surgical options are limited, although an ingenious technical artifice was introduced for the preservation of bicuspid aortic valves [7].

Recent advances in understanding the different mechanisms of aortic regurgitation (AR) have resulted in the evolution and application of valve- conserving operations due to an increasing number of patients with aortic regurgitation [(1)].

Aortic valve repair for AR in patients with tricuspid leaflet morphology is a safe procedure that provides good intermediate-term results [(8)].

Isolated prolapse of one or more aortic cusps is a frequent cause of regurgitation. While aortic valve repair for dilated annulus is the most accepted indication, some controversy exists about aortic valve repair for patients with bicuspid aortic valve (BAV) and cusp prolapse of trileaflet valves [(9)].

It is advocated that, aortic regurgitation due to perforation or tear can be treated effectively by aortic valve repair using pericardial patch plasty. The functional results are satisfactory. With the application of this technique also more complex pathologies of the aortic valve can be addressed adequately thus extending the concept of valve preservation in patients with aortic regurgitation [(10)].

In patients with aortic aneurysms or dissections involving the aortic root, 2 reparative approaches have been used. The first consists of a remodeling operation with radical excision of all diseased aortic tissue down to the annulus followed by reconstruction of the root using three tongue-shaped processes to recreate the aortic sinuses. The second approach (the tube operation), consists of less radical excision of the diseased aortic wall followed by insertion of the mobilized valve inside a Dacron tube [1].

Freedom from reintervention after complex valve repairs was not different from that after valve replacement, with acceptable residual aortic stenosis and insufficiency. Simple repairs and repair of aortic insufficiency with ventricular septal defect yielded excellent long-term freedom from reintervention [11].

The long-term morbidity and mortality is low and valve repair may be an option in carefully selected patients [12].

AIM OF THE WORK

A highlight in recent advances of aortic valve repair will be presented, and outcome data will be discussed.

ANATOMY OF LEFT VENTRICLE AND AORTIC VALVE

Inlet and Apical Trabecular Portions:

The left ventricle can be subdivided into three components, similar to the right ventricle. The inlet component surrounds, and is limited by, the mitral valve and its tension apparatus. The two papillary muscles occupy anterolateral and posteromedial positions and are positioned rather close to each other. The leaflets of the mitral valve have no direct septal attachments because the deep posterior diverticulum of the left ventricular outflow tract displaces the aortic leaflet away from the inlet septum. The apical trabecular component of the left ventricle extends to the apex, where the myocardium is surprisingly thin. The trabeculations of the left ventricle are quite fine compared with those of the right ventricle (Fig. 1). This characteristic is useful for defining ventricular morphology on diagnostic ventriculograms [13].

Outlet Portion:

The outlet component supports the aortic valve and consists of both muscular and fibrous portions. This is in contrast to the infundibulum of the right ventricle, which is comprised entirely of muscle. The septal portion of the left ventricular outflow tract, although primarily muscular, also includes the membranous portion of the ventricular septum. The posterior quadrant of the outflow tract consists of an extensive fibrous curtain that extends from the fibrous skeleton of the heart across the aortic leaflet of the mitral valve, and supports the leaflets of the aortic valve in the area of aortomitral continuity (Fig. 2). The lateral quadrant of the outflow tract is again muscular and consists of the lateral margin of the inner curvature of the heart, delineated externally by the transverse sinus. The left bundle of the cardiac conduction system enters the left ventricular outflow tract posterior to the membranous septum and immediately beneath the commissure between the right and non coronary leaflets of the aortic valve. After traveling a short distance down the septum, the left bundle divides into anterior, septal, and posterior divisions [13].

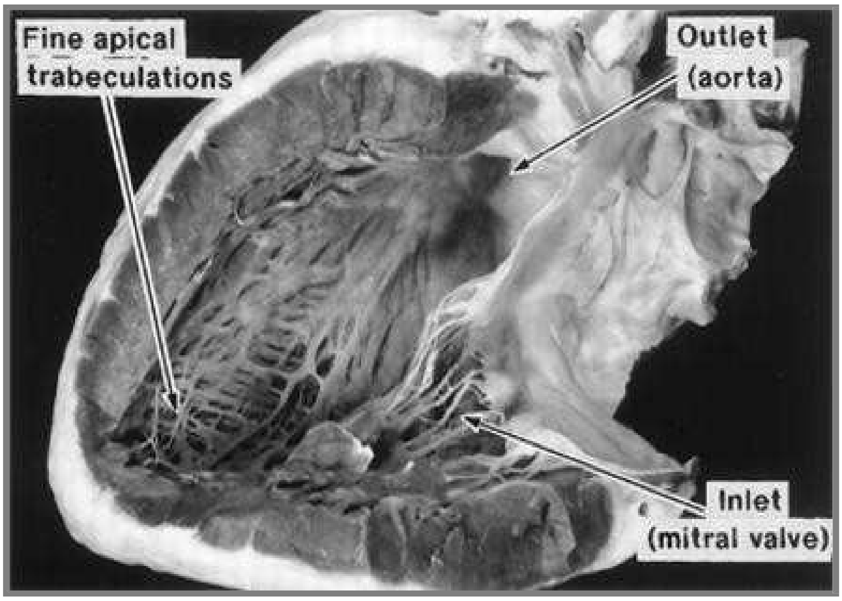

Figure (1): Dissection of the left ventricle shows its component parts and char acteristically fine apical trabeculations [13].

