

# Study of the Role of Cardiac Resynchronisation on Moderate to Severe Heart Failure in Relation to Overall Morbidity and Mortality



## Medical Science

**KEYWORDS :** Mortality and Morbidity, Pacemaker, Chronic Heart Failure, Cardiac Resynchronisation.

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## ABSTRACT

*The use of atrial-synchronized biventricular pacing can improve cardiac function, enhance functional capacity and the overall quality of life. Even though this method has received FDA (Food and Drug Administration) approval in 2001 as standard treatment, no long term studies have been conducted to know the outcome in these patients. Keeping in view the above facts / findings there is a need to study the outcome of cardiac resynchronization in patients with moderate to severe heart failure.*

## INTRODUCTION

The syndrome of congestive heart failure is responsible for substantial morbidity and mortality. Patients with heart failure have shortness of breath & limited capacity for exercise, have high rates of hospitalizations and early deaths.

The primary mode of therapy of this syndrome is based on antagonism of neurohormonal pathways activated in the failing cardiovascular system. The drugs that antagonize these pathways decrease mortality and morbidity. Drug regimens comprising up to six classes of drugs have become the corner stone of therapy for heart failure. Mechanical support with left ventricular assist devices & heart transplantation are reserved for the minority of patients who have severely decompensated heart failure

Despite these therapeutic advances, it is generally accepted that current therapies do not adequately address the clinical needs of patients with heart failure and additional strategies are being developed.

Approximately 30% of patients with cardiomyopathy have intraventricular conduction delay leading to loss of co-ordination of ventricular contraction. This dyssynchronous pattern of ventricular contraction is believed to contribute to the pathophysiology of heart failure, reducing already diminished contractile reserve of heart. Specifically dyssynchronous contraction exacerbates inefficient use of energy by the heart in patients with conduction system delays, indicated by a widened QRS interval on the surface electrocardiogram. Consequently such cases have worse clinical outcome than those with normal QRS intervals. Accordingly the idea that cardiac pacing technology might be used to restore the synchrony of ventricular contraction has been the subject of interest, for over a decade.

A recent multicentric study [MIRACLE TRIAL] demonstrated improvement in symptoms and exercise capacity and reduced rate of hospitalizations for heart failure over a six month period.

The findings confirm the results of earlier trials & pathophysiological studies. Even though the results are exciting there is a need for studies to assess the long term outcome of cardiac resynchronization.

## MATERIALS AND METHODS

Patients of Command Hospital Air Force (CHAF), Bangalore who have under gone cardiac resynchronization for moderate to severe heart failure were included in the trial. This was a hospital based study involving 60 patients.

Inclusion criteria were moderate or severe (NYHA class III or IV) chronic heart failure due to either ischemic or nonischemic cardiomyopathy, left ventricular ejection fraction of 35 percent

or less, QRS interval of 130 msec or more, a six-minute walking distance of 450 m or less, patients must have received all appropriate treatments for heart failure, which included a diuretic, an ACE-inhibitor or an ARB, and (usually) digitalis and a beta-blocker. The doses of these background medications were stable for at least one month, except for doses of the beta-blocker (which were stable for three months).

Patients were excluded if they had a pacemaker, cardioverter-defibrillator, contraindication to cardiac pacing, cardiac or cerebral ischemic event within the previous three months, or if they had had an atrial arrhythmia within the previous month. Patients with any other end organ failure were excluded, patients with diabetes and hypertension were not excluded. In addition, patients were excluded if they had a systolic blood pressure of more than 170 or less than 80 mm Hg, a heart rate of more than 140 beats per minute, a serum creatinine level of more than 3.0 mg per deciliter (265 µmol per liter), or serum aminotransferase levels more than three times the upper limit of normal. Data collection was done by clinical history taking, examination & investigations

Over one year follow-up, statistically significant improvement in 6 minute walking ability, ejection fraction on 2-D echo and reduction in total hospital admissions were noticed. Even though changes in ECG were also noticed, the p-value was not statistically significant.

## SAMPLE SIZE

**Total 60 Patients were included in the study.**

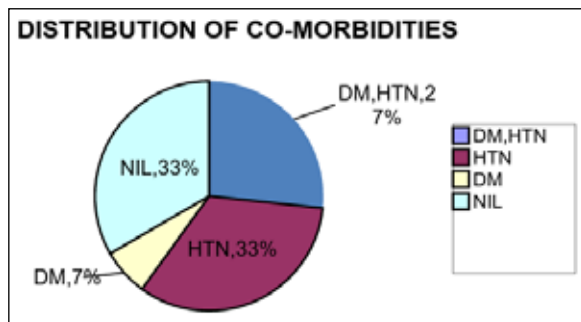
## RESULTS

TABLE NO1 - FINAL OUT COME		
VARIABLE	t - VALUE	p - VALUE
ECG CHANGES	1.89	p=0.091
SIX MIN WALK	7.371	p<0.001
EF CHANGES	13.18	p<0.001

Over one year follow-up, statistically significant improvement in 6 minute walking ability, ejection fraction on 2-D echo and reduction in total hospital admissions were noticed. Even though changes in ECG were also noticed, the p-value was not statistically significant. Results of this study show that cardiac resynchronization is helpful in subjective improvement in quality of life in the form of decreased hospital admission and increased ability to walk more comfortably, this is objectively supported by statistically significant improvement in cardiac ejection fraction.

