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ORIGINAL ARTICLE

Frequency of Left Ventricular Mechanical Dyssynchrony in Chronic Heart Failure

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ABSTRACT

Objective: To determine the frequency of left ventricular mechanical dyssynchrony in chronic heart failure patients.

Material and Methods: After approval from the Hospital ethical committee, the study was conducted in the department of cardiology Hayatabad medical complex Peshawar from 1st September 2021 to 28th February 2022. In this descriptive cross-sectional study, 155 patients in total were examined while 27% of heart failure patients had mechanical dyssynchrony, a 95% confidence interval, and a 7% margin of error were maintained according to WHO sample size computations.

Results: This study's participants had an average age of 60, with a standard deviation of ±1.26 years. 62% of the patients were male, compared to 38% of females. 35% of patients had a Broad QRS complex, whereas 65% of patients had a Narrow QRS complex. Mechanical dyssynchrony was identified in 32% of chronic heart failure patients.

Conclusion: Patients in chronic heart failure with QRS > 150ms and having mechanical dyssynchrony are benefited with Cardiac Ressynchronisation Therapy (CRT) implantation which reduces morbidity and mortality, while those with a narrow QRS (<150ms) are generally non – responders.

Keywords: Mechanical dyssynchrony, chronic heart failure, left ventricular ejection fraction

INTRODUCTION

When it comes to mortality and disability, heart failure (HF) ranks high on the list worldwide. In the United States, 10% of patients die within the first 30 days after being diagnosed with HF, 20% within the first year, and 45% within the fifth year [1]. Patients with HF, reduced left ventricular ejection fraction (LVEF), and QRS width more than 150 ms who also had implantation of CRT showed significantly lower morbidity and mortality compared to those who only received medical therapy [2]. Pacing both ventricles at a time is a relatively recent invasive procedure. Improved mechanical contractility, resynchronized time of left ventricular depolarization, and reduced mitral regurgitation are all results of biventricular pacing. Despite the high success rate of CRT implantation, not all heart failure patients recover completely.CRT may be beneficial if echocardiographic testing indicates ventricular dyssynchrony, which occurs in about half of the population. About a third of patients find that CRT does not help them, therefore it's important to investigate them [3].

In accordance with the selection criteria, CRT should only be implanted in patients who have heart failure and a significant QRS complex (>150ms) on the ECG. Patients with a wide QRS complex on the electrocardiogram are more likely to exhibit mechanical dyssynchrony on echocardiography than those with a narrow QRS complexes. The Cardiac Resynchronization-Heart Failure (CARE-HF) study compared patients with a narrow QRS complex to those with a wide one and found that 27% of heart failure patients had left ventricular mechanical dyssynchrony [4]. Selecting the best candidates for CRT is crucial. It is probable that echocardiographic measurements of mechanical dyssynchrony are more useful in predicting who may benefit from CRT [5-7]. Tissue Doppler imaging (TDI) has been demonstrated to be a reliable predictor of responsiveness after CRT, especially in cases where mechanical dyssynchrony was present.

The goal of the present study is to ascertain how often newly diagnosed heart failure patients have left ventricular mechanical dyssynchrony. We will learn the present scope of the issue via this research, which will be the first of its type in Peshawar. The results of this study may be shared with other cardiologists and we will be able to suggest further adjustments to present treatment guidelines since CRT implantation is dependent on the width of the QRS complex.

MATERIAL AND METHODS

After approval from the Hospital ethical committee, the study was conducted in the department of cardiology Hayatabad medical complex Peshawar from 1st September 2021 to 28th February 2022. According to WHO guidelines, the sample size was determined to be 155 while maintaining a 95% confidence interval and a 7% margin of error for the percentage of patients with mechanical dyssynchrony due to heart failure. Simpson's technique of determining the ejection fraction for assessing systolic cardiac function was used to validate the diagnosis of congestive heart failure utilizing Toshiba echocardiography equipment. Using echocardiography, M-mode and pulse wave tissue doppler imaging methods were employed to identify intraventricular dyssynchrony. We performed ECGs on all patients, and we estimated QRS duration. All patients aged 18 and above with chronic heart failure and an echocardiographically confirmed EF of less than 35% were eligible to participate in the study.

