ECHOCARDIOGRAPHIC COMPARISON OF MITRAL VALVE FUNCTION & HEMODYNAMICS BEFORE AND AFTER PERCUTANEOUS BALLOON MITRAL VALVULOPLASTY . A SHORT TERM STUDY

Thesis

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بسم الله الرحمن الرحيم

قُلْ هَلْ يَسْتَوِي الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لَا يَعْلَمُونَ

إِنَّمَا يَتَذَكَّرُ أُولُوا الْأَلْبَابِ

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بسم الله الرحمن الرحيم

Introduction

Percutaneous mitral valvuloplasty is a relatively new treatment of patients with symptomatic mitral stenosis, & since the report of Inoue et al on percutaneous balloon mitral valvuloplasty in 1984, many studies have documented the efficacy of the balloon mitral valvuloplasty result in symptomatic & hemodynamic benefits. It is now widely used as an alternative to surgical mitral commissurotomy because of its intial success & low complication rate. "Jai Patel Erol 1991).

The ideal candidate for balloon dilatation of the mitral valve is a young patient with a pliable valve, commissural fusion & little valvular and subvalvular calcification or thickening. (Thomas et al. 1993).

Although several investigators have reported favorable results in the follow up period after valvulaoplasty, little information is available regarding the serial change in the mitral valve haemodynamics especially in the mitral valve area in a relatively short period after valvuloplasty.

Measurement of mitral valve area by cardiac catheterization is invasive & costly & therefore not suitable for serial assessment of valve area. The evaluation of the mitral valve before & after balloon valvuloplasty has been greatly aided by the use of two dimensional &

doppler echo cardiography.

Echo cardiograpahy is highly efficient method for the evaluation & selection of patients who will undergo percutaneous mitral balloon valvuloplasty, complementing clinical and hemodynamic investigations. It allows the assessment of mitral morphology "echo scores" & dynamic "mitral valve area & transvalvular pressure gradient" before & after valvuloplasty (Castello et al. 1992).

Aim Of The Work

The aim of this study is serial assessment of mitral valve dynamics by echocardiographic examinations performed before & immediately after balloon & 24 hours and one month after valvuloplasty with estimation of the followng:-

(1) Mitral valve area.

(2) Transvalvular pressure gradient.

(3) The occurance & degree of mitral regurgitation.

REVIEW OF LITERATURE

CHAPTER I

Anatomy of the Normal Mitral Valve

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Anatomy of The Normal Mitral Valve

The mitral valve is a complex structure comprising four major structures, which are: the leaflets, chordae tendinae, papillary muscles and the annulus. The mitral valve orifice is best viewed from the atrial aspect. Its mean circumference is 9.0 cm in males, and 7.2 cm in females (Ranganathan et al., 1970). In normal adults the cross sectional area of the mitral valve orifice is 4 - 6 cm^2 (Reichek et al., 1973).

The mitral valve orifice is directed anterolaterally to the left and a little inferiorly, i.e., towards the left ventricular apex. It is almost complamer with the tricuspid orifice but posterosuperior to it, whereas it is postero-inferior and slightly to the left of the aortic orifice.

I- The Mitral Valve Leaflets:

The mitral valve is described now as consisting of a continuous veil attached around the entire circumference of the mitral orifice; its free edge bears indentations, two being deep and regularly positioned and receiving fan shaped commissural chordae tendinae, and permit the division ofthe veil into anterior and posterior leaflets (Ranganathan et al., 1970).

1.5 cm). Consequently, the anteromedial leaflet is more mobile than posteromedial one. One the contrary, the annular attachment of the anteromedial leaflet is half that of the posterolateral one (Roberts, 1983).

b) The posterior leaflet:

It has been called also ventricular, mural, smaller or posterolateral. Usually it has two minor indentations. Lam et al., (1970), have provided precise definition of the commissural chordae showing that the posterior leaflet is best regarded as all valvular tissue posterior to the anterolateral and posteromedial commissures. Thus it has wider attachment to the annulus than the anterior (mean values are 5.4 cm in males 4.3 cm in females).

The posterior leaflet is divided by cleft chordae tendinae and clefts into a relatively large middle scallop and smaller anterolateral commissural and posteromedial commissural scallops. Each scallop has a crescentic, opaque rough zone, receiving chordal attachments on its finely serrated margin and ventircular aspect, defining the area of valvular opposition in full closure. From the rough zone to within 2 - 3 mm of its annular attachment is a membranous clear zone devoid of chordal attachment. The basal zone is thick 2 - 3 mm in length, vascular and receives chordae tendinae. The ratio of rough to clear zone in the anterior leaflet 1.4, thus much more posterior leaflet is in opposition with the anterior during mitral closure (Lam et al., 1970).

Although the two mitral leaflets differ greatly in height and motility, both contribute importantly to effective valve closure, and both have approximately to the same surface area (Roberts, 1983).

Mitral Chordae Tendinae:

They are of two main types:

False chordae tendinae and true chordae tendinae.

