ANALYSIS OF CASES OF AORTIC INCOMPETENCE

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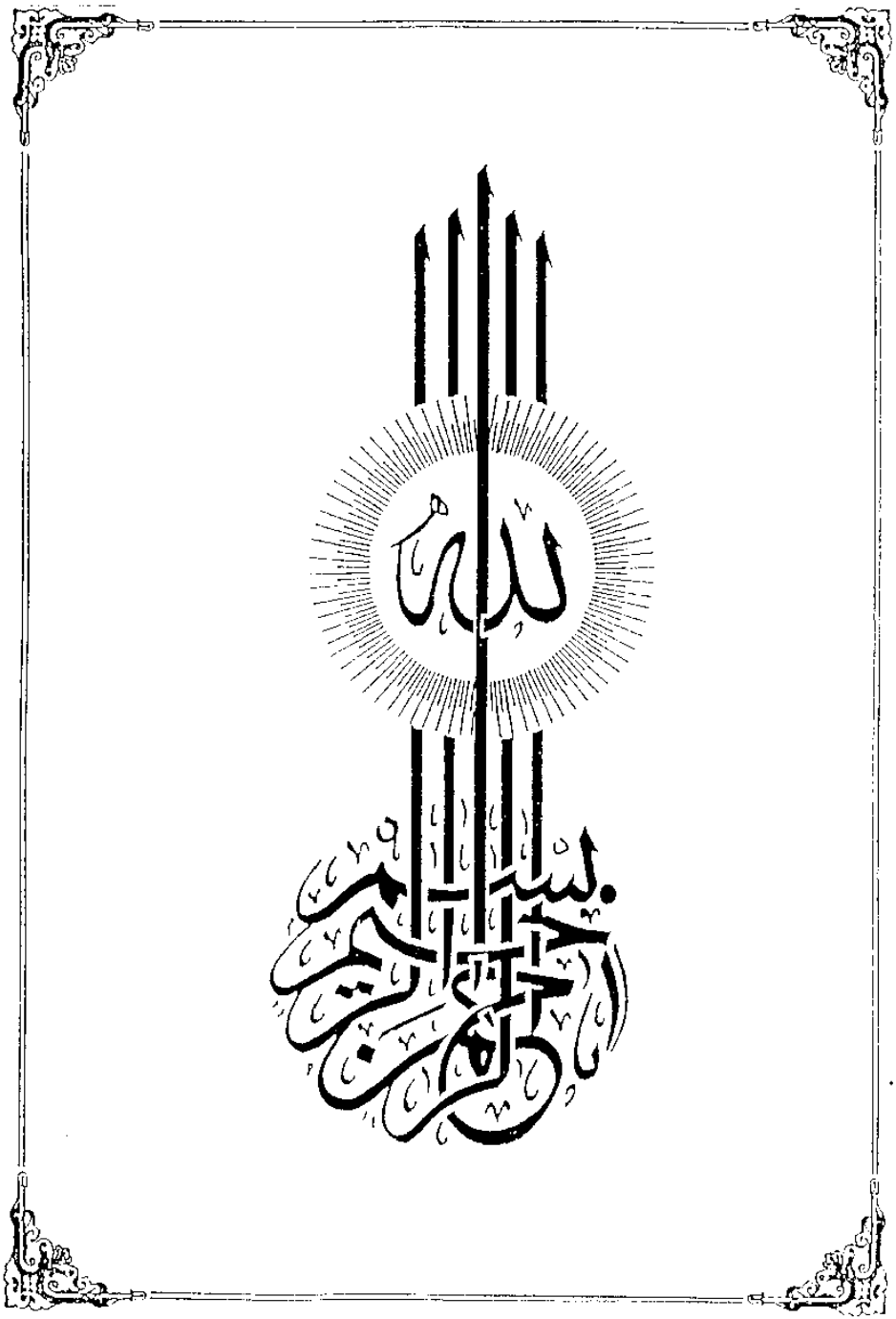
بسم الله الرحمن الرحيم

" قالوا سبحانك لا علم لنا الا ما علمتنا
انك أنت العليم الحكيم "

صدق الله العظيم

سورة البقرة : آية ٣٢



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INTRODUCTION

HISTORY AND INTRODUCTION

Valve surgery started in 1913, when Doyen performed the first operation on a human cardiac valve. He dilated a stenotic pulmonary valve using a tenotome knife. But unfortunately his patient died shortly after operation.

One year later, Tuffier in 1914, performed the first successful operation for treatment of aortic stenosis, by invaginating the ascending aortic wall with his finger in order to dilate the stenosed valve.

After that time, valvular heart surgery became very popular. Successful trials were performed to treat stenotic mitral valves and with the great development of mitral valve surgery, procedures were being devised to obtain surgical palliation for patients with aortic stenosis (Lefrak and Starr, 1979).

Smithy in 1948, performed both transaortic and transventricular aortic valvotomy in experimental

animals. Two years later, Bailey, (1950) performed retrograde aortic valve dilatation through the carotid artery, but this method was replaced by transventricular technique due to arterial dissection and creation of aortic incompetence.

In 1953, Bailey used a triangular expansile instrument to perform aortic valve commissurotomy through the apex of the heart with reasonable success.

Treatment of aortic incompetence was a difficult procedure, but Bailey (1955) and Harken (1958) tried to use a heavy suture tied around the base of the aorta to constrict the valve annulus, but unfortunately the procedure was unsuccessful.