An echocardiography finding of organic valvular heart disease, an echocardiographic finding of mitral annular calcification, and an electrocardiographic finding of a rhythm other than sinus (including atrial fibrillation and paced rhythm), were not eligible. Written informed consents were taken from all included patients after explaining all the benefits and risks. Complete history was taken and thorough clinical examination was performed. Any bias was controlled by using standardized instruments for the study; similar levels of expertise (expert cardiologist having minimum of 7 years of experience) in clinical examination and by strictly following the exclusion criteria to overcome confounders. Data was collected through objective oriented Proforma.

The information was fed into SPSS 10 for analysis. Descriptive statistics were used to provide an ordered summary and description of the collected data. Since age was a quantitative variable, its mean and standard deviation were calculated. The frequencies and percentages of categorical factors like left ventricular mechanical dyssynchrony were calculated. The effects of variations were studied by dividing patients into groups based on age, gender, presenting QRS Complex type, and duration of symptoms. The results were laid up in charts and tables for easy persual.

RESULTS

Analysis of the age distribution among 155 patients revealed that n=93 (60%) patients were between the ages of 61 and 80. The standard deviation was 1.26, and the mean age was 60 years. When the gender distribution of 155 patients was evaluated, 96 (62%) of the patients were men and 59 (38%) were women. Duration of symptoms among 155 patients was analyzed n=54(35%) patients had chronic heart failure from < 1 year and

n=101(65%) patients had chronic heart failure from > 1 year. Mean duration of symptoms was 1 year with standard deviation ± 2.59. Types of QRS Complex among 155 patients was analyzed n=54(35%) patients had Broad QRS complex while n=101(65%) patients had Narrow QRS complex.

Frequency of Mechanical Dyssynchromy among 155 patients was analyzed with age group table 1. was analyzed as among 50 patients of mechanical dyssychrony in chronic heart failure, 26 patients were in age range 61-80 years.Fifty individuals were found to have mechanical dyssynchrony and chronic heart failure; 38 were males and 12 were women. It was investigated whether or not there was a link between mechanical dyssynchrony and the ratio of male to female patients. Table No. 1 shows that.

After looking at the correlation between mechanical dyssynchrony and the length of time patients experienced symptoms, researchers found that 19 of the 50 patients with chronic heart failure and mechanical dyssynchrony experienced symptoms for less than a year, while 31 experienced symptoms for more than a year. Here are the results (Table No. 3).

Table 1: Association of Mechanical Dyssynchrony with Age Group (n=155)

Mechanical Dyssynchrony	< 20 year	21-40 years	41-60 years	61-80 years	Total
Yes		5	19	26	50
No	6	17	15	67	105
Total	6	22	34	93	155

There was statistical significance (P = 0.002) in the chi-square test.

Table 2: Gender and Mechanical Dyssynchrony (n=155)

Mechanical Dyssynchrony	Male	Female	Total
Yes	38	12	50
No	58	47	105
Total	96	59	155

Table 3: Duration of Symptoms in Connection with Mechanical Dyssynchrony (n=155)

Mechanical Dyssynchrony	< 1 year	> 1 year	Total
Yes	19	31	50
No	35	70	105
Total	54	101	155

The chi-square test yielded a significant result of 0.001

Analysis of the correlation between mechanical dyssynchrony and symptom persistence was performed among 50 patients with chronic heart failure with mechanical dyssynchrony, 33 showed a wide QRS complexes and 17 showed a narrow QRS complexes.

DISCUSSION

Patients having QRS complexes > 150 ms and echocardiographic indications of mechanical dyssynchrony after 6 months who had implantation of Cardiac Resynchronization Therapy show a large decrease in LV diameter (LVEDD, LVESD) and a significant improvement in MPI [8-10]. There is a failure rate of over 30% with CRT. Improving patient selection and CRT performance is facilitated by echocardiographic assessments of mechanical dyssynchrony [11]. Echocardiographic indicators of baseline mechanical dyssynchrony may help identify CRT candidates according to Prospect trial [12-14]. Placing the left ventricular pacing lead near the lateral part determine CRT success [15].

Results from evaluating LV dyssynchrony and the site of most recent mechanical activation in patients undergoing CRT, as performed by Shenkman HJ et al. and Bleeker GB et al. were positive [16-17].

