

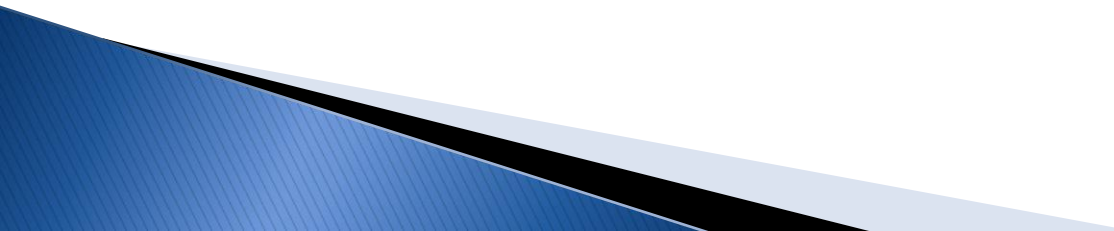


上海交通大学 医学院
附属仁济医院 肾脏科

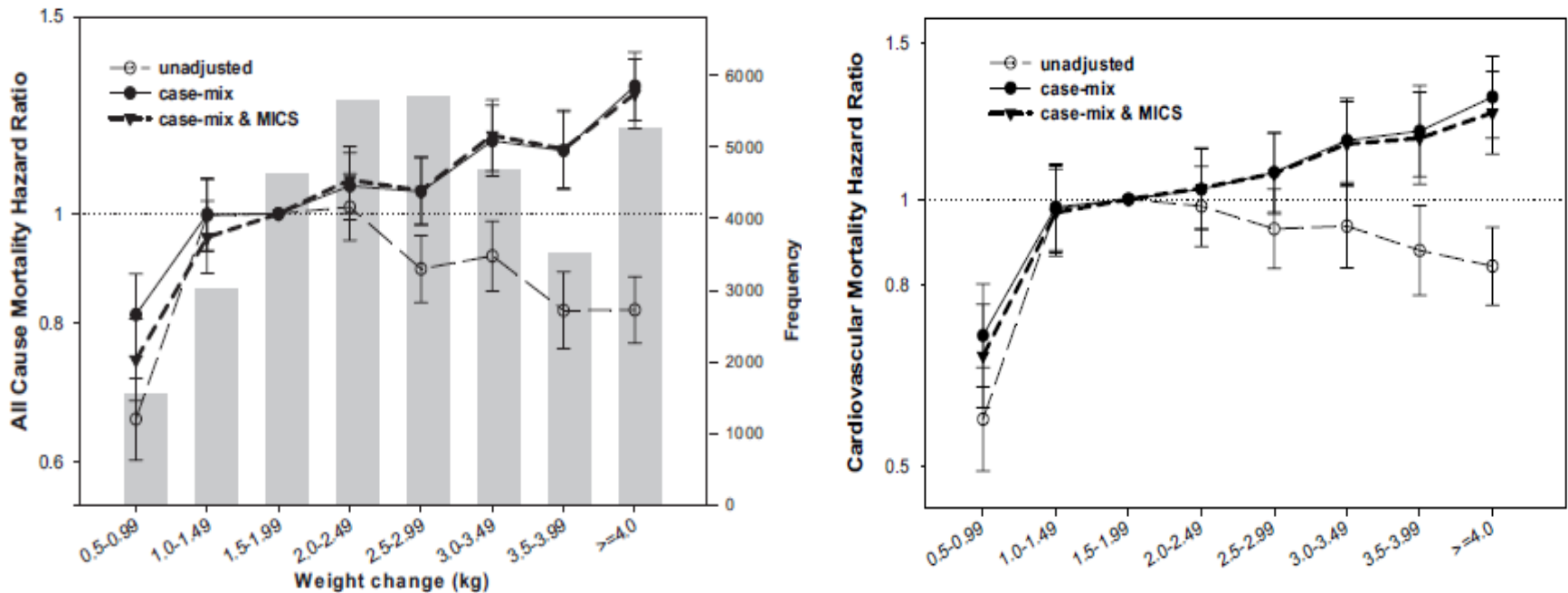
The use of body composition monitor (BCM) in Hemodialysis Patients