During the same period, Hufnagel (1951) and Campbell (1950), both designed an artificial valve consisting of a lucite tube and a mobile spherical poppet. The valve was inserted in the descending thoracic aorta of dogs, the valve improved the haemodynamic abnormalities of aortic incompetence.

In September 1952, Hufnagel ignited the fire of prosthetic valve implantation by successfully inserting the ball-and cage valve into the descending thoracic aorta of a patient with severe aortic regurgitation (Hufnagel and Harvey, 1953). Soon after this monumental accomplishment, Murray used a similar technique to implant homograft aortic valve segments in the same position used by Hufnagel (Murray, 1956).

By 1953, the work of Hufnagel and Murray was well known, and careful evaluation was done of their heterotopic artificial valve placement procedures. It was soon realized that the position of implantation was unsuitable due to interference with coronary blood flow. (Lefrak and Starr, 1979).

Gibbon in 1953, excited the entire field of medicine for the first successful use of total cardiopulmonary bypass for intracardiac surgery. After that accomplishment, surgeons became interested in improving their results with "blind" procedures for stenotic and incompetent cardiac valves (Gibbon, 1954).

Following the initial enthusiasm with this direct-vision approach, two important problems were noted: many valves were too contracted and calcified to obtain any haemodynamic improvement and the restenosis rate after commissurotomy was high. Dissatisfaction with the incomplete relief obtained for aortic insufficiency using Hufnagel's valve in the descending thoracic aorta inspired surgeons to try a more direct approach, thus the bicuspidization operation was devised, in which the noncoronary cusp was excised or plicated and the annulus narrowed (Garamella et al., 1959). Bailey (1958) tried still another operation in which he constructed a flap valve from the aortic wall itself and placed it above the incompetent valve orifice and Muller adapted the concept of leaflet extension and sutured a piece of Ivlon to the free edge of one of the aortic valve leaflets (Muller et al., 1960).

The selective combination of closed-heart operations for aortic valve disease resulted in improved palliation for a large number of patients in the middle and late 1950s. However many valves were too shrunken, calcified and immobile to allow adequate

repair, and it soon became obvious that development of implantable valve substitutes would be absolutely necessary, so the preliminary efforts towards this goal were those in which partial replacement with a mobile prosthesis was evaluated, leaflets were fashioned from pericardium, teflon, or Dacron and employed for replacement of aortic cusp (Kay **et al.**, 1961; Van Der Spuy, 1964).

However none of these partial valve replacement techniques were successful because of problems of dehisence, thrombosis and loss of compliance of the leaflets also, it was evident that the entire aortic valve was severely diseased and thus total, rather than partial valve replacement was necessary. Bahnson et al. (1960) used Teflon leaflets to replace the aortic valve, and Roe et al. (1958) employed compression modelled silastic to attain the same goal. Hufnagel (1977) designed a leaflet prosthesis using silicone rubber impregnated into a Dacron mesh base.

In 1960,Harken reported successful implantation of a ball valve in the subcoronary position for severe

aortic insufficiency (Harken et al.,1961).

In 1960, Starr's original ball-valve prosthesis was a significant development in aortic valvular replacement surgery, but, these initial prosthesis have either been abandoned or undergone multiple modifications because of problems related to structural failure or embolic complications.

Disc prosthesis (Kay-Shiley, Kay-Suzuki, and Cross-Jones) were developed to overcome the problems of poppet inertia and ventricular-prosthetic disproportion (Cross et al., 1966). However, , because of its significant thromboembolic incidence, the cloth-covered disc prosthesis was first used clinically in 1967 (Beall et al., 1968). In 1969, the Bjork-Shiley model was introduced, with a free floating and rotating disc (Bjork et al., 1970). In 1970, a third pivoting disc valve, the Lillehei-Kaster prosthesis was first used clinically (Brawley et al., 1975).

The principal deficiency associated with the mechanical prosthesis is that none are free of thrombotic complications, and this significant deficiency

has been the stimulus for surgeons to attempt valve replacement with various types of tissue valves. In 1962, Ross and Barratt-Boyes began the clinical application of aortic valve homograft replacement in the subcoronary position, initially fresh valves were used, but problems of procurement resulted in the use of various methods of sterilization and preservation, while these preserved homograft functioned well in the early postoperative period, degenerative changes in the non viable cusps lead to late valve failure (Barratt-Boyes 1964).

Because of difficulty in procuring homograft and the need for unusual precise surgical technique in their implantation, the bovine and porcine heterograft valves were used, and the most widely utilized heterograft valve, the Hancock porcine prosthesis was first clinically implanted in the aortic position in July 1974 (Lefrak and Starr, 1979).

REVIEW OF LITERATURE

ANATOMICAL AND FUNCTIONAL CONSIDERATIONS OF AORTIC VALVE

The aortic valve is situated at the junction of the summit of the left ventricular outflow tract and ascending aorta. It consists of three pocket - like cusps or leaflets. The right coronary cusp which is anatomically anterior, and the left coronary cusp (left posterior anatomically), and the non coronary cusp (right posterior anatomically) (Muller and Nolan, 1972). (Fig. 1).

The aortic valve surrounds the aortic orifice, which is a circular aperture infront and to the right of the left atrioventricular orifice; from which it is separated by anterior cusp of the mitral valve. It is also postero-inferior and slightly to the right of the pulmonary valve. It has a diameter of about 2.5 cm. The portion of the ventricle lying immediately below the aortic orifice is termed the aortic vestibule and possesses a largely fibrous instead of muscular wall (Muller et al., 1960).