Frequency of Fluid Overload Utilizing Body Composition Monitor Versus Clinical Assessment by Nephrologist.

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ABSTRACT

Background: Fluid status assessment is very important in clinical assessment of HD patients. Inaccurate assessment may result in hypovolemic or over hydration states. Bio impedance analysis is a new tool to provide better assessment of fluid status in hemodialysis population with clinical implication.
Study Material And Methods: Descriptive cross sectional study conducted at five hemodialysis centers, Lahore. Patients fulfilling the inclusion criteria were assessed for fluid status by body composition monitor and two consultant nephrologists before hemodialysis session using Body composition monitor (BCM®), Fresenius Medical Care, Bad Homburg, Germany). Patient's weight gain was recorded based upon pre dialysis weight and predetermined dry weight.
Results: Total of 150 consecutive patients were assessed. Among 150 patients 80 (53.33 %) were male and 70 (46.67 %) were female. Data of one pt was lost. Majority of patients were in between age of 41-65 yrs (n=113 i-e 75.33 %). BCM revealed fluid overload in 66 patients (44 %) however there was no fluid overload in 84 patients. Among 149 patients , 86 patients (57.71 %) had concordance and agreement between clinical and BCM assessment. While same number of patients (n=86 i-e 57.71 %) had agreement and concordance with pre dialysis weight gain when assessed clinically by nephrologists . In total 73 patients (48.99%) there was concordance between pre dialysis weight gain and BCM assessment. All three modalities i-e BCM , clinical assessment and pre dialysis weight gain were on the same page in terms of volume status in 55 patients (36.9 %) .Majority of Patients (82 i-e 55.033 %) had weight gain between 1 to 3 kg .
CONCLUSION: Body composition monitoring is a useful and comparable tool to conventional clinical methods in assessing the fluid status of patient. In under developed countries, BCM could be a useful tool to assess fluid status of dialysis patients where there is a paucity of trained nephrologists and clinicians.
Keywords: BCM, Body composition monitor, hemodialysis, clinical assessment, assessment, fluid overload.

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PJKD 2019;(10):165-172

Introduction

Ultra filtration goal is an important part of dialysis prescription requiring repeated clinical assessment. Inaccurate assessment may result in in- accurate fluid removal causing hypotension or pulmonary edema and associated with high morbidity (cardiac arrhythmias, hypertension, fatigue etc. and mortality). [1-3]

Dry weight is defined as the ideal weight at which the patient feels well, has good exercise tolerance and no clinical signs of fluid overload. In addition, normalization of BP or minimal requirement / reduction of medications for control of hypertension and also signs of achievement of dry weight.[4,11]
Subjectively one can though clinically assess dry weight by presence or absence of jugular venous pressure, edema, ascites, shortness of breath, pleural effusion and blood pressure. Yet majority of patients still remain a challenging. Studies have shown that the clinical methods in assessing fluid status are as good as objective methods. Several objective methods have been proposed to estimate the correct dry weight of HD patients such as ultrasound for inferior vena cava diameter, radionuclide dilution techniques and echocardiography. These methods are difficult to be performed in everyday practice due to cost and being time-consuming [5]. In addition, these are qualitative methods and are unable to quantify the amount of fluid excess or deficiency in HD patients. Deuterium and sodium bromide measurements are the gold standards of measuring total body water and are only used for research purposes [6]. Currently weight assessment is therefore solely based on clinical judgement and subjective criteria in majority of centers [3].
The Body Composition Monitor (BCM) utilizes bio impedance technology for body fluid monitoring and has been extensively validated and found to be helpful in fluid status assessment. BCM enables clear separation between extracellular and intracellular water by the extremely wide range of measurement frequencies(5 to 1000 kHz) and determine electrical resistance in different body compartments [7] .The BCM allows correct quantification of ECW and therefore assessment of fluid with bio impedance analysis provides better management of fluid status [8] .In contrast to clinical judgment ,Pedro ponce et al , showed in all of their patients over hydration state was picked up correctly by BCM [9] . The aim of this real-life study was to compare the performance and safety of a BCM device versus conventional clinical judgment as used in our daily practice in a hemodialysis population.

