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A CLINICAL REPORT ON BODY COMPOSITION MONITORING IN HEMODIALYSIS

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ABSTRACT
The achievement of a normal hydration state in patient is one of the most important goals of hemodialysis treatment. Several parameters related to body composition need to be monitored continuously to achieve this goal. Apart from routine clinical judgment, Body Composition Monitoring machine has been specifically designed for patients with kidney failure to study parameters related to hydration. Using BCM machine, a prospective, observational, multicenter study was performed between September 2014 and February 2015. A group of 20 people were included in the study out of which 4 were healthy persons and remaining were patients of Chronic Kidney disease and other diseases. The aim and objective of this study was to find out if there was any advantage in using the BCM tools compared to Routine Clinical Judgement for preventing over hydration (OH) and avoiding intradialytic hypotension. Different parameters like over hydration, urea distribution volume (v), systolic and diastolic blood pressure, total body water(TBW), lean body mass (LBM), Body mass index(BMI) etc. were monitored and compared between kidney failure and healthy persons. The study confirmed a marginal better performance to prescribe dry weight but on the other hand it was considered that although the BCM recommendation is accurate for the ideal extracellular volume but maximum time we may not a be able to reach that fluid status (that is dry weight).

KEYWORDS: Over-hydration, Chronic kidney disease, Body composition monitoring, dry weight.

INTRODUCTION
Chronic fluid overload is a common condition among patients on hemodialysis. It has been related to hypertension, heart failure, left ventricular hypertrophy and other adverse cardiovascular outcomes. Cardiovascular complications result in serious morbidity and mortality in patient on maintenance hemodialysis.[1] Hypertension is a major cause of these complications secondary only to the presence of diabetes.

Therefore, the achievement of a normal hydration state in patient is one of the most important goals of hemodialysis treatment. The concept of "dry weight" is part of the daily practice of Hemodialysis. In a dialysis patient dry weight is that body weight at the end of dialysis at which the patient can remain normotensive until the next dialysis despite the retention of salt water.[4] Dry weight varies overtime as lean body mass (i.e LTM) and body fat changes (i.e ATM). At dry weight the extra cellular volume (ECV) is at or near normal but not less than normal.

The intermittent nature of hemodialysis result in an increase in extra cellular volume (ECV) as reflected in a body weight increase between session. There is a dry point achieved at the end of each session and a wet point just before the next one. The blood pressure should remain in the normal range during the whole interdialytic period.[5] If the patient remains hypertension after a dialysis or becomes hypertensive before the next dialysis, he is by definition above his dry weight.In this present study we used a bioimpedance spectroscopy method Body composition monitor (BCM) (Fresenius Medical Care AG and Co. KGaA 61346 Bad Homburg, Germany).[2]

The BCM calculates body composition including Extra cellular water (ECW) and intercellular water (ICW) by measuring body's resistance to electrical current. This non-invasive tool measures electrical resistance of the total body water (TBW) and the extra cellular water (ECW) while high-Frequency current passes through the total body water, low Frequency current cannot penetrate cell membranes and thus flows exclusively through the extra cellular water.[3] This non-invasive bioimpedence machine delivers within 2-3 minute not only the fluid status of a dialysis pt. but also monitor following parameters as below.

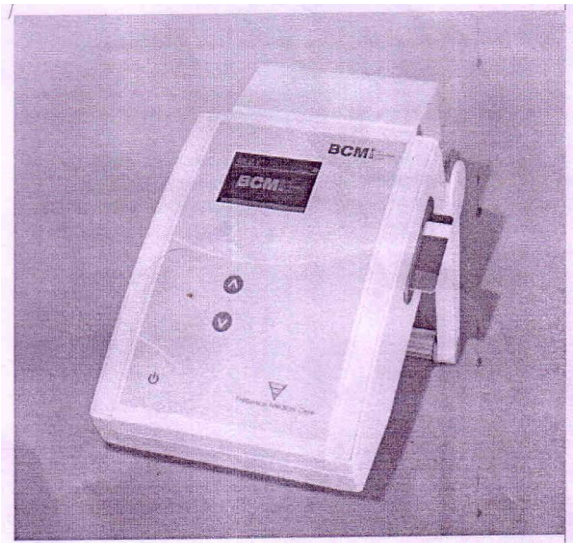


Image 1: BCM Machine.