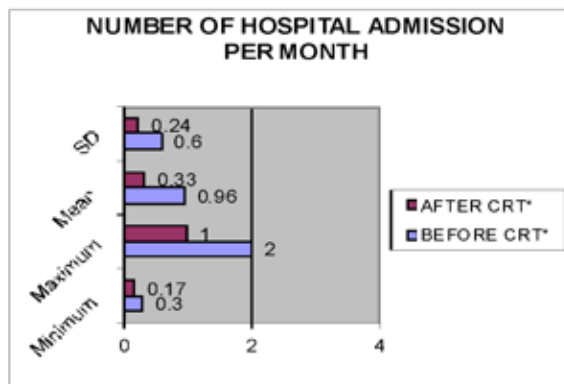
Out of 60 patients almost 2/3rd had co-morbidities in the form of type 2 diabetes mellitus, hypertension or combination of the

two as shown in figure 03. Of these 1/3rd of the patients had no co-morbidities. Patients with any other end organ failure were excluded from study.



During follow up three patients died with in first three months of cardiac resynchronization. One patient was lost to follow up after three months of cardiac resynchronization.

During the period of follow up clinically and statistically significant improvement was noticed in LVEF, distance walked in six minutes and reduction in number of hospital admissions after cardiac resynchronisation compared to hospital admissions before cardiac resynchronisation.



#### \* CARDIAC RESYNCHRONISATION THERAPY

	BEFORE	AFTER
Minimum	0.30	0.17
Maximum	2.00	1.00
Mean	0.96	0.33
SD	0.60	0.24

#### DISCUSSION

The syndrome of congestive heart failure is responsible for substantial morbidity and mortality. Patients with heart failure have shortness of breath & limited capacity for exercise, have high rates of hospitalizations and early deaths.

The primary mode of therapy of this syndrome is based on antagonism of neurohormonal pathways activated in the failing cardiovascular system. The drugs that antagonize these pathways decrease mortality and morbidity. Drug regimens comprising up to six classes of drugs have become the corner stone of therapy for heart failure. Mechanical support with left ventricular assist devices & heart transplantation are reserved for the minority of patients who have severely decompensated heart failure. Despite these therapeutic advances, it is generally accepted that current therapies do not adequately address the clinical needs of patients with heart failure and additional strategies are being developed.

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A recent multicentric study [MIRACLE TRIAL (wr1)(9)] demonstrated improvement in symptoms and exercise capacity and reduced rate of hospitalizations for heart failure over a six month period. A recent population study has shown that patients having a first hospital admission for CHF have a 5 year mortality of 75% (compared to much better survivals for similar patients with almost all forms of cancer or acute myocardial infarction). The situation is improving, but much, much more needs to be done. Approximately 90% of heart failure patients die of cardiovascular causes such as progressive heart failure, arrhythmia and ischaemic events. Current treatment strategies prolong life expectancy in the heart failure population, but have done little to alter the mode of death. Clinicians are familiar with the various patterns of progression in heart failure. The process of remodeling is a central mechanism leading to continuous deterioration whereas myocardial infarction and arrhythmia contribute to the stepwise progression of heart failure and increase the risk of sudden death. Chronic heart failure (CHF) is an increasing world-wide problem, with significant morbidity and mortality. In the last decades, several agents have been developed that decrease the progression of this syndrome, and large-scale clinical trials have proven the applicability and efficacy of these drugs. Especially, the use of ACE inhibitors and beta-blockers have been proven beneficial, resulting in a decline of symptoms and a decrease of various "hard" cardiovascular end-points, including mortality. These drugs are generally combined with "standard" treatment of CHF, consisting of diuretics, with or without digoxin. Cardiac resynchronization therapy has been accepted as a supplemental treatment of drug-refractory congestive heart failure. This new therapy aims to improve quality of life and exercise capacity, in patients selected on the basis of dilated cardiomyopathy and cardiac asynchrony. The overall implantation success rate has shown a progressive increase from 61% in the early to 98%. The rate of acute and late LV lead dislodgement decreased from 30% in the early 90's to 11% end of the decade. The rate of implantation failure and of lead-related problems has considerably decreased with the growing experience and the availability of new and specific leads and tools, such as "over the wire" leads. The significant symptomatic benefits have also been confirmed in a large European registry – the CONTAK registry, including more than 1000 patients followed up to 6 months after CRT. Finally, all trials - PATH-CHF (18), MUSTIC (19), MIRACLE (wr1) and CONTAK-CD - have consistently reported lower hospitalization rates and number of deaths when CRT has been used. More recently cardiac resynchronisation therapy (CRT) by left or biventricular stimulation has evolved as a new therapy for patients with advanced heart failure (HF) and intraventricular conduction defects, particularly left bundle branch block (LBBB). Patients who had undergone successful implantation (CRT device) were followed up 3 monthly for one year & the following tests were done:- a) Six minute walk test, b) 2D echocardiography, c) 12 lead electrocardiogram and recorded as per the protocol. The decision of which of these two therapeutic options is appropriate for a particular setting is best determined on an individual basis by patients and their Cardiologists. The data collected was subjected to statistical analysis for determining the significance of the results. Clearance was been obtained from the Hospital Ethical Committee.

#### CONCLUSIONS

Results of this study show that cardiac resynchronization is helpful in subjective improvement in quality of life in the form of decreased hospital admission and increased ability to walk more comfortably, this is objectively supported by statistically significant improvement in cardiac ejection fraction.

#### CONFLICT OF INTEREST

None

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