Material and Methods
This Multi Centre cross-sectional study was approved by the institutional research and ethics committee. In this study we used (BCM® Fresenius Medical Care, Bad Homburg, Germany) to assess fluid status.

Inclusion criteria: Patients on maintenance HD for more than 3 months, age 18-65 years and of both gender.
Exclusion criteria: patients with cardiac stents, pacemaker, defibrillator and artificial joints, pins, amputated limbs, Pregnant and lactating women.

Clinically fluid status assessments were independently performed by two nephrologists immediately before HD session. Clinical signs such as presence or absence of dependent edema, bilateral basal lung crepitation, gallop rhythm, jugular venous pressure, dryness of tongue and postural changes in blood pressure were used to estimate fluid status of each HD patient. Patient's weights were recorded as pre dialysis, predetermined dry weight and weight gain.
The BCM measurement was taken immediately before the HD session, lying in supine position. Electrodes were placed on the wrist of the arm without the arterio-venous fistula or graft and on the ipsilateral ankle and connected to the BCM device and results were noted. Overload was recorded as per operational definition (15% of ECW expansion i-e FO/ECW×100%).[19]

Statistical Analysis

Data was entered and analyzed in SPSS version 22.0. Mean and standard deviation were calculated for numerical variables like age and duration of maintenance hemodialysis. Qualitative variables like gender and fluid overload were presented in the form of frequency and percentages. Data stratified for age, gender ,clinical assessment and pre dialysis weight gain.

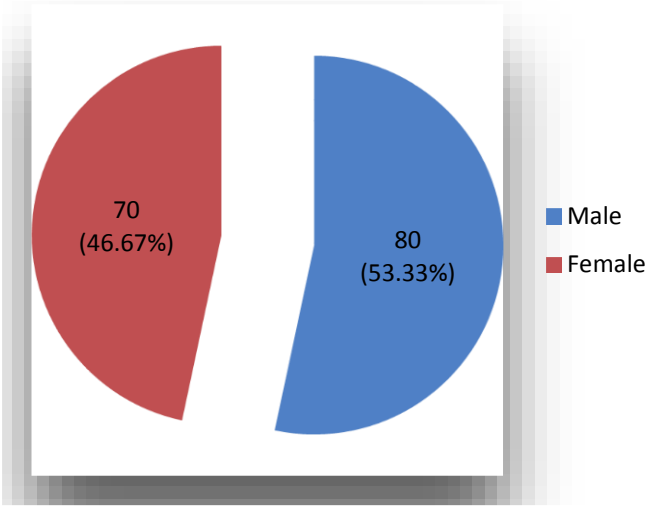
Results

In total 150 patients were assessed. Data of one patient was lost. Age range in this study was from 18 to 65 years with mean age of 50.46 ± 13.99 years. Majority of the patients 113 (75.33%) were between 41 to 50 years of age as shown in Table 1. Out of these 150 patients, 80 (53.33%) were male and 70 (46.67%) were female with male to female ratio of 1.1:1 (Figure I). Percentage of patients according to duration of disease are shown in Table 2 with mean duration of disease was 2.23 ± 2.58 years.

Table-1: Age distribution of Maintenance hemodialysis patients evaluated for body composition monitoring (n=150).

