A New Technique For Establishing Dry Weight In Hemodialysis Patients Via Estimation Of Pulmonary Capillary Wedge pressure. A Tissue Doppler Imaging Study

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Objective: Dry weight (DW), could be defined as the post hemodialysis weight where the patients with end stage renal disease (ESRD) is in a state of normovolemia. Quantitative techniques are necessary to achieve DW in patients with ESRD. Pulmonary capillary wedge pressure (PCWP) provides an indirect estimate of left atrial pressure (LAP) and therefore preload. PCWP could be estimated by the Tissue Doppler echocardiography (TDE). The current work evaluates the use of estimated PCWP in hemodialysis patients for the prediction of normovolemia and therewith DW.

Methods: Early diastolic mitral peak velocity (E)/ early diastolic myocardial peak velocity (é) rate, as a parameter of left ventricular filling pressure and PCWP using the formula 1.9+1.24(E/é) were calculated. PCWP is also useful in evaluating volume status. PCWP is are normally 5-12 mmHg. The patients were divided into two groups (group 1 PCWP<20 mmHg, group 2 PCWP>20 mmHg) according to the PCWP value. We evaluated the correlation between PCWP and such as left atrial diameter (LAD), left atrial volume (LAV), systolic blood pressure (SBP) and the N-terminal of the prohormone brain natriuretic peptide (NT pro-BNP) other markers of volume overload.

Results: There was no difference between the groups in demographic characteristics and biochemical analysis. Systolic blood pressure (161±35 vs 126±27mmHg, p=0.008) and mean arterial pressure (113±20 vs 94±19mmHg, p=0,026), pulse pressure (73±28 vs 48±17 mmHg, p=0.011) LAD (4,6±0,3 vs 4,1±0,7 cm, p=0.021) LAV (9,5±2,4 vs 7,6±2 cm3, p=0.034), E /é (18,9±3,4 vs 10,1±2,6, p=0,0001), E/Vp (2,8±0,5 vs 1,9±0,6, p=0,0001) in group 2 than group 1 respectively.

Table 1. Demographic, hemodynamic and echocardiographic features of the study groups

Variables	Group 1(n=32)	Group 2 (n=9)	p*
Age (years)	53,4±15,5	59,8±15,5	0,264
Hemodialysis duration (months)	56±65,2	58,9±59,1	0,820
The excess liquid (ml)	1940,3±997,9	2200±801, 6	0,494
Overweight / output weight (ml / kg)	33,5±18,4	35,2±14,4	0,710
Systolic blood pressure (mmHg)	126±27	161±35	**0,008**
Diastolic blood pressure (mmHg)	78±16	88±17	0,086
Mean arterial pressure (mmHg)	94±19	113±20	**0,026**
Pulse pressure (mmHg)	48±17	73±28	**0,011**
Pulse (beats / min)	77±13	74±14	0,315
NT-ProBNP (fmol/mL)	200,6±137,4	226,3±97,1	0,257
Total UF (ml)	2302,9±1026,1	2593±772,5	0,592
Residual urine volume (ml)	359,7±622,8	400±512,3	0,523
PCWP (mmHg)	14,1±2,6	26,5±4,8	**0,0001**
Ejection fraction (%)	56,1±7,8	57,2±3,6	0,698
E/A	1,1±0,5	1,2±0,7	0,364
Left ventricular S velocity (cm/sec)	7,4±1,8	7,2±1	0,734
Right ventricular S velocity (cm/sec)	11,8±2,8	12,9±2,7	0,168
Left ventricular diastolic diameter (cm)	4,6±0,7	4,8±0,4	0,177
Left ventricular systolic diameter (cm)	3,4±0,7	3,5±0,4	0,242
Left atrial diameter (cm)	4,1±0,7	4,6±0,3	**0,021**
Stroke volume (cm^3)	79,6±29,7	82,6±23,5	0,627
Stroke volume index (cm^3/m^2)	49,2±15,5	51,2±14	0,639
Left atrial volume (cm3)	7,6±2	9,5±2,4	**0,034**
Left atrial volume index (cm3/m2)	4,8±1,2	6±1,9	0,083
E /é	10,1±2,6	18,9±3,4	**0,0001**
E / Vp	1,9±0,6	2,8±0,5	**0,0001**
Cardiac output (L)	6,1±2,6	6±1,6	0,639
Cardiac output index (L/m2)	3,8±1,4	3,7±1,1	0,833

Table 2. Correlation of the other markers of volume overload with PCWP

Variables	PCWP	
	r[a]	p
Systolic blood pressure	0,420**	**0,006**
Diastolic blood pressure	0,285	0,071
Mean arterial pressure	0,364*	**0,019**
Pulse pressure	0,430**	**0,005**
Pulse	-0,250	0,115
NT-ProBNP	0,472**	**0,002**
The amount of residual urine	-0,037	0,818
Ejection Fraction	-0,133	0,409
Left ventricular diastolic diameter	0,285	0,071
Left ventricular end-systolic diameter	0,215	0,177
Left atrial diameter	0,421**	**0,006**
Stroke volume	-0,026	0,871
Stroke volume index	0,034	0,834
Left atrial volume	0,186	0,244
Left atrial volume index	0,203	0,203
Cardiac output	-0,085	0,599
Cardiac output index	-0,094	0,559
E / é	0,952**	**0,0001**
E / Vp	0,358*	**0,022**

Table 1. Abbreviations; A, late diastolic mitral peak velocity; E, early diastolic mitral peak velocity; é, early diastolic myocardial peak velocity; NT-ProBNP, N-terminal of the prohormone brain natriuretic peptide; PCWP, pulmonary capillary wedge pressure; Vp, transmitral flow propagation velocity. * Mann-Whitney U test.

Table 2.Abbreviations; E, early diastolic mitral peak velocity; é, early diastolic myocardial peak velocity; NT-ProBNP, N-terminal of the prohormone brain natriuretic peptide; PCWP, pulmonary capillary wedge pressure; Vp, transmitral flow propagation velocity. [a]Spearman correlation.

Conclusion: A strongest correlation was found between the markers of volume overlod and estimated PCWP via TDE. This approach will offer considerable improvement for the routine management of DW in the hemodialysis patients. Pulmonary capillary wedge pressure via TDE could be a new method for the prediction DW.

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