Evaluation of the Effect of Haemodlalysis on Cardiac Dysfunction in Patients of Chronic Renal Failure

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Abstract

Thirty-eight patients with end stage renal disease who were on haemodialysis and had recurrent congestive cardiac failure were analysed. Echocardiographic findings were evaluated at start of haemodialysis and after 6 dialysis sessions. Seventeen cases (48%) had diastolic dysfunciton, 11 (29%) systolic dysfunction8 (18%) had normal echocardiogram and 2(5%) had dilated left ventricle with normal ejection fraction. In the systolic dysfunction group the end diastolic diameter decreased after 6 dialysis sessions. In the diastolic dysfunction group the end diastolic diameter and ejection fraction decreased minimally. In the systolic dysfunction group 8 patients (42%) expired within 18 months with a mean survival of 5 months and in the diastolic dysfunction group 5 patients (28%) died within 18 months with a mean survival of 12 months. (JPMA 48:230,1998).

Introduction

Cardiac morbidity and mortality is still the main cause (40%)[1] for hospitalisation and deaths in cases of chronic renal failure. Leftventriculardysfunction can manifest clinically as heart failure, arrhythmias, dialysis related hypotension or ischemic symptoms. Congestive heart failure is responsible for approximately 15% of deaths in haemodialysis patients and for substantial nonfatal dialysis associated morbidity. Both systolic and diastolic dysfunction may occur.

Pulmonary edema is one of the most dreaded complication of patients with chronic renal failure and is triggered off when the patient has modest salt and water overload (diastolic dysfunction) and even when euvolemic (systolic dysftmction). Echocardiography is extremely useful in the assessment of left ventricular dysfunction in dialysis patients. Factors that effect left ventricular function in patients of end stap renal disease are uremia[2,3], hyperparathyroidism[4,5] anemia , arteriovenous fistula[7,8] fluid overload[9] , hyperiension[10] myocardial calcium deposits[11] and any systemic disease that may involve the heart and kidney[12].

In the present study 38 patients with end stage renal disease with recurrent congestive cardiac failure on haemodialysis were analysed to answer the prevalence of echocardiographic heart disease at the start of haemodialysis and to see if haemodialysis improves the left venthcular function of these patients.

Patients and Methods

Patients included in the study were cases of end-stage renal disease with congestive heart failure (both diabetics and non-diabetics). Ailpatients had echocardiography performed using 2- D echocardiogram according to the criteria set by American Society of Echocardiography[13]. Echocardiography measurements included LV end diastolic diameter, LV end systolic diameter, left atrial diameter, LV wall thickness in diastole and LV ejection fraction. Echocardiography was performed before initiation of study and after six dialysis sessions. Haemodialysis sessions were of four hours eachwith an acetate bath.

Information collected included age, sex, histoty of angina or myocardial infarction, diabetes or

hypertension. Physical examination was performed to detect congestive cardiac failure using Criteria of Echeverria et al[14]. Congestive heart failure was defined as persistent orrecurrent heart failure when patient was considered to be at 'thy' weight with history of dyspnoea, peripheral edema and cardiomegaly. In addition two of the five following signs were necessary to make the diagnosis: a raised jugular venous pressure, basal creptations, peripheral edema, pulmonary venous hypertension or interstitial edema on chest x- ray film.

Blood tests included hemoglobin, creatinine, blood urea, calcium, phosphorous, alkaline phosphatase and parathyroid hormone. Chest X-ray, electrocardiogram and hand x-ray to detect hyperparathyroidism were also performed. The terminology of left ventricular study by echocardiography were the following:

Dilated canliomyopathy (low output LV failure) was used when LV end diastolic diameter was of 5.5 cm or greater and ejection fraction of less than 55%. The use of ejection fraction to define LV dysfunction has been used by other investigators[15-18]. LV dilation was termed when LV and diastolic diameter was of 5.5 cmorgreater and ejection fraciion was 55% or greater. Hypemophic hyperkinetic disease was when LV wall thickness was of 1.4cm or greater, LV end diastolic diameterless than 5.0 cm and ejection fraction greater than 70%. This is derived from Topol et al[19]. Forevaluatingdifferencesof means in patients at pre-dialysis and post-dialysis stages \'t\' test was applied in different parameters.

Results

Of 38 patients who underwent haemodialysis, 17(48%) had diastolic dysfunction, 11(29%) systolic dysfunction, 8 (18%) normal echocardiogram and 2 (5%) had dilated left ventricle with normal ejection fraction. On further analysis in the diastolic dysfunction group, 11(64%) had hypertension, 6 (33%) diabetes andfourpatients had associated ischemic heart disease. In the systolic dysfunction group of 11 cases (29%) diabetes alone was present in 5 (48%) diabetes with hypertension in 4 (34%) and Ischemic Heart Disease in 2 (18%). In the systolic dysfunction group after 6 sessions of haemodialysis(duration4 hours, ultrafiltration 1-2 litres) end diastolic diameter decreased (Table I).

Table I. Echocardiographic,haemodynamic and volume changes pre and post haemodialysis in patients with dilated cardiomyopathy.

