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To Compare Pressure Gradient across Aortic Valve after Bileaflet and Tilting Disc Mechanical Valve Replacement by Post Operative Echocardiography

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Abstract: *Aortic valve replacement is done in variety of diseases of aortic valve. Different type of valves are available with there own advantage and disadvantages.In this study we compare effect on pressure gradient between St. jude bileaflet mechanical valve and TTK chitra tilting disc mechanical valve. in this small evaluation of 50 patients(25 had AVR with St.jude and 25 with TTK chitra) St. Jude appear to have less PG than TTK. . Average pressure gradient was 11.5 mm of Hg. In St. jude and 15mm Hg. In TTK. It shows better(low) pressure gradient in St. jude than TTK.*

Key Words: *Aortic valve replacement, pressure gradient, St. jude valve, TTK Chitra valve*

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I. Introduction

Aortic valve direct the flow of blood from left ventricle to aorta. The sinotubular junction, the aortic sinuses of valsalva, the valve cusps and commissures, and the junction of the aortic valve with the ventricular septum and anterior mitral valve leaflet make up the aortic valve complex. The narrowest circumference referred to as surgeons to determine the size of an aortic prosthetic valve measure the aortic ring. Crown shaped annulus, fibrous trigones, aortic cusps, aortic sinuses and sinotubular junction share a dynamic coordinated action to provide unidirectional transmission of large volumes of blood pumped intermittently through channel while maintaining laminar flow, minimal resistance, optimal coronary artery flow, and least damage to blood elements during widely variable and frequently changing conditions. Valve dysfunction in form of stenosis and regurgitation may require valve replacement surgery

The ideal valve would be durable with a longevity approaching that of a native valve. Thrombogenicity would be non existent and there would be no need for supplemental anticoagulation. The ideal replacement valve would have no inherent gradient in and off itself and would allow for unimpeded outflow. It also would be easily implanted and readily available. Finally growth commensurate with that of the recipient would be possible

St. jude consists of two semicircular leaflets with small ears that pivot in a butterfly shaped recess in the housing of device. It is manufactured from pyrolytic carbon and graphite impregnated with tungsten for radio-opacity. Each leaflets open to 85 degree. The leaflets open and close almost entirely with in the orifice ring resulting in a low profile leaflet excursion is controlled by recesses located in the pivot guards. Projections on the leaflets float within these recess, which are washed by blood during systole and diastole, minimizing thrombogenesis. SJM master series valves have a valve orifice ring, which can be rotated with in sewing cuff to the surgeons preferred position after the valve has been sutured in place

TTK chitra valve is a tilting disc valve. Disc is made up of UHMW polyethylene. Strut and ring is made up of chromium cobalt alloy as a single unit. Sewing ring is made up of polyester fibers.

Left Ventricular- Aortic energy loss(pressure gradient)- Defined as loss of blood pressure in its path of flow because of resistance in flow. Normally systolic pressure in left ventrical and ascending aorta is equal as there is no resistance across aortic valve. Pressure drop across a discrete stenosis in the heart or vasculature occurs because of energy loss due to the three processes-1)- Accelaration of blood through the

orifice(convective acceleration). 2)-Inertial force(flow acceleration). 3)- Resistance to flow at the interfaces b/w blood and orifice(viscous friction). In most clinical situations the contribution of inertial forces and viscous friction are minimal and can be discounted. In this study we used continuity equation by echocardiography for measuring pressure gradient

II. Aims And Objectives

To compare pressure gradient across aortic valve after bileaflet and tilting disc mechanical valve replacement by post operative echocardiography.

III. Material and Methods

Aortic valve replacement by tilting disc valve and bileaflet valve were studied. After valve replacement results were compared by pressure gradient across valve by echocardiography. Comparison done in identical valve size and cardiac output. Echocardiography done before discharge and at 3/6 months follow up.

25 cases of aortic valve replacement by St. Jude valve studied in prospective manner.

25 cases of aortic valve replacement by TTK chitra valve studied in prospective manner.

All operated cases were operated by same technique(aortic valve replacement at annular position) so no chance of error in comparison regarding technique

These patients were selected randomly in all age groups and both sexes to avoid select bias. These patients were divided into two treatment groups i.e. A and B

Group A: Patients had AVR with St. Jude valve

Group B: Patients had AVR with TTK chitra valve

Post operatively patients were managed by hemodynamic management, antibiotics, anticoagulant(to keep INR 2-2.5)

Pressure gradient was calculated by follow up echocardiography

As per definition pressure gradient is related with cardiac out put so echocardiographic mean PG and cardiac output(Stroke volume x Heart rate at time of echo) were calculated

Results were evaluated regarding type of valve, size of valve and cardiac out put

IV. Results

Most of the patients who were included in this study were degenerative calcific AS- 18(36%), RHD come next order by constituting 26% of all cases

Most of operations which were included in this study were AVR only(38%), bentall procedure come next order by constituting 36% of all cases.

Out of total 50 patients, 32 were male and 18 were females. The most commonly affected age group of males was in third and sixth decade while in females it was fourth decades. Out of 50 patients male female ratio was 1.68:1 thus males affected more than females. Most of the valve used are 23mm in size than 21mm size than 19mm, 25mm and 27mm in order of frequency.

In 19mm size valves gradient is found more in St. Jude(32.5mm) then TTK(10mm of Hg). In 21mm size valves gradient is found less in St. jude(6mmHg at cardiac output -3.5 liter per minute and 11.6mm of Hg at cardiac output- 4 liter per minute) than TTK(7mm Hg at cardiac out put-3.5 and 18mm of Hg at cardiac output-4). In 23mm size valves gradient is found less in St.Jude(8mm Hg at cardiac output -3.5) than TTK(16mm Hg at cardiac output-3.5). In 25mm size valves gradient is found less in St. Jude (7mm Hg at cardiac output-3.5) than TTK(12mm of Hg at cardiac output-3.5). In 27mm size valves there was no comparable group.

V. Discussion

50 patients with aortic valve disease of various etiology(RHD, bicuspid calcific aortic valve stenosis, degenerative aortic stenosis, annuloaortic ectasia etc.) with or with out other valve involvement or ascending aortic involvement were included in this study. These patients had been operated with aortic valve replacement with associated disease corrections Patients were devided into two groups: 1-AVR with St. Jude valve 2-AVR with TTK chitra valve Patients with diagnosed systemic disease were excluded from study. These diseases were excluded by history, general physical examination and investigations(which ever relavant) Operation was done by standard technique of CPB. Patients were treated by antibiotics, hemodynamic management and anticoagulants.

Pressure gradient in both groups were compared by postoperative echocardiography which was done just before discharge, 3 month and 6 month follow up.

Comparison of results of our study done with other studies where ever literature available. Because of paucity of literature comparison could not be possible for every observation but most of observations were compared.

Pressure gradient was measured by post operative echocardiogram. Average pressure gradient was 11.5 mm of Hg. In St. jude and 15mm Hg. In TTK. It shows better(low) pressure gradient in St. jude than TTK. Statistical value P is .045 hence statistically significant.

VI. Conclusion

Based on response seen in this small evaluation St. Jude appear to have less PG than TTK. . Average pressure gradient was 11.5 mm of Hg. In St. jude and 15mm Hg. In TTK. It shows better(low) pressure gradient in St. jude than TTK. Statistical value P is .045 hence statistically significant. Pitfalls of this study are the small sample size and great variation in results in different sizes of valve. Another pitfall is that subvalvular gradient should also be considered which is not measured in this study. However based on the results of this study we believe that a large controlled multicentre clinical trial is warranted to better quantify its effects on PG.

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