Parameters	Unit
Over hydration (OH)	(L)
Lean tissue index (LTI)	(kg/m^2)
Fat tissue index (FTI)	(kg/m^2)
Total body water (TBW)	(L)
Extra cellular water (ECW)	(L)
Inter cellular water (ICW)	(L)
ECW/ICW	Ratio
Lean tissue Mass (LTM)	kg
Fat Mass	kg
Adipose tissue Mass (ATM)	kg
B. M .I (kg/m^2) (Body Mass Index)	Index
B.C.M. (Body Cell Mass)	kg
V (Urea)	L

AIM OF THE STUDY

The aim and objective of this Study was to find out if there is any advantage in using the BCM tools compared to Routine Clinical Judgement for preventing over hydration (OH) and avoiding intradialytic Hypotension. Secondary objectives are --------

- Improves management of hypertensive and fluid status.
- Provides individual nutritional assessment (i.e - BMI).
- Decrease rate of the Morbidity and Mortality who were under haemodialysis.

MATERIALS & METHODS

The study was a prospective, multicenter study [FHKI and Fortis Tertiary Hospital] over hydrated dialysis patients treated with Fresenius 4008 S model. Incident and prevalent Hemodialysis patients were included older than 18 years with a relative pre dialytic Over Hydration (OH) on average more than 2 Liter. All patients were treated by 3 (three) times weekly Hemodialysis treatment of 4 (four) per session.

Patients with an implanted electronic medical device or who were connected to an external electronic medical device were excluded, Further exclusion criteria were any kind of metal implants or metal prosthetic Joints (e.s Pace maker, knee replacement). On the other hand dental implants and Piercings were well allowed. patients with major amputation, pregnant women excluded.

RESULT

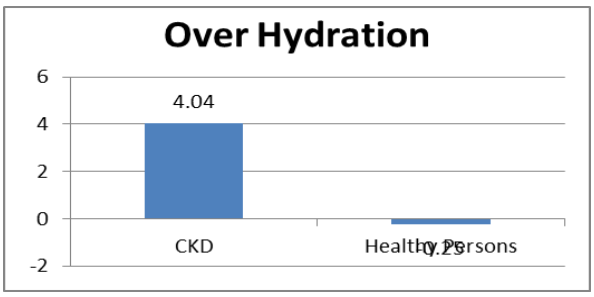
Assessment of the parameters

According to BCM (Body composition monitoring) development and validation studies normohydration is defined when absolute fluid overload is between (-1.1 and + 1.1 L) while volumes below or above this range define under or over hydration, respectively.

Monthly dialysis treatment, together with hydration status, pre and post dialytic were assessed. Additionally blood pressure was determined before and after dialysis treatment. During the assessment period hospital admission and mortality were recorded.

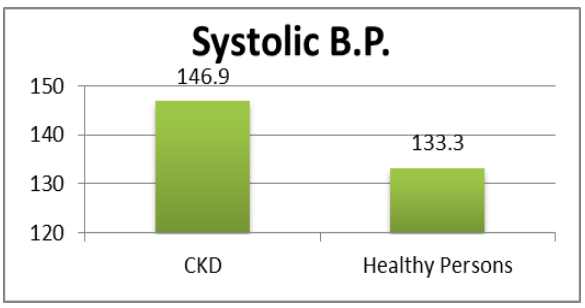
Initially 20 Nos. recruited potential participants (n=20). In the two dialysis units, an open access BCM group was there out of which 16 were CKD with other disease and 4 were healthy persons. Only assessment with available treatment and body composition monitoring data were accepted for analysis. Patients in both sexes were of age [18yrs to 80 yrs]. The majority were Male patients.

Patient Characteristics



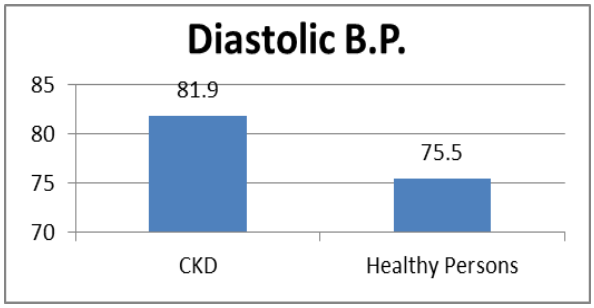
CKD	Healthy Persons
4.04	-0.25

Figure 1: Comparison of Over Hydration.



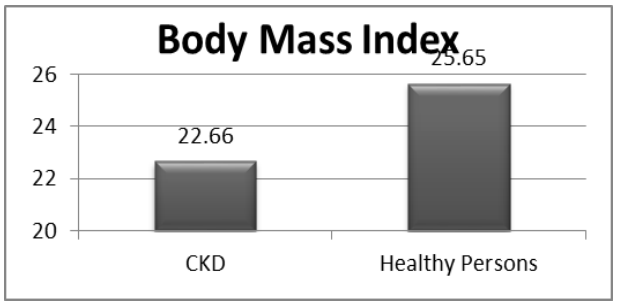
CKD	Healthy Persons
146.9	133.3

Figure 2: Comparison of Systolic B.P.



