Short Communication

A gross anatomical study of pulmonary valve in human cadavers

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ABSTRACT

The knowledge of anatomy of the heart has evolved over the ages and has contributed to the applications of cardio thoracic surgery and in understanding physiology of the various heart related diseases. In this study an attempt has been made to study the anatomy of pulmonary valve in human cadaveric hearts. The anatomy of pulmonary valve was studied by gross examination and dissection of hearts. The range of various parameters along with mean value and standard deviation was calculated. The annular length of the pulmonary valve was in the range of 5.4-7.8 cm with mean of 6.5±0.59cm.The width of right anterior, left anterior and of posterior leaflet was in the range of 1.9-3.1cm with mean of 2.4±0.35, 1.8-3.4cm with mean of 2.5±0.45 and 2.1-3.5 cm with mean of 2.7±0.4 respectively. As a result of such studies, current notions may be so changed and extended so as to understand the better morphologic structures of the heart and to provide a scientific basis for its function.

Keywords: *Cardiac anatomy, cardio thoracic, pulmonary valve*

Introduction

The World is currently witnessing the advent of new diagnostic tools and therapies for heart diseases, but, without serious scientific consensus on fundamental questions about normal and diseased heart structure and function. The knowledge of anatomy of the heart has evolved over the ages and has contributed to the applications of cardio thoracic surgery and in understanding physiology of the various heart related diseases. The effective pumping action of cardiac chambers depends largely on the effectiveness of valves at the atrioventricular openings and at the arterial outlets. [1] The degree and intensity of the deformity of the cardiac valves mainly determine the severity and longevity of the patients. [2] For accurate corrective surgery and valve replacement, knowledge of normal parameters of size of valves is essential. The data on valves, particularly the mitral and pulmonary might help in development of indigenous valves.

Recently, the increased use of pulmonary autografts demands a better understanding of the pulmonary valve functional anatomy. [3, 4] The right ventricle communicates with the right atrium through the right atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice. The pulmonary trunk at the level of semilunar valve lies anterior and slightly to the left of aorta. It is in a plane almost at right angles to that of aortic valve. The pulmonary orifice is guarded by the pulmonary valve. [5] Pulmonary valve is made up of a fibrous annulus which is shaped like a three pronged cornet to which are attached three equal sized semilunar

cusps. [6] Reflux into the great veins is inhibited by muscle contraction at these inlets early in the cardiac cycle. So, the length of annulus plays an important role. The leaflets are thin flexible sheets freely suspended between the lateral attachments. [7] Each of three leaflets forms a cup deeply concave and possesses a horizontally aligned rim or free margin. The lateral attachments of the cusps form commissures, each being the junction between two adjacent leaflets. [8] The three semilunar cusps are termed as anterior, right posterior and left posterior. [9]

The interest in the morphology of cardiac valves, which during the 60's and 70's was limited to the pathological features, has extended to other spheres as well. Valvoplasty is one field which has caught the fancy of today's cardiovascular surgeons and anatomists. The more accurate knowledge of anatomy began to play an important role in the success of valvoplasties. The technique of aortic root replacement with a pulmonary autograft, as introduced by Ross in 1986, seems to offer an attractive alternative in the pediatric age group. [10] A pulmonary autograft is not prone to structural degeneration and does not require anticoagulant therapy. It offers the advantage of growth potential, thus avoiding reoperation for an increasing pressure gradient across the valve in the growing child. [11, 12]

Material and Methods

This study was conducted in the Department of Anatomy, DMCH, Ludhiana after approval from the Hospital Ethics Committee. For the study, fifteen human cadaveric hearts were taken. The ascending components were cut above the arterial valves. Blood clots were washed and the hearts were fixed in 10% formal saline. The total annular length of the pulmonary valve was measured. The width of each leaflet (measured between the peripheral zones of attachment along the sinus ridge) was measured. The measurements were taken with the help of non stretchable Nylon thread/ divider and Metric ruler. The dissection was completed and the specimens were photographed. In the statiscal analysis, p value was calculated and t test was applied.

Results

Table 1: Total annular length of Pulmonary valve

Total annular length of pulmonary valve (cm)	No. of cases	Range	Mean±S.D.
Human	**15**	**5.4-7.8**	**6.50±0.59**

Table 2: Width of cusps of Pulmonary valve

Width(cm)	No.of cases	Range	Mean± S.D.
Right Anterior	15	1.9-3.1	**2.4± 0.35**
Left Anterior	15	1.8-3.4	**2.5±0.45**
Posterior	**15**	**2.1-3.5**	**2.7±0.4**

As shown above- The annular length of the pulmonary valve was in the range of 5.4-7.8 cm with mean of 6.5 ± 0.59cm.The width of right anterior, left anterior and of posterior leaflet was in the range of 1.9-3.1cm with mean of 2.4 ±0.35, 1.8-3.4cm with mean of 2.5 ± 0.45 and 2.1-3.5 cm with mean of 2.7 ± 0.4 respectively. (Fig. 1 ,2)

Fig. 1 Showing the position of pulmonary trunk

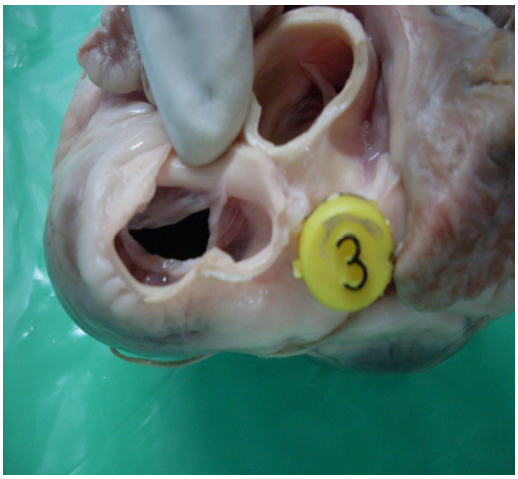

Fig. 2 Showing leaflets of the pulmonary valve

Discussion

Table 3: Comparison of measurements of Pulmonary Valve (cm)

Author	No.of cases	Annular Length(cm)	Average width of cusps(cm)		
			Right Anterior	Left Anterior	Posterior
Brandenberg et al [13]	30	7	-	-	-
Friedrich et al [14]	50	7.2	-	-	-
Westaby et al [15]	160	7.63	-	-	-
Kinare et al[16]	25	6.66	-	-	-
Present Study	15	6.50±0.59	2.4	2.5	2.7

In postmortem hearts, Brandenberg et al, [13] Friedrich et al [14] and Westaby et al, [15] found the average length of pulmonary valve, which is on higher side than found in the present study whereas work done by Kinare et al [16] on formalized hearts is showing similar results as in our study.

The knowledge of anatomy of the valves and their leaflets is useful in treatment of congenital cardiac defects and acquired diseases such as subacute bacterial endocarditis, crushing chest injuries with compression of the heart, severe cardiac strain from exertion, to name a few. We are now embarking on a new era in the treatment of valvular heart disease with the introduction of percutaneous and minimally invasive devices and techniques to repair valve dysfunction without conventional surgical repair/replacement. There are at least 30 percutaneous valve programs taking place

currently in the field of cardiology. [17] Valve replacement is used for patients with badly scarred valves, severe regurgitation or valvular stenosis. The importance of the valvular structures in the functioning of cardiac mechanism is well appreciated. In the present study, an effort has been made to describe the anatomy of pulmonary valve which might help in further researches.

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