



## Factors Influencing Out Come of Double Valve Replacement

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### ABSTRACT

**Background:** *Of all the subsystems of a hospital, resource consumed, use of specialized technical manpower, technology and skill, inpatient care and some factors play an important role in surgical outcome of valve replacement patients. Preoperative ejection fraction is very important in determining the out come of valve replacement surgery.*

**Aims:** *The study was conducted, to observe the significance of various factors influencing the out come of valve replacement surgery.*

**Methods:** *The admission and discharge record of all the patients was recorded from the report book. Hospital files of all the patients were checked to know complete biodata, symptomatology, clinical findings, diagnosis, outcome of management, besides the morbidity and mortality.*

**Results:** *A total of 70 patients had double valve replacement done. Male patients were more with mean age of 33 years, 42 patients had definite history of rheumatic fever and 3% of the patients had mitral restenosis.*

**Conclusion:** *Regurgitant lesions fair worse than the patients receiving double valve replacement of any other combination. Surgical intervention should be done before irreversible left ventricular dysfunction sets in. Left ventricular function is the single most important predictor of good postoperative outcome. Patients with good left ventricular function have quick post operative recovery, short hospital stay, improvement in functional class and excellent long term results.*

**Keywords:** *Left ventricular function, Double valve replacement.*

### INTRODUCTION

Surgical treatment of combined aortic and mitral valve disease began in early 1950s by closed methods. In 1955 simultaneous closed repair of aortic and mitral valve stenosis was reported. Rheumatic heart disease is one of the most common cause of cardiac valvular disease, and in particular in India the number is very significant. Most of the patients are in third decade of life, but no age is exempt, except the first decade.

Symptomatology may be gradual, or sudden onset when the patients presents with classical features of rheumatic polyarthritis, carditis, subcutaneous nodules, chorea and other. The natural history of the disease is also not well known though varies from individual to individual. The patients may present with stenotic or regurgitant lesions, or a combination of both, the disease may effect single or multiple valves. Clinical signs depend on functional class, valve involvement and the type

of lesions. Echocardiography is the initial investigation of choice, high risk group and patients above 45 years of age need angiography. Besides symptomatic drugs, long acting penicillin as prophylaxis is recommended in patients with rheumatic heart disease (RHD). However, in spite of all the precautions, drugs, prophylaxis the patient may not improve and the surgery becomes inevitable. Depending on the type of lesion the surgery is planned. Double valve replacement invariably refers to replacement of aortic and mitral valve. The morbidity and mortality involved is quite high. It is therefore very important to analyze the risk factors contributing to safe outcome in such operations. Leaving aside age, systemic illness, other co morbidities, and valvular lesions, left ventricular function is the single most important factor in predicting the outcome of valvular heart surgery.

#### MATERIAL AND METHODS

The study was conducted in the super specialty department of cardiovascular and thoracic surgery. All the patients irrespective of age, sex, race, diagnosis and management who underwent double valve replacement were included in the study. A detailed history thorough general / systemic examination, investigative and surgical findings were recorded in all. Using Swan Ganz thermo dilution catheter, the hemodynamic parameters such as cardiac index, pulmonary capillary wedge pressure, pulmonary artery pressure, systemic blood pressure pulmonary and systemic vascular resistance were analyzed. The patients were divided into two groups those with ejection fraction of more than 45 were put in group A, and those with ejection fraction of less than 45 were put in group B. Ejection fraction of more than 45 was taken as an indicator of good left ventricular function. To correlate the ejection fraction, an indicator of left ventricular function with hemodynamic parameter in postoperative period, the need for inotropic agents, vasodilators, ventilator support and circulatory assist devices (IABP) were also assessed in both

the groups. Patients were regularly followed up in out patient department.