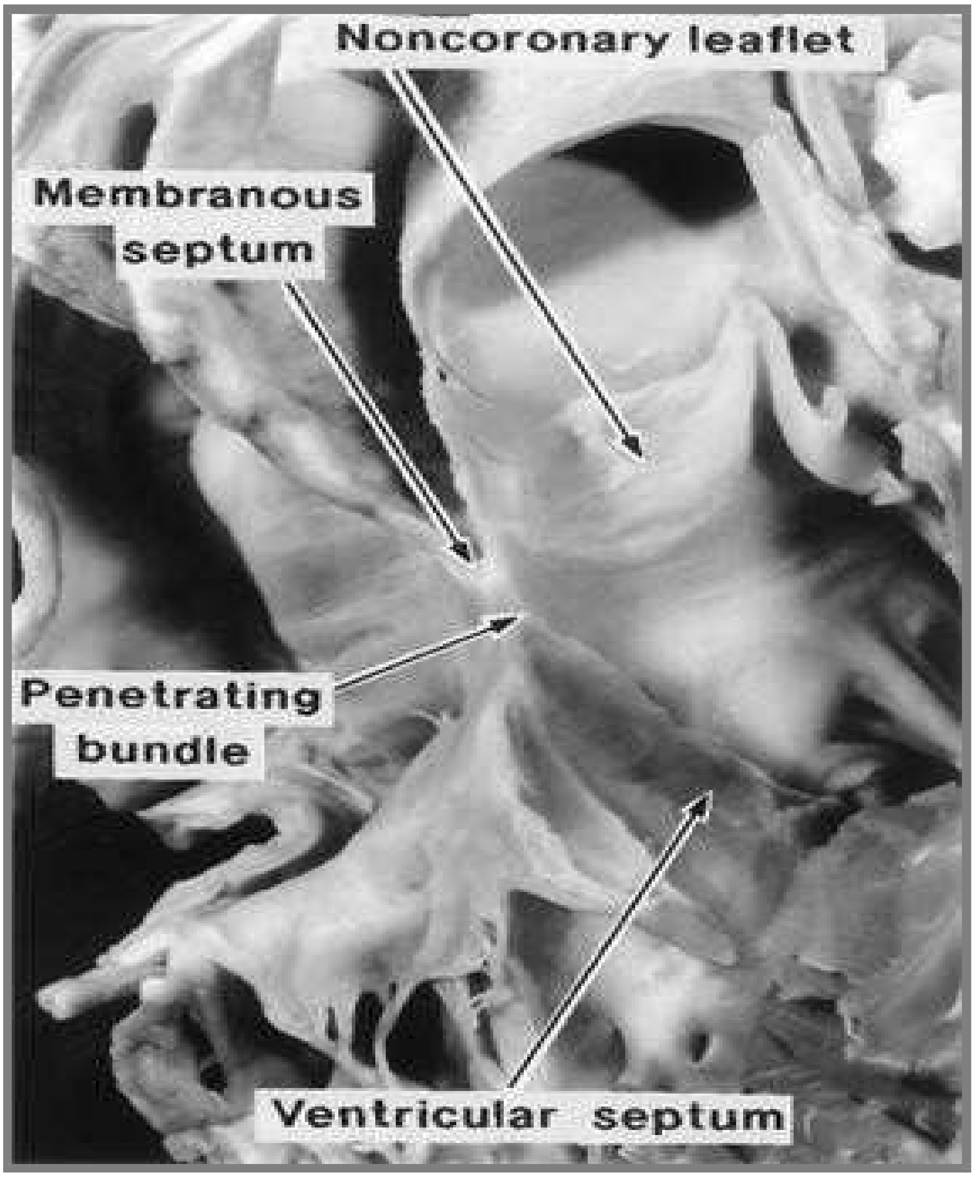

Figure (2): Dissection made by removing the right and part of the left aortic sinuses to show the relations of the fibrous triangle between the right and non coronary aortic leaflets [(13)].

Aortic Root:

The aortic root is the anatomical segment between the left ventricle and the ascending aorta. It contains the aortic valve and other anatomical segments which function as a unit. The aortic root has four anatomical components. The aortic annulus, the aortic cusp, the aortic sinus and the sinotubular junction [14].

The aortic annulus is a fibrous structure that attaches the aortic root to the left ventricle. It is attached directly to the myocardium in 45% of its circumference and to fibrous structure in the remaining 50%. The aortic annulus has scalloped shape. The aortic root has a fibrous continuity with the anterior leaflet of the mitral valve and the membranous septum and is attached to a muscular interventricular septum by a fibrous strand. A fibrous tissue that separate the aortic valve from the mitral valve is termed the intervalvular fibrous body [15].

Aortic Valve:

The aortic valve is a semilunar valve, morphologically quite similar to the pulmonary valve. Likewise, it does not have a discrete annulus (Fig. 3). Because of its central location, the aortic valve is related to each of the cardiac chambers and valves (Fig. 4). A thorough knowledge of these relationships is essential to understanding aortic valve pathology and many