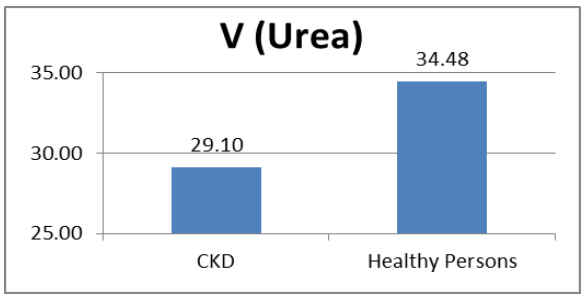
CKD	Healthy Persons
81.9	75.5

Figure 3: Comparison of Diastolic B.P.



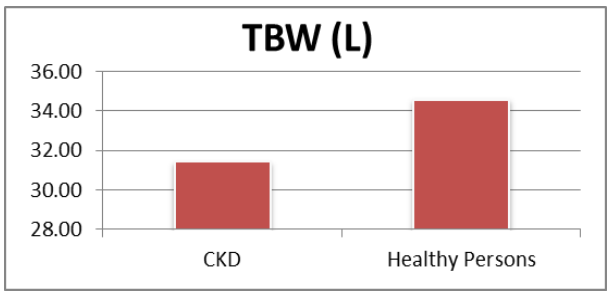
CKD	Healthy Persons
22.66	25.65

Figure 4: Comparison of Body Mass Index.



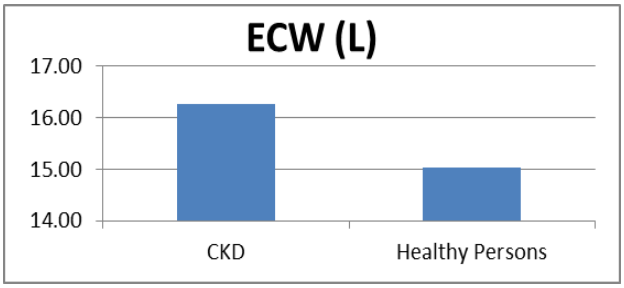
CKD	Healthy Persons
29.10	34.48

Figure 5: Comparison of Urea Level.



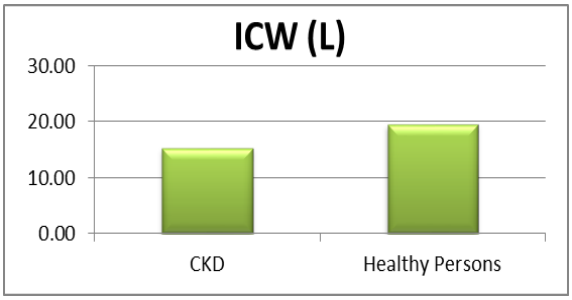
CKD	Healthy Persons
31.43	34.60

Figure 6: Comparison of Total Body Water (TBW in Liter).



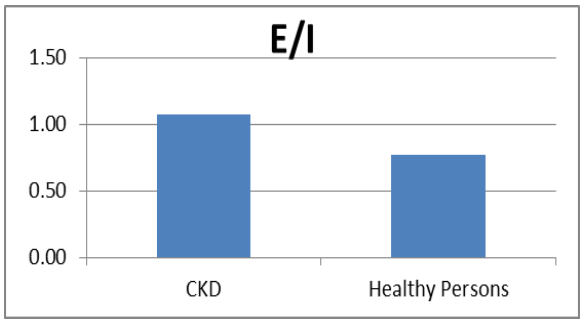
CKD	Healthy Persons
16.26	15.03

Figure 7: Comparison of Extra Cellular Water (ECW in Liter).



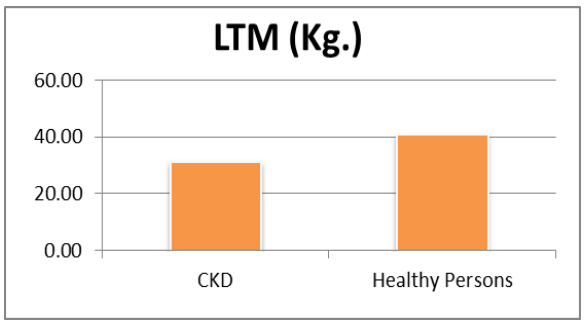
CKD	Healthy Persons
15.29	19.55

Figure 8: Comparison of Intra Cellular Water (ICW in Liter).