#### RESULTS

The study included 40 male and 30 female patients, with mean age of 28 years in group A and 34 years in group B. Group A included 38 patients and group B 32 patients. 60% of the patients had definite history of rheumatic fever and 3% had undergone closed mitral valvotomy (CMV). All the patients in group B were in functional class III and IV, and the symptomatology varied from 6 to 8 years, Table-1. Aortic / mitral insufficiency were the most common lesions, Table-2, followed by mixed lesions (stenosis / regurgitant), stenotic lesions in both the valves were observed in 44.2% of the patients. St Jude Prosthesis was used in majority, table-3, four patients needed simultaneous tricuspid valve repair. Inotropic and ventilatory support was needed more in patients in group B. Late complications were recurrent cardiac failure, Table-4, and congestive cardiac failure was the common cause of postoperative deaths. Patients in group A had improved immediate post operative cardiac parameters, and after surgery all the patients improved by at least one functional class. Group B patients had low cardiac index, higher pulmonary capillary wedge pressure and low systemic arterial pressure. Post operative data showed significant change in both the groups. Inotropic and ventilatory support was needed more in group B patients, also more deaths occurred in group B patients. Deaths were recorded more in patients with ejection fraction of between 20 – 40%, no death occurred where ejection fraction was more than 60%. Long term follow up was achieved in 86% of the patients ranging up to 80 months with a mean of 40 months. Late complications such as recurrent cardiac failure, thromboembolic and bleeding complications, cerebrovascular accidents, and infective endocarditis were recorded in 11 patients. 61% late deaths were due to congestive cardiac failure.

**Table-1:** Age Sex and Hemodynamic data of the patients

Patient data	Group A	Group B
No of patients	38	32
Mean age	28	34
Male:Female	20:18	18:14
Duration of symptom Yrs	6	8
NYHA functional class	II and III	III and IV
Cath data		
Cardiac Index	2.5	1.4
LVED	15	25
PAP	25	40
Ejection fraction	>45	<45

**Table-2** Type of Valvular Lesions

Valvular lesions	Group A % age	Group B % age
Aortic regurgitation	45	40
Mixed Aortic valve disease	42	31
Mitral stenosis	36	18
Mitral regurgitation	26	40
Mixed mitral valve disease	36	37
Aortic stenosis	5	25
Tricuspid regurgitation	2.6	9
Previous CMV	None	6.2

**Table-3** Selection of prosthesis

Type of prosthesis	Aortic	Mitral
St. Jude	51	45
Starr Edward	19	19
Medtronic	--	04
Sorin valve	--	01
Omniscience	--	01

**Table-4** Late complications

Complications	Number of patients	%age
Recurrent cardiac failure	04	5.7
Thromboembolism	02	2.8
Bleeding	03	4.2
Cerebrovascular accidents	01	1.4
Infective endocarditis	01	1.4

## DISCUSSION

The morbidity and mortality associated with double valve replacement (DVR) is one of the biggest worry of a cardiac surgeon. How and why to reduce it is very important for a good outcome, and improved life style after surgery. The problem of valvular heart disease patients is that they remain busy with treatment from local quacks, professionals who neither have any idea of the

disease nor know the consequences of the late complications. By the time these patients present to a super specialty department, the left ventricular functions (which is the single most important factor in predicting the outcome of valve replacement in such patients) has already deteriorated in majority. Double valve replacement (DVR) is often indicated when acquired disease of both aortic and mitral valve is

severe enough to necessitate surgical management. Cartwright and colleagues first reported simultaneous aortic and mitral valve replacement.<sup>1</sup> Besides rheumatic heart disease, Marfans syndrome and other connective tissue disorders may cause prolapse and dilatation of more than one valve annulus, leading to valvular regurgitation, degenerative calcification of the aortic valve may be associated with degenerative mitral annular dilatation, also different pathological conditions such as infective endocarditis and ischemic papillary dysfunction may cause regurgitation.<sup>2</sup> In patients with multivalvular disease, the clinical manifestations depend on the relative severity of each lesion and by the chronicity and order of development each of these lesions can be expected to produce its characteristic effects on the heart and circulation. Operative risk of DVR is about 50% higher than that for the single valve replacement, which though has been steadily declining and now ranges from 5 to 10%.<sup>3</sup> 63% survival rate for DVR compared to 80% for single valve has been reported as early as 1993.<sup>4</sup>