Age (in years)	No. of Patients	Percentage (%)
18-40	37	24.67
41-65	113	75.33
Total	**150**	**100.0**

Figure I: Distribution of patients according to Gender (n=150)



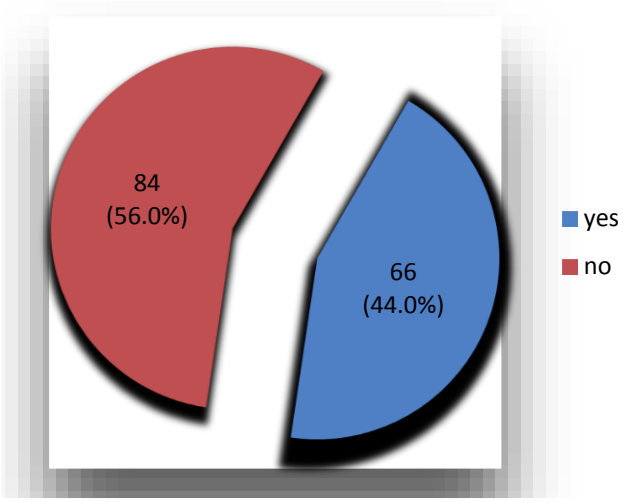
Our study showed that frequency of fluid overload of patients with CKD on hemodialysis using Body Composition Monitor was found in 66 (44.0%) patients as shown in Figure 2. Among 66 patients, 41 patients (62.12 %) had concordance between clinical and BCM assessment while remaining 25 patients (37.87 %) had disagreement. Majority of Patients (36 i-e 54.54 %) had weight gain between 1 to 3 kg as shown in Table 3. Among 83 patients, 45 patients (54.21 %) had agreement between clinical and BCM assessment while remaining 38 patients (45.78 %) had disagreement. Majority of such Patients (n=46, 55.42 %) had weight gain between 1 to 3 kg as shown in Table 4.

Table-2: Distribution of patients according to duration of dialysis.

Duration of dialysis (in years)	Total (n=150)	
	No. of patients	Percentage (%)
≤3 year	124	82.67
>3 year	26	17.33
Mean ± SD	**2.23 ± 2.58 years**	

Among 149 patients, 86 patients (57.71%) had agreement and concordance between clinical and BCM assessment as shown in Figure 3. In terms of weight gain vs BCM there is agreement and concordance in 73(48.99 %) as shown in Figure 4. Moreover, 86 patients (57.71 %) had agreement and concordance between weight gain by dry weight and clinical assessment as shown in Figure 5. Figure 6 shows that all three modalities are on the same page in 55 patients (36.9%) for fluid status assessment as shown in table x.

Figure 2: Frequency of fluid overload of patients of CKD on hemodialysis using Body Composition Monitor



Discussion

In this study we found that there was agreement among BCM and clinical assessment in (57.71 %) patients in terms of fluid status , moreover same number of patients are in agreement in terms of pre hd weight gain and Clinical assessment by nephrologists .Clinical assessment by nephrologists in terms of prescribing dry weight and adequate ultra-filtration goals is routine in all dialysis patients. Majority of HD patients start with preserved urine output and gradually lose residual renal functions over months to years .[10] Failure to adjust dry weight with time can cause overload in these patients. In auric patient's weight gain in between HD sessions is generally variable based upon fluid intake or insensible losses.

Table 3: Patients with Fluid Overload By BCM: Clinical Assessment and Weight gain by Dry Weight

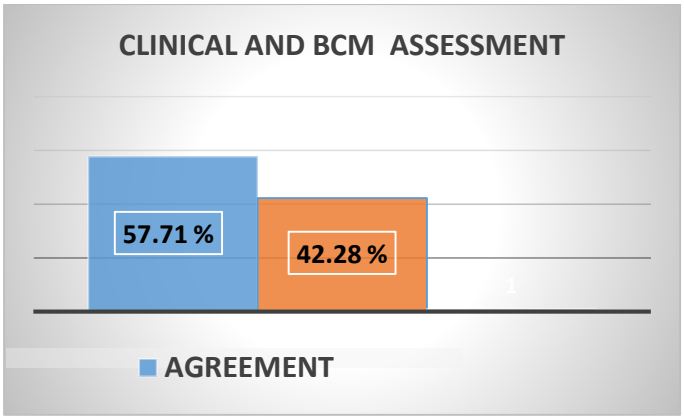
Weight Gain (Pre-HD Weight. - Designated Dry Weight.)	Clinical Assessment for Fluid Overload		BCM Positive Patients for fluid overload
(kg)	Yes=41	No = 25	Total N= 66
<1.0	05	04	09
1.0 TO 3.0	21	15	36
> 3.0	15	06	21