Huihua Pang

Renji Hospital, Shanghai Jiaotong University School of Medicine

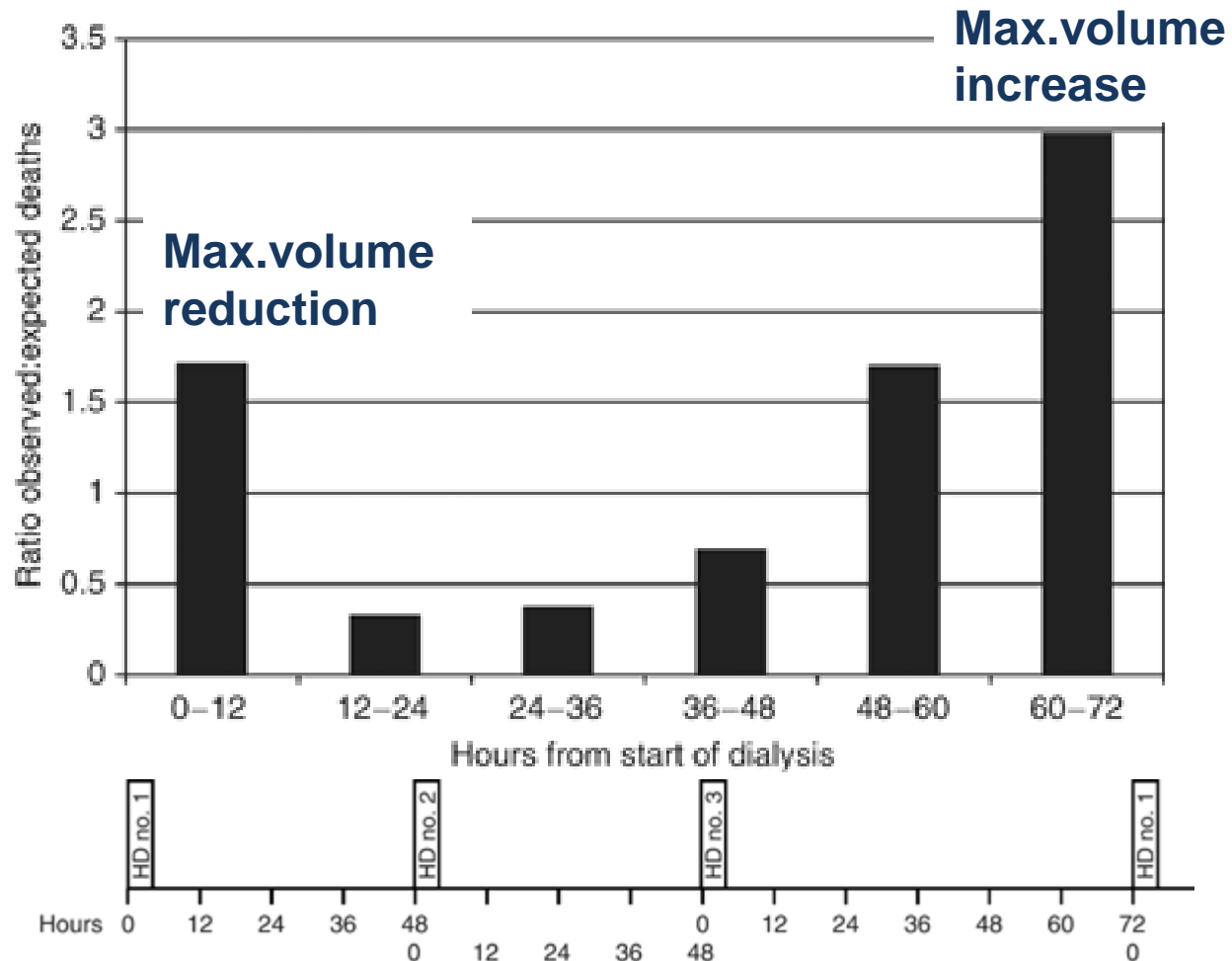
- ▶ Hydration and volume status are important predictors of outcome in patients with end-stage renal disease on dialysis therapy.
 - ▶ Fluid overload (FO) may significantly contribute to hypertension, accelerated arteriosclerosis and the high prevalence of left ventricular hypertrophy observed in ESRD patients.
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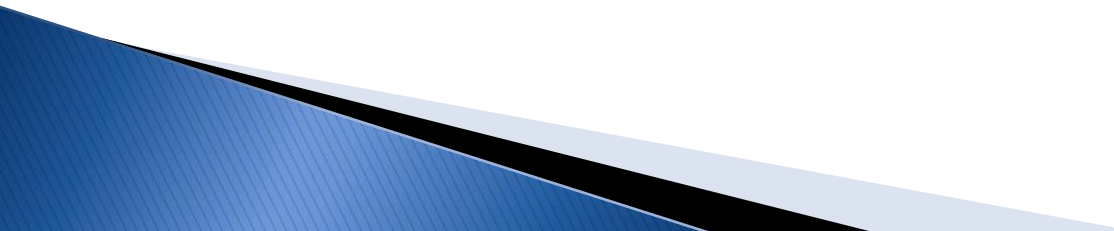
Fluid Retention Is Associated With Cardiovascular Mortality in Patients on hemodialysis



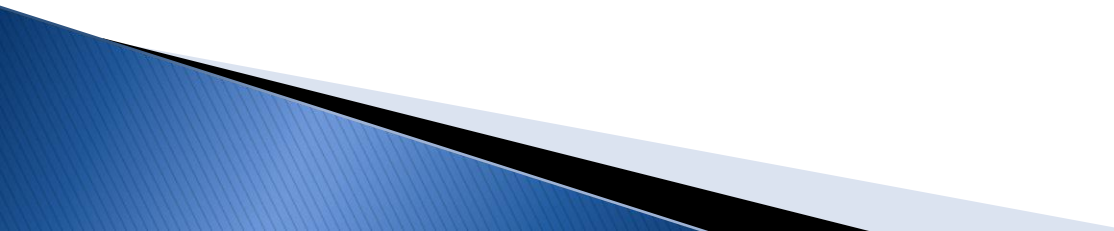
greater fluid retention between 2 subsequent hemodialysis treatment sessions is associated with higher risk of all-cause and cardiovascular death