The long term survival depends strongly on the preoperative New York Heart Association functional class (NYHA), advanced age, body surface area, black race, pulmonary artery hypertension, left ventricular enlargement, accompanying ischemic heart disease and ejection fraction. Surgical outcome also depends on use of cardioplegia, type of cardioplegia, global myocardial ischemic time, experience of operating surgeon, technique and selection of prosthetic valve in addition to other systemic illnesses.<sup>4-5</sup> Medical and surgical management of the patient with combined valvular disease is guided by the relative severity of each individual lesion and by the severity of non valvular myocardial factors. If the myocardial factors are not excessive, the decision to intervene surgically is prompted by the most symptomatic or life threatening lesions, yet we must emphasize that the severity of concurrent lesions must be fully appreciated before deciding for or against a specific form of therapy, in

particular, co existing lesions may seriously complicate cardiac surgery or prevent the expected post-operative improvement.<sup>6-7</sup> Majority of the patients in 3<sup>rd</sup> to 5<sup>th</sup> decade of life is at variance to the reported mean age of 50.5 years,<sup>8</sup> In resemblance to present observation multivalvular rheumatic disease has been reported more in male patients,<sup>9</sup> however, there are variable reports and female patients have been reported as high as 75%.<sup>10</sup> Majority of the patients being in NYHA functional class III to IV is in similarity to other studies,<sup>8, 10</sup> except that more patients were in functional class IV in group B of the present study. Duration of symptoms of 6 to 8 years is in accordance to mean duration of cardiac symptoms of 5.2 years.<sup>8</sup> Rheumatic heart disease was present in majority of the patients in present study, but differs from the reported incidence of 94%,<sup>9</sup> and 41%.<sup>8</sup> Previous valve surgery in some patients before double valve surgery is well documented, also simultaneous additional surgical procedures besides DVR is well known.<sup>8</sup>

Simultaneous closed repair of aortic and mitral valve was reported in 1955,<sup>11</sup> simultaneous repair of both the valves by open technique using cardio pulmonary bypass was reported in 1958,<sup>12</sup> and in 1963 simultaneous replacement of aortic and mitral valve was reported.<sup>13</sup> The universal approach to heart for valve surgery has been median sternotomy, A lower half partial sternotomy may be considered for any cardiac valve operation.<sup>14</sup> Choice of replacement device does not affect long term survival,<sup>15</sup> but tricuspid valve operations in combination with aortic and mitral valve operations reduces early and late survival.<sup>16</sup> In significant aortic and mitral valve disease DVR is the operation of choice and should be performed using using St Jude, Starr Edwards or Medtronic Hall cardiac valvular prosthesis, similar prosthesis have been used in other centers with good results,<sup>9</sup> Bjork Shiley in majority besides St Jude, Omniscience, Carbomedics and bioprosthesis has been used in some centres.<sup>8</sup> Inotropic and ventilatory support was needed

more in patients with ejection fraction of less than 45%, more so in patients with ejection fraction of 20 to 40%, the main predictor of post operative outcome was the preoperative left ventricular ejection fraction. The main predictors of late survival have been reported as age at surgery, preoperative left ventricular ejection fraction, low cardiac index, pulmonary vascular resistance, tricuspid surgery and additional aorto coronary bypass graft,<sup>8</sup> however we differ on the observation that additional tricuspid valve surgery increases mortality, because there was no mortality in the four patients who under went additional tricuspid valve repair in the present study. Left ventricular function is the single most important predictor of post operative out come and these findings are in accordance to the reported studies from other institutions. Mortality and morbidity being more in patients with less ejection fraction is well documented and our observations are in consistence to others.<sup>8-9, 12, 14</sup> The long term follow up of 80 months reported in present series is reported by others also, but 86% of the patients doing well at 80 months follow up is better than many other study. Probably ours was better patient selection, excellent intra operative myocardial preservation / post operative care, and ideal education regarding prevention of thromboembolic and bleeding complications. That may also be the reason that all the survivors improved by at least one functional class.

## CONCLUSION

Regurgitant lesions fare worse than the patients receiving DVR of any other combination. Surgical intervention should be done before irreversible left ventricular dysfunction. Left ventricular function is the single most important predictor of good post operative outcome. Patients with good left ventricular function have quick post operative recovery, short hospital stay, improvement in functional class and excellent long term results.

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## DECLARATION

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