Clinical assessment is highly subjective and cannot estimate the exact volume of over hydration for each patient, and therefore some patients may remain in a state of residual over hydration (mamat et al 2012). [11] BCM is a newer relatively better tool that provides an objective and relevant target for clinical dry weight assessment (Wabel et al. 2009)[12]. We concur that BCM is a useful tool in addition to clinical assessment of fluid status of HD patient. Kapun et al also found that the BCM was a useful tool to assess dry weight and recommended it be used in addition to clinical judgement [13].In our study, clinical assessment of 86 patients matched with BCM for hydration status as well as when assessed in terms of pre hd weight gain. However in terms of pre hd weight gain 73 patients(48.99%) matched with BCM assessment for hydration status . In our openion BCM is very helpful in difficult patients for their dry weight adjustment. Our study agrees with other clinical studies arguing the

Table 4: Patients without fluid overload by BCM: Clinical ssessment and Weight gain by Dry Weight

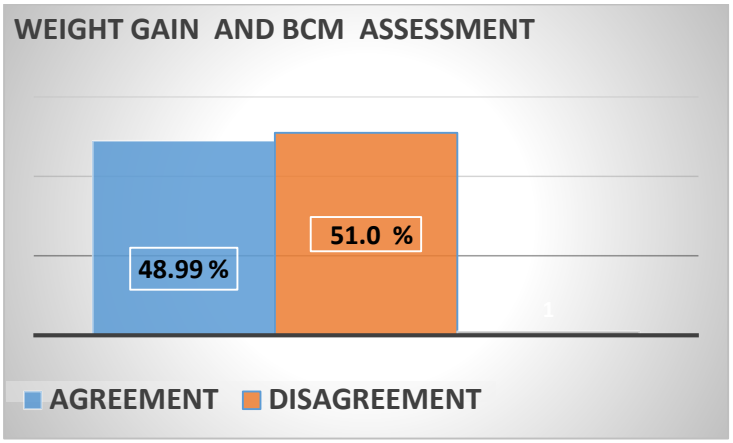
Weight Gain (Pre-HD Weight. - Designated Dry Weight.)	Clinical Assessment for Fluid Overload		BCM Negative Patients for fluid overload
(kg)	Yes (38)	No (45)	Total N= 83
< 1.0	02	14	16
1.0 TO 3.0	25	21	46
>3.0	11	10	21

Figure 3: Body composition monitoring and agreement with clinical assessment by nephrologist.



benefits of BCM in assessing fluid status like Onoferiescu et al showing significant benefit in survival, blood pressure and fluid overload .[14] Similarly, Moissl et al depicted the importance of active fluid management and improvement of overall status of patient using BCM as guide and Luo et al showed significant improvement of fluid overload status.

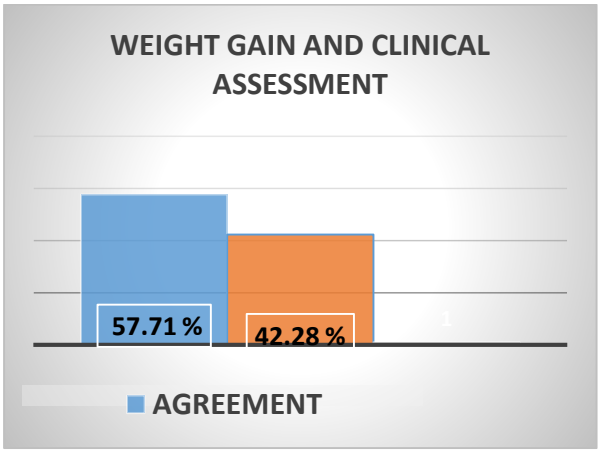
Figure 4: Body composition monitoring and Weight Gain as assessed by Dry Weight.