False chordae tendinae: defined as discrete fibromuscular bands crossing the left ventricular cavity and having connections between its different structures. "Left ventricular bands" is another name that has been used for used for these structures. They are irregularly distributed, may inter-connect papillary muscles, extend from the latter to a point on the ventricular wall, or interconnect two points on the ventricular walls. They are ignored in many accounts and when mentioned, considered of little or no functional significance. They are common and occur in about 50% of a human hearts, and often cross the outflow tract. Often left ventricular bands can be identified by two-dimensional echocardiography. A positive association between the presence of left ventricular bands and the occurrence of a vibratory systolic auscultatory murmur has been claimed (Lam et al., 1970).

True chrodae tendinae: are fibrous strings that arise from the apical portion of the two left ventricular papillary muscles and insert into the mitral valve, and can be divided into:

*** Chordae inserting into the interleaflet area (commissural chordae):**

They are two in number anterolateral and posteromedial commissural chordae arising near the tips of papillary muscles by a single stem fanning out at once into radiating strands attached to the smooth free margin of the commissure, some enter the lamina fibrosa of their adjacent leaflets and continue to their annular attachement. Branches of posteromedial commissural chordae are longer, thicker and spread more.

*** Chordae tendinae of the anterior leaflet (Rough zone chordae):**

These origiante from the papillary muscle and divide soon into three, one cord is attached to the free leaflet margin, one beyond it on the ventricular surface at the line of closure and one between these. Peculiar to the anterior leaflet are two which are thickest and strongest in the mitral complex; they come from the tips of the anterolateral and posteromedial papillary muscles to attach near the line of valvar closure posteromedially (4 - 5 O'clock position) and antrolaterally (7 - 8 O'clock position). They are strut chordae (Lam et al., 1970).

*** Chordae tendinae of the posterior leaflet:**

Three types of chordae are attached to the posterior leaflet:

*** Rough zone chordae:** have similar morphology to that of the rough zone chordae of the anterior leaflet, but these are shorter and thinner.

* **Cleft chordae:** Fan shpaed, have small branches radiating to the free marings of clefts between scallops, the deeper branches passing to the ventricular aspect of the adjacent rough zones.

* **Basal chordae:** These are unique to the posterior leaflet and usually confined to the large middle scallop and one of the two smaller scallops. They arise directly from the mural ventricular myocardium as a single strand which flares into minute branches before attachment into the ventircular aspect of the the valvular basal zone.

Generally, an average of 24 chordae are attached to the papillary muscles and about 120 chordae are attached to the leaflet (Roberts, 1983).

The chordae prevent the upward prolapse of the mitral leaflets into the atrium during ventricular systole, this prevent regurgiation of blood from the left ventricle to the left atrium in systole (Romances, 1977).

The function of the mitral apparatus can be disturbed by abnormally long or short chordae, ectopically inserted chordae, fusion of chordae and ruptured chordae.

The Papillary Muscles:

The two left ventricular papillary muscles vary in length and in breadth and may be bifid. Their location is anterolateral and posteromedial in the inflow tract of the left ventricular cavity (Roberts, 1970).

The anterolateral papillary muscle is more uniform and consists only of a single trunk that protrudes more into the cavity than does the other one. The posteromedial papillary muscle is smaller and replaced by 2 - 3 smaller pillar (Roberts, 1983).

The impulses reach the papillary muscles earlier than the rest of the ventricular muscle, thus the papillary muscles contracts early and so the chordae tendinae are taught at an early stage of ventricular contraction, so that the valve cusps are drawn together and prevented from balloning into the left atriun in systole (Romances 1977).

Sudden rupture of a papillary muscle causes acute severe mitral regurgiation. The anatomic site at which papillary muscle rupture occurs, is the important determinant of the magnitude of regurgitation and the subsequent clinical course.

Arterial Supply of the Left Ventricular Papillary Muscles:

The anterolateral papillary muscle receives branches from the anterior descending coronary artery and either the diagonal left ventricular arteries or the marginal branches of the left circumflex artery. The posteromedial muscle receives a variable supply from the left circumflex artery and/or branches of the right coronary artery. The epicardial branches of the coronary arteries coarse from base to the apex of the heart, giving penetrating intramyocardial branches.

The Mitral Annulus:

It is a junctional zone that separates and gives attachment to the muscle of the left atrium and left ventricle and also to the mitral valve leaflets (Walmsley and Watson, 1978).

the annulus has two major collagenous structures, the right and left fibrous trigones. The right fibrous trigone, or central fibrous body, lies in the midline of the heart. It represents the confluence of the fibrous tissue from the mitral valve, tricuspid valve, membranous septum and the posterior wall of the aortic root. On the other hand, the left fibrous trigone is composed of fibrous tissue at the confluence of the left margin of the aortic and mitral valves (Titus, 1967).

Extending dorsally from the trigones on both sides of the mitral orifice are the tendon like fila of Henle, which gives attachment to the posterior leaflet of the mitral valve, and it varies considerably in thickness in different subjects (Walmsley and Watson, 1978).

Between the trigones and ventrally, the anterior leaflet of the mitral valve is in direct fibrous continuity with the aortic root. There is no thickened fibrous ring in this region and the annulus is represented as a poorly defined non thickened zone that gives attachment to the muscle fibres of the roof of the left atrium (Walmsley and Watson,