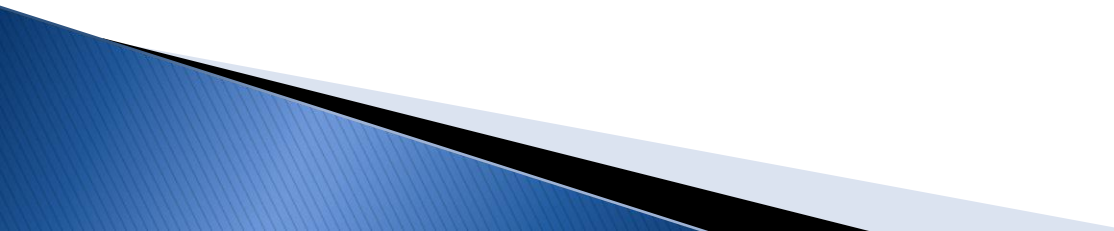
Sudden Death



- ▶ Adequate hydration control is a principal goal of dialysis
 - ▶ However, correct quantification of fluid overload by assessing the individual dry weight in patients still remains a challenge.
 - ▶ We usually assess the dry weight based on subjective clinical criteria.
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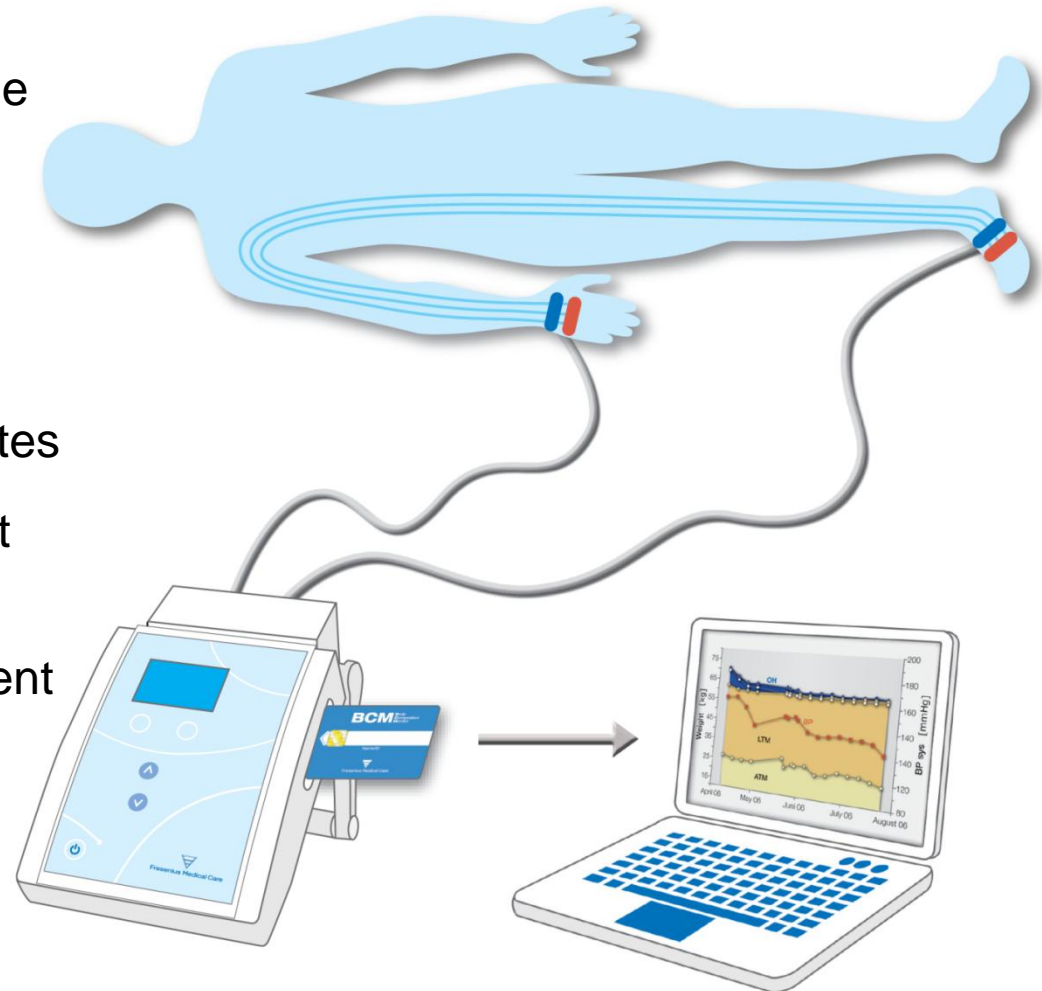
Assessment of hydration state

- ▶ Body weight change
 - ▶ Clinical sign: Blood pressure, edema,...
 - ▶ Chest x-ray, Echocardiography
 - ▶ Serum natriuretic peptides
 - ▶ Body composition analysis by bioimpedance technique
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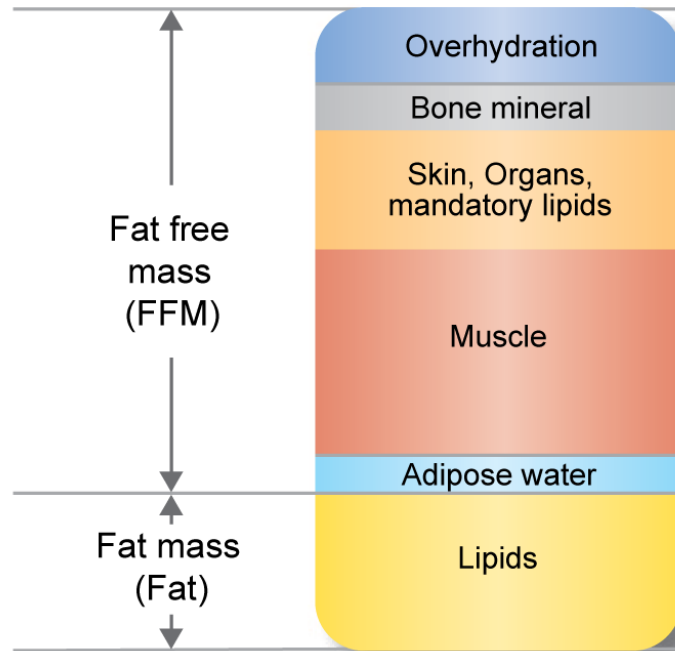
- ▶ Multifrequency bioimpedance offers a possibility of evaluating in a simple way at bedside the body composition and hydration state of the patients objectively
 - ▶ The Body Composition Monitor (BCM, Fresenius Medical Care) has recently been validated and introduced for use in everyday clinical practice
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Body composition monitor system

- Electrodes are attached to one hand and one foot (non-fistulae side in HD patient) with the patient in a supine position
- Patient cable is connected
- Measurement is initiated and results are displayed within 2 minutes
- Results are stored on the Patient Card
- Data can be transferred via Patient Card to a personal computer for further analysis with the Fluid Management Tool

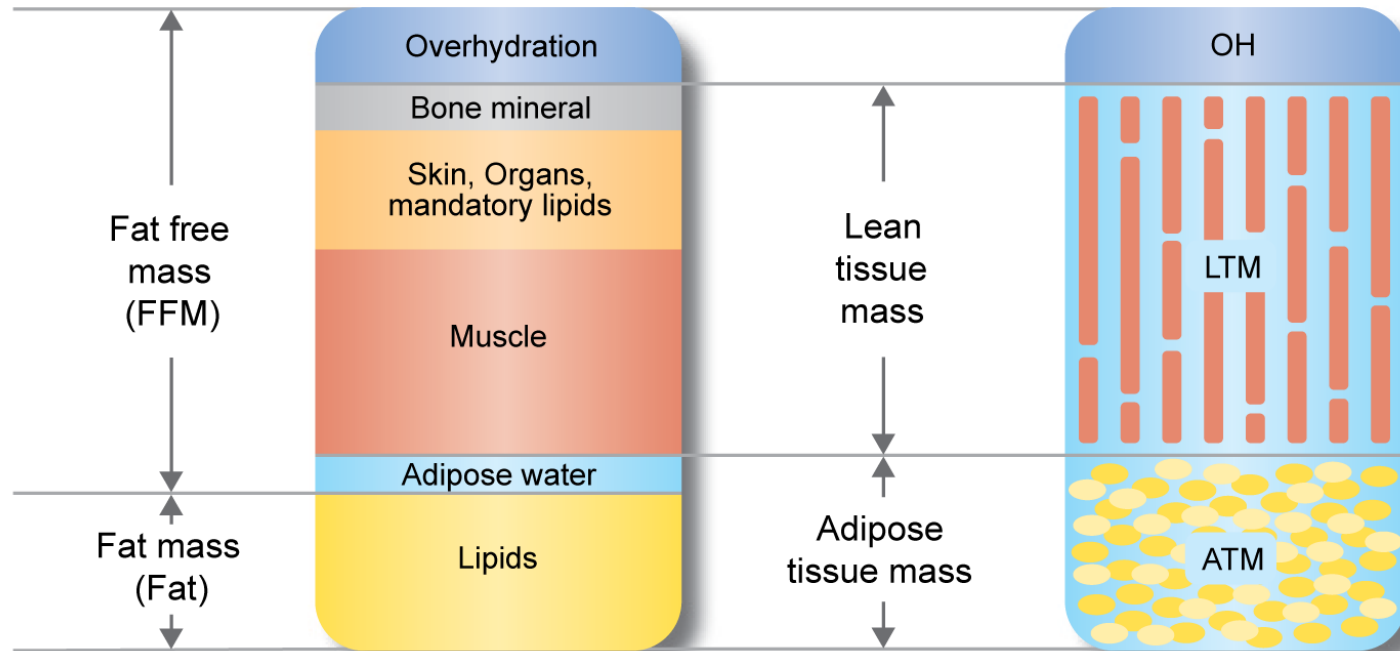


Conventional body composition analysis

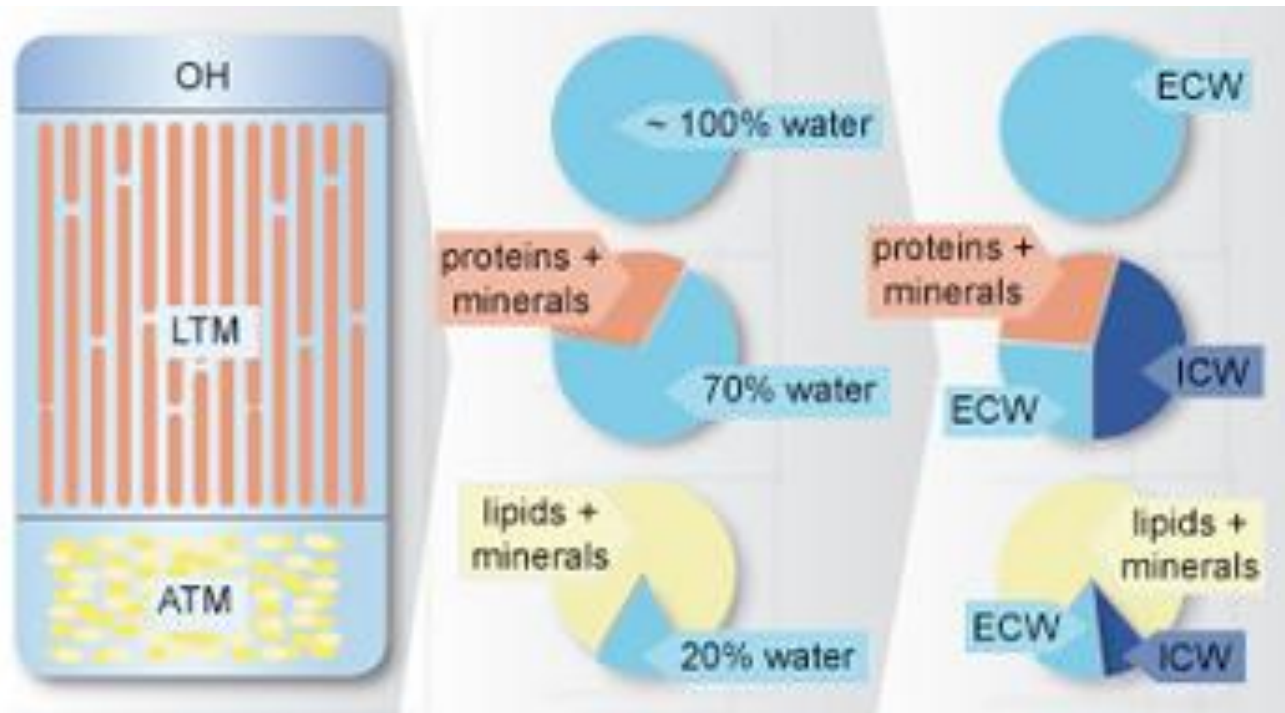


Physiological 3 compartment model used by BCM

Body weight = LTM + ATM + OH

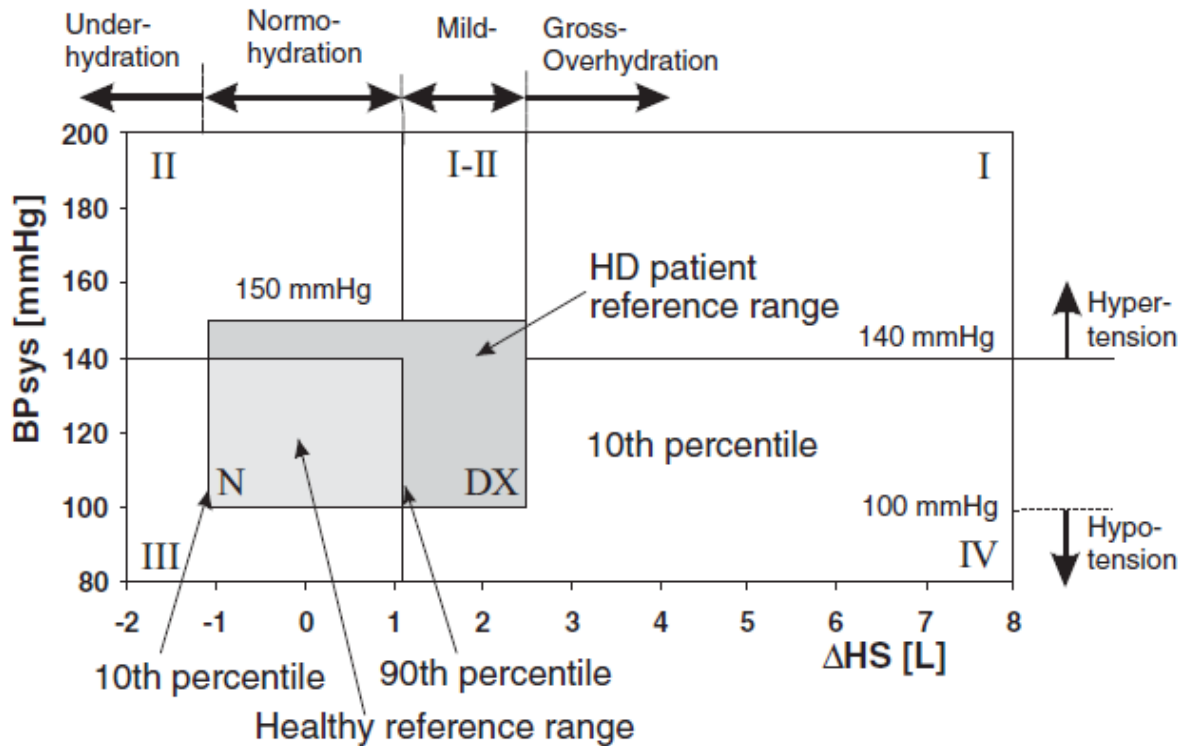


- ▶ The BCM separates excess fluid (over-hydration) from the lean and adipose tissue components of the body on the basis of a unique body composition model.
- ▶ The three compartments (LTM, ATM and OH) are identified from measurements of body weight, height, intracellular (ICW) and extracellular water (ECW) determined by whole body bioimpedance spectroscopy (BIS).



OH

Overhydration represents the excess fluid (fluid overload) stored almost exclusively in the extracellular volume of a patient, and is therefore part of the ECW



Wabel, P. et al., NDT 2008:1

Region I. represents patients with a HS >2.5L and an increased BPsys >140mmHg. There is a high likelihood that hypertension in these patients is indicative of the gross FO observed.

Region I-II. represents a population with mild elevation of HS between 1.1 and 2.5 L concomitant with an increased BPsys >150 mmHg.

Region II. represents patients in a state of normohydration but BPsys >150 mmHg. Patients in this region are clearly hypertensive but there is far less likelihood that volume is a contributing factor.

Region III. It characterises underhydrated patients with normal or low BPsys <140 mmHg.

Region IV. represents patients with gross FO, HS >2.5 L and a normal or low BPsys <140 mmHg. In this patient population, the gross FO is not reflected in BPsys.

The mortality risk of overhydration in hemodialysis patients

- ▶ 269 prevalent HD patients in 3 European centres fulfilled the inclusion criteria
- ▶ The patients were measured once a baseline pre-dialysis with the BCM to assess the hydration status
- ▶ The survival of patients until 2007 (3.5 years follow-up) was documented.

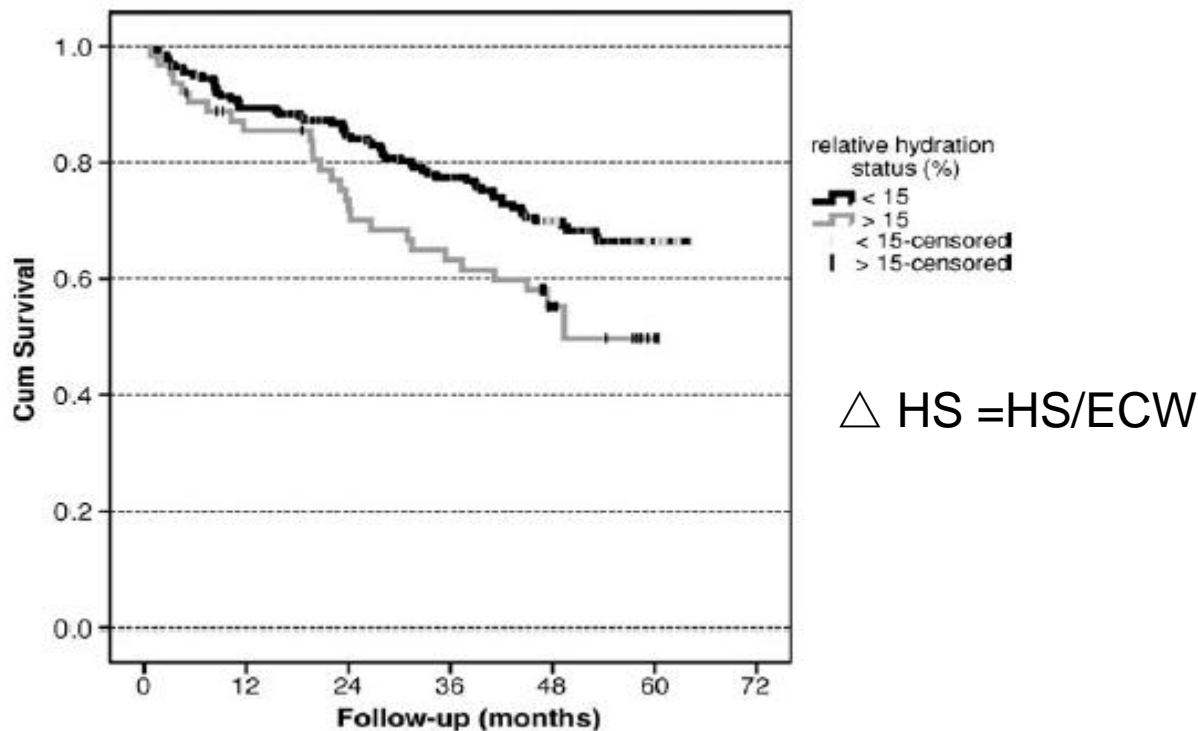


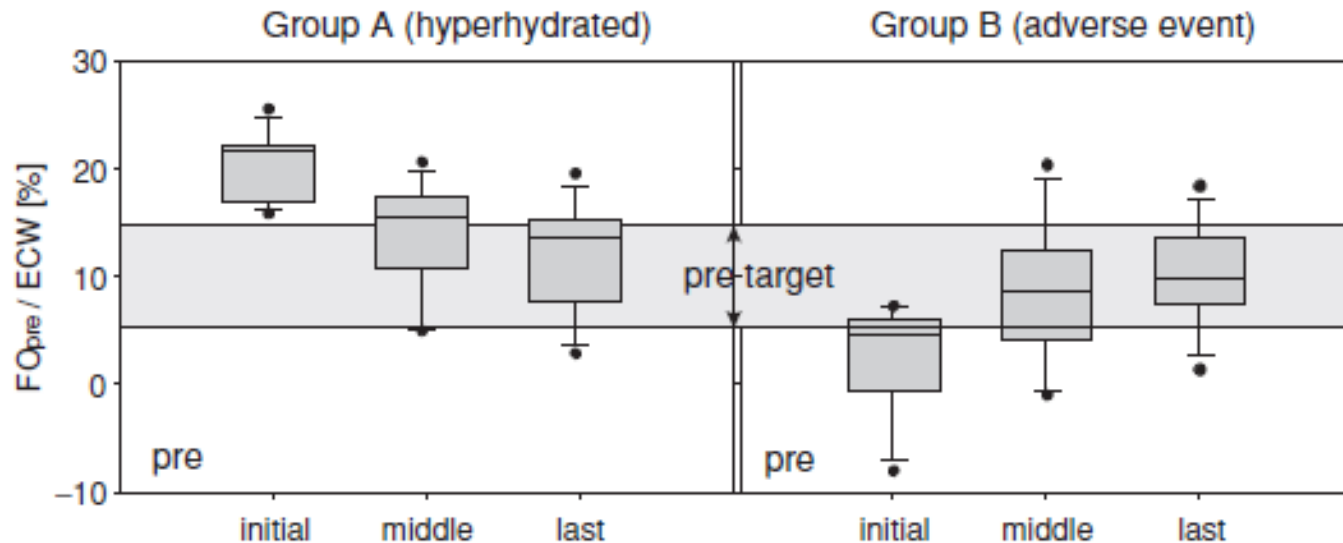
Fig. 1. Kaplan–Meier curve separating the patients for the relative hydration status ($\Delta HS > 15\%$).

The cut off threshold for the definition of hyperhydration was set to 15% relative to the extracellular water (ECW), which represents an excess of ECW of ~ 2.5 l.

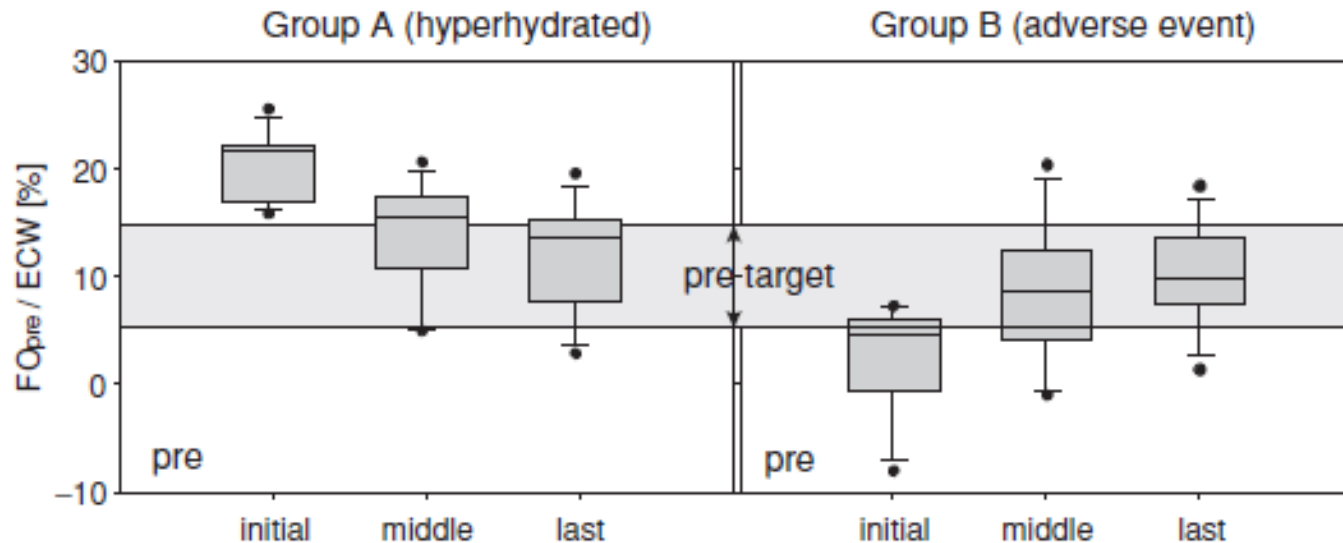
- ▶ The results of this study indicate that the hydration state is an important and independent predictor of mortality in chronic HD patients.
- ▶ It is essential to measure the hydration status objectively and quantitatively in order to obtain a more clearly defined assessment of the prognosis of haemodialysis patients.

Guided optimization of fluid status in hemodialysis patients

- ▶ The aim of this prospective trial was to guide the patient population of a complete dialysis centre towards normohydration over the course of approximately 1 year.
- ▶ The patient population was divided into three groups:
 - the hyperhydrated group (relative fluid overload $>15\%$ of ECW; $n = 13$; Group A)
 - the adverse event group (patients with more than two adverse events in the last 4 weeks; $n = 12$; Group B)
 - the remaining patients ($n = 27$; Group C).



- ▶ In the hyperhydrated group (Group A), fluid overload was reduced by 2.0 L ($P < 0.001$) without increasing the occurrence of intradialytic adverse events. This resulted in a reduction in systolic blood pressure of 25 mmHg ($P = 0.012$). Additionally, a 35% reduction in antihypertensive medication ($P = 0.031$) was achieved



- ▶ In the adverse event group (Group B), the fluid status was increased by 1.3 L ($P=0.004$) resulting in a 73% reduction in intradialytic adverse events ($P<0.001$) without significantly increasing the blood pressure.

- ▶ The BCM provides an objective assessment of normohydration that is clinically applicable. Guiding the patients towards this target of normohydration leads to better control of hypertension in hyperhydrated patients, less intradialytic adverse events and improved cardiac function

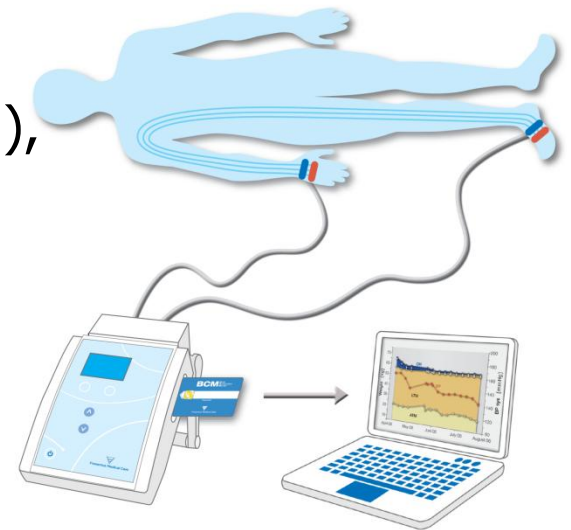
Cross section observational study of
body composition on HD patients in
Renji Hospital

Subjects

- ▶ Hemodialysis(HD) patients and peritoneal dialysis(PD) patients in Renji Hospital
- ▶ Exclusion:
 - Patients with cardiac pacemakers or defibrillators or metal prostheses
 - Patients with above ankle or above wrist amputations were excluded
 - Pregnancy
 - Less than 18years old

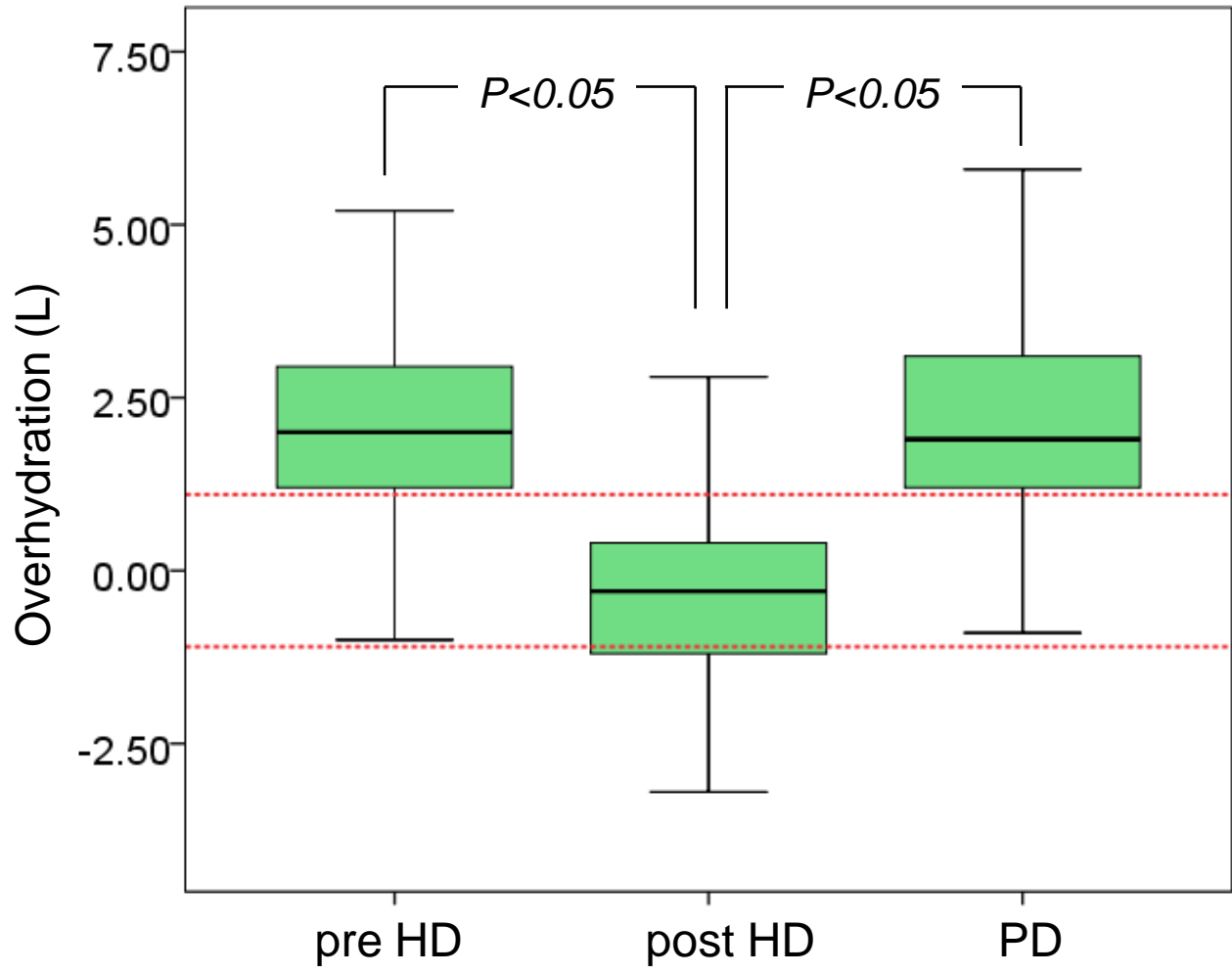
Methods