	Pre dialysis n=18	Post dialysis n=18	p value	't' value	Significance
1.End diastolic diameter	5.4±3 cm	4.7±1 cm	p>.05	0.096	Nog significant
2.PLVWT	11.2±1 cm.	11.0±2 cm.	p>.05	0.091	Not significant
3.Ejection fraction	32±1 cm.	49±2 cm.	p>.001	3.05	Significant
4.Mean arterial BP	152±4 cm.	144±2 cm.	p>.05	1.82	Not significant
5.Pulse	92±1 cm.	90±2 cm.	p>.05	0.90	Not significant
6.Weight	63 kg±3 cm.	63 kg±3 cm.	p>.05	0.42	Not significant

In the Diastolic dysfunction group the end diastolic diameter and ejection fraction decreased minimally after six sessions of haemodialysis (Table II).

Table II. Echocardiographic, haemodynamic and volume changes pre and post haemodialysis in patients with hypertrophic cardiomyopathy.

	Pre dialysis n=18	Post dialysis n=18	p value	't' value	Significance
1. End diastolic diameter	4.4±1 cm.	4.6±2cm.	p>.05	0.09	Not significant
2.PLVWT	13.4±2 cm	13.8±3 cm	p>.05	0.11	Not significant
3. Ejection fraction	69.8±1 cm	70.1±2 cm	p>.05	0.14	Not significant
4.Mean arterial BP	180±2 cm	144±1 cm	p<.001	16.4	Significant
5.Pulse	84±2 cm	87±3 cm	p>.05	0.85	Not significant
6.Weight	59 kg±1cm	57.5 kg±3 cm	p>.05	0.68	Not signifcant

The arterial pressure also decreased.
Using multiple logistic regression the best predictors for systolic dysfunction or Dilated Cardiomyopathy was age (59 years vs 44 years; p= >0.05) and for diastolic dysfunction or hypertrophic cardiomyopathy was hypertension (systolic: mean±SEM 180±4vs 152±2 mmHg respectively; p= <.001 and diastolic: rnean±SEM 110±2vs 90±1 mmHg respectively; p=<.001). There was no difference in the level of hemoglobin, duration of diabetes and ischemic heart disease in both the groups (Table III).

Table III. Analysis of risk factors of dilated and hypertrophic cardiomyopathy.

	H.C.		D.C.				
	Range	Mean	Range	Mean	p value	't' value	Significance
1.Hypertension							
- Systolic	220-140	180±4	184-128	152±2	p<.001	6.4	Significant
- Diastolic	140-100	110±2	112-78	90±1	p<.001	9.1	Significant
2. Age	28-60 yrs.	44 yrs±3.8	38-74 ys.	59 yrs±3.2	p<.05	3.06	Significant
3.Anemia	4-9.4 gms	8.2±0.65 gms	4.4-9 gms	9gms±3.2	p>.05	0.56	Not significant
4.PTH	0.8-3.4 ng/ml	2.8 ng/ml±0.31	0.9-1.4 ng/ml	1.2 ng/ml±.06	p<.001	5.3	Significant
5. Diabetes	1 yr -22 yrs.	4.5 yrs±2.5	6m-18 yrs	3.8 yrs±2.1	p>.05	0.21	Not significant
6. C.A. Ds	3m - 11 yrs	2.8 yrs±1.3	1 yr-8 yrs.	1.4 yrs±0.84	p>.05	0.93	Not significant

Though the increase in semm PTh was statistically significant (P 0.00 1) in hypertrophic cardiomyopathy vs dilated cardiomyopathy, no correlation between the two groups could be elicited. In case of age the calculated value exceeded the value of p.05 and thus 't' is significant at this level of significance and not at <.001. The prognosis in patients with systolic dysfunciton was that 8 patients (42%) expired within 18 months witha mean survival of 5 months. In the diastolic dysfunction group 5 patients (28%) died within 18 months with a mean survival of 12 months.

Discussion

Congestive heart failure is a common problem in dialysis patients. It is defmed as persistent or recurrent heart failure when the patient is considered to be a 'thy weight' with a history of dyspnoea or peripheral edema and with cardiomegaly[20].
The exact mechanism by which cardiac contractility is increased by haemodialysis is yet not known but various theories have been postulated. Uremic state has been suggested to have a negative ionotropic effect, atleast in vitro[21,22]. Thus with removal of uremic substances the myocardial contractility would improve. Similarly an increased ionised calcium or reduction in acidemia after dialysis would be expected to exert positive ionotropic actions[23].

In this study we were unable to differentiate between dilated and hypertmphic heart disease on clinical grounds because hypertension and cardiac failure does not automatically mean hypertrophic cardiomyopathy. Eochoevema et al[14] postulated that echocardiography was useful and at times essential part for the evaluation of patients with congestive heart failure. Echocardiogmphic studies have shown an increase in the mean velocity of circumferential fiber shortening following a four hour Haemodialysis[24].

In the present study there was definite improvement in the Echocardiographic measurements of ejection fraction and left ventricular end diastolic diameter in cases of dilated cardiomyopathy. There was definite correlation of age and dilated cardiomyopathy and of hypertension and hypertrophic cardiomyopathy. Anemia which is common in renal failure patients ould not be related to the presence of Cardiomyopathy. Parathyroid disease was statistically significant in the hypertrophic group but there was no clinical correlation between the hypertrophic and dilated group.

This study confirms that echocardiography is a potentially useful method for predicting diitctional changes in left ventricular performance (resulting from haemodialysis) and evaluating the prognosis of patients with End Stage Renal Disease.

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