In patients whose LV lead position did not match the region of recent mechanical activation, 2-year mortality was 21% (19 patients), but only 15% (23 patients) (p <0.05). The place of the most recent mechanical stimulation increases the possibility of a favorable response (LV reversal remodeling) and improves long-term survival. Unknown is how the LV lead location relates to the most recent mechanical activation in those with a narrow QRS complex. Generalizing these encouraging results to all QRS patients is premature. "Narrow" dyssynchrony and cardiac resynchronization in numerous studies during the past decade, heart failure patients with a narrow QRS complex and poor LVEF had mechanical dyssynchrony (130 ms). 32% of 155 study participants had mechanical dyssynchromy. 5 patients were 21–40, 19 were 41–60, and 26 were 61–80. 12 women and 38 men were hospitalized. 33 patients had a wide QRS complex, 17 had a narrow one, and 19 experienced symptoms for less than a year and 31 for longer. Ahmad H et al found similar results [18].

In order to guarantee ventricular capture, the left ventricle was paced with the longest possible A-V delay. Patients with resting pulmonary wedge pressures more than 15 mm Hg saw a significant increase in cardiovascular output. Al. investigated the long-term effects of CRT on individuals with wide QRS complexes and mechanical dyssynchrony [19].

Patients with significant LV dyssynchrony and narrow QRS complexes (Ts-(lateral-septal) 65 ms) were studied by Sogaard P et al. After 6 months, patients had a significant reduction in their LV volumes and an increase in their New York Heart Association class (LVESV from 189 660 ml to 144 658 ml and LVEDV from 238± 672 ml to 203± 666 ml, both p= 0.001). Change (p= 0.001): (3.160 ±32.0606). Similar findings have been seen in other studies that have focused on people with narrow QRS complexes and echocardiographic signs of mechanical dyssynchrony [20].

A randomised, multicenter study was conducted to evaluate the effectiveness of CRT in patients with heart failure and narrow QRS complexes. Read Schiller's NB. Among 172 participants in the Bowen RO35 study, half received CRT ON and the other half did not (CRT OFF).

When comparing the septum to the LV free wall (lateral or posterior), echocardiographic tests consistently show a delay in wall motion of 65 ms, and when comparing the septum to the posterior wall, the delay is 130 ms. No significant difference in peak oxygen consumption was seen between the control and CRT groups after 6 months of therapy (both groups increased their intake by 1 ml/kg/min). The CRT group increased by 54% whereas the NHYA group increased by 29% (p = 0.006). An unhealthy relationship exists between high oxygen use and disease and a decreased lifespan. More than half of prospective heart transplant patients with an IVEF of 35% and a lowered peak oxygen demand showed only mild or moderate haemodynamic deterioration during exercise testing, according to data from Ritter P. et al. The study by Packer M et al. found that peak oxygen consumption predicted death in 114 individuals with ambulatory heart failure after cardiac transplantation. Peak oxygen consumption measurement served as the benchmark for transplant eligibility. It is not possible to utilize Peak oxygen intake is a risk factor for death in heart failure patients because it affects their eligibility for a heart transplant (and survival). Multiple studies have shown no correlation between high O2 intake and improved survival for heart failure patients [21-22].

It's possible that measuring CRT responsiveness by peak oxygen consumption is not the best option. There is a strong relationship between the ability to walk 6 minutes and the severity of heart failure symptoms and the success of CRT therapy. Similar to what was seen in the study by Wilson et al., we found that CRT increased the 6-minute walking distance. It is yet unclear what, if any, long-term therapeutic effects CRT has on individuals with narrow QRS complexes (worsening heart failure, survival). More than 1,200 people with heart failure and a narrow QRS complex will be randomly assigned to a CRT or control group in the ongoing Echo CRT research [23]. The major objectives of the study are to reduce all-cause mortality and the requirement for heart failure-related hospitalizations after 24 months. One theory is that this occurs because LV diameter changes before volume does, at least in certain populations. You may get additional information about the issue if you have an Echo CRT [24-25].

CONCLUSION

Patients in chronic heart failure with QRS > 150ms and having mechanical dyssynchrony are benefited with Cardiac Ressynchronisation Therapy (CRT) implantation which reduces morbidity and mortality, while those with a narrow QRS (<150ms) are generally non – responders.

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