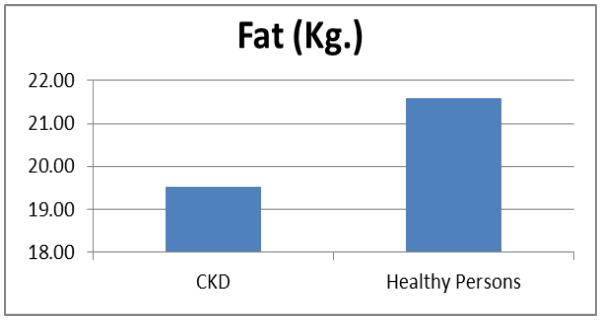
CKD	Healthy Persons
1.07	0.77

Figure 9: Comparison of E/I.



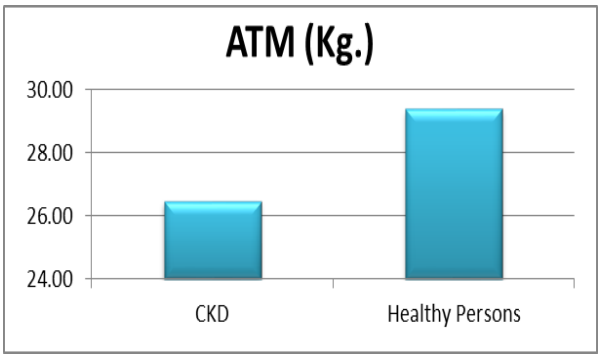
CKD	Healthy Persons
31.08	40.68

Figure 10: Comparison of Lean Tissue Mass (LTM).



CKD	Healthy Persons
19.52	21.58

Figure 11: Comparison of Fat (in Kg).



CKD	Healthy Persons
26.46	29.38

Figure 12: Comparison of Adipose Tissue Mass.

At baseline Max patients of CKD & other disease were Over Hydrated and the other hand healthy persons were normohydrated. Accordingly at end of study observed that out of 20 Nos.

1. All CKD & other disease patients were OH (Over Hydrated) than healthy persons.
2. Others parameters also indicated the difference between CKD & other disease comparatively healthy persons under below =>

A) BP (Systolic Pressure and Diastolic Pressure) higher than normohydrated patients.
B) Healthy persons B.M.I presents value higher than CKD patients.
C) V (Urea), TBW, average results indicate higher than CKD patients. On the other hand ECW greater than normohydrated persons.
D) ICW of healthy persons represents higher value than CKD patients. But the ratio between E/I potentially higher than healthy persons.
E) Lastly LTM (Lean Tissue Mass), Fat, ATM (Adipose Tissue Mass) also indicating higher than CKD patients compared to healthy persons.

DISCUSSION

Clinical assessment of the body fluid status is difficult since the body fluid change rapidly particularly in Hemodialysis patient. This case showed that the BCM may be an accurate and Practical way to estimate the target weight to control a patient's dry weight and to maintain hemodynamically stability during hemodialysis.

Volume regulation in hemodialysis patients is totally difference from that in patients with normal renal function since excess volume should be reduced by ultrafiltration during hemodialysis. However, There was no available guideline for the volume management of patients on hemodialysis. In this case, we could estimate the proper dry weight using the BCM and control the fluid overload and the Pt. body weight could reach the dry weight with the patient in a hemodynamic stable condition.

Many physicians estimate hydration status by using clinical parameters such as edema, wt. gain or Blood Pressure. Although there was a direct correlation between systolic B.P and tissue hydration. A number of patients had systolic hypertension despite normohydration or even tissue under hydration.

These are probably Patients who suffer from vascular stiffness. Further dehydration of these Patients in an attempt to normalize B.P might be dangerous, as it might abruptly compromise coronary perfusion. A number of patients had a low or normal B.P, despite being fluid overload. It is conceivable that many of these patients suffer congestive heart failure. Fluid management is crucial to the treatment of ESRD to improve cardio-vascular tolerance to dialysis treatment quality of life and survival. Infect, mortality increases beyond a sustained Predialysis fluid overload levee of around 2.5 liter.

Our results indicate that bioimpedance spectroscopy measurement with BCM Module was advantageous in the fluid management of our ESRD population, because after BCM Patient of the CKD patients group had a clear trend for better fluid control.

The BCM seemed to be a helpful diagnostic tool that reasonably complements existing clinical Method in the management of over hydration.

In our short follow up we could not replicate a mortality benefit in our bio-Impedance group. But again there was also an improvement in the fluid management of the control group.

CONCLUSION

The study confirms a marginal better performance to prescribe dry weight but on the other hand it is considerable that although the BCM recommendation is accurate for the ideal extracellular volume but Maximum time we may not always be able to reach that fluid status (that is dry weight). Cardiovascular impairment and subsequent morbidity caused by end-organ hypo-perfusion and hyper-perfusion may occur if we try to

decrease or increase volume status as recommended, even if rightly so.

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