with the use of BCM as guide.[15, 16] Limitations to the use of BCM include patients with stents, pacemaker, artificial joints, metallic valve and pins because of interference with bio impedance. Bio impedance analysis can be done in critically ill patients [17] but there are some pitfalls need to consider like changing posture, incorrect position of arms, incorrect contact with electrodes and interference of measurement with other objects in ICU. [18]

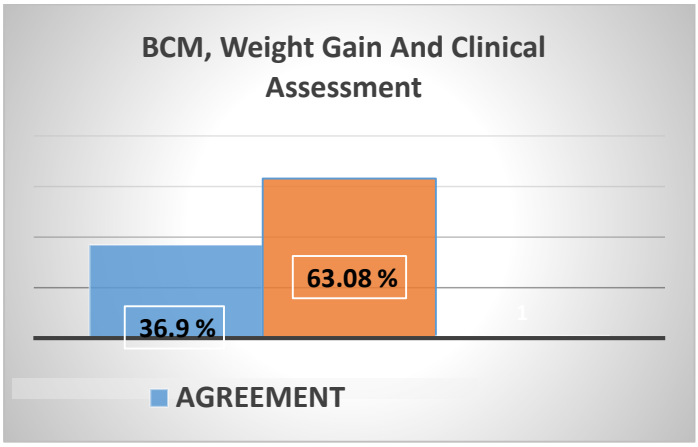
Fluid overload is associated with higher levels of biomarkers representing activated coagulation and cardiac muscle decomposition and ischemia, supporting the hypothesis that fluid overload plays a significant role in the generation and augmentation of vascular and cardiac damage. [19] The degree of under estimating over hydration can have dire consequences like hypertension in chronic hemodialysis population. Wizemann et al. (2009) [20] reported that fluid overload was an independent predictor of mortality in chronic HD patients and 15 % ECF expansion is associated with high mortality.. A word of caution however therapeutic decisions must never be made solely on BCM findings particularly in elderly, diabetic and hypertensive who

Figure 5: Weight gain by dry weight and clinical Assessment



may need clinical assessment by clinicians. The BCM should be considered an additional companion to the clinician in this regard mamat et al. (2012). This is first study from Pakistan. We propose that BCM is an important tool for fluid status assessment of HD patients which are being catered by non-nephrologists in far off areas of Pakistan.

Figure 6: Fluid status assessment by all three modalities: Body composition monitoring, clinical assessment and dry weight.



In under developed countries like Pakistan, large proportion of HD patients are undergoing dialysis treatment in far off areas without clinical monitoring due to lack of nephrologists. Many of such patients present to causalities of tertiary care hospitals with pulmonary edema, Hypo or hypertension, cramps, inability to complete HD session, inadequate dialysis and they need readjustment of their dry weight. BCM can help in these far off areas for better dry weight adjustment. This will significantly reduce the emergencies burden of tertiary care hospitals and reduce the mortality and morbidity in long term care of such HD patients.

In Pakistan, no long term mortality and morbidity data is available and several factors influence the outcome. These factors include adequacy, quality of HD and Water prcessing, financial aspects, anemia, bone mineral disease, vascular access and twice week dialysis as compared to thrice per week in west. It is important that long term studies are done for evaluation of mortality and morbidity to improve the quality of life for ESRD patients.

Limitations of our study include cross sectional data. Prospective follow up data with intervention as weight adjustment according to the BCM or clinical evaluation was not done.

Conclusion

In conclusion, BCM is an easy, rapid and useful tool to assess the fluid status of HD patients in addition to the clinical assessment. BCM is equally helpful for patient's volume status assessment when compared with conventional clinical methods. In under developed countries like Pakistan with very few trained nephrologists, BCM may be a useful tool to assess fluid status of dialysis patients. BCM may be helpful to overcome the problems associated with the fluid assessment in maintenance hemodialysis patients without easy access to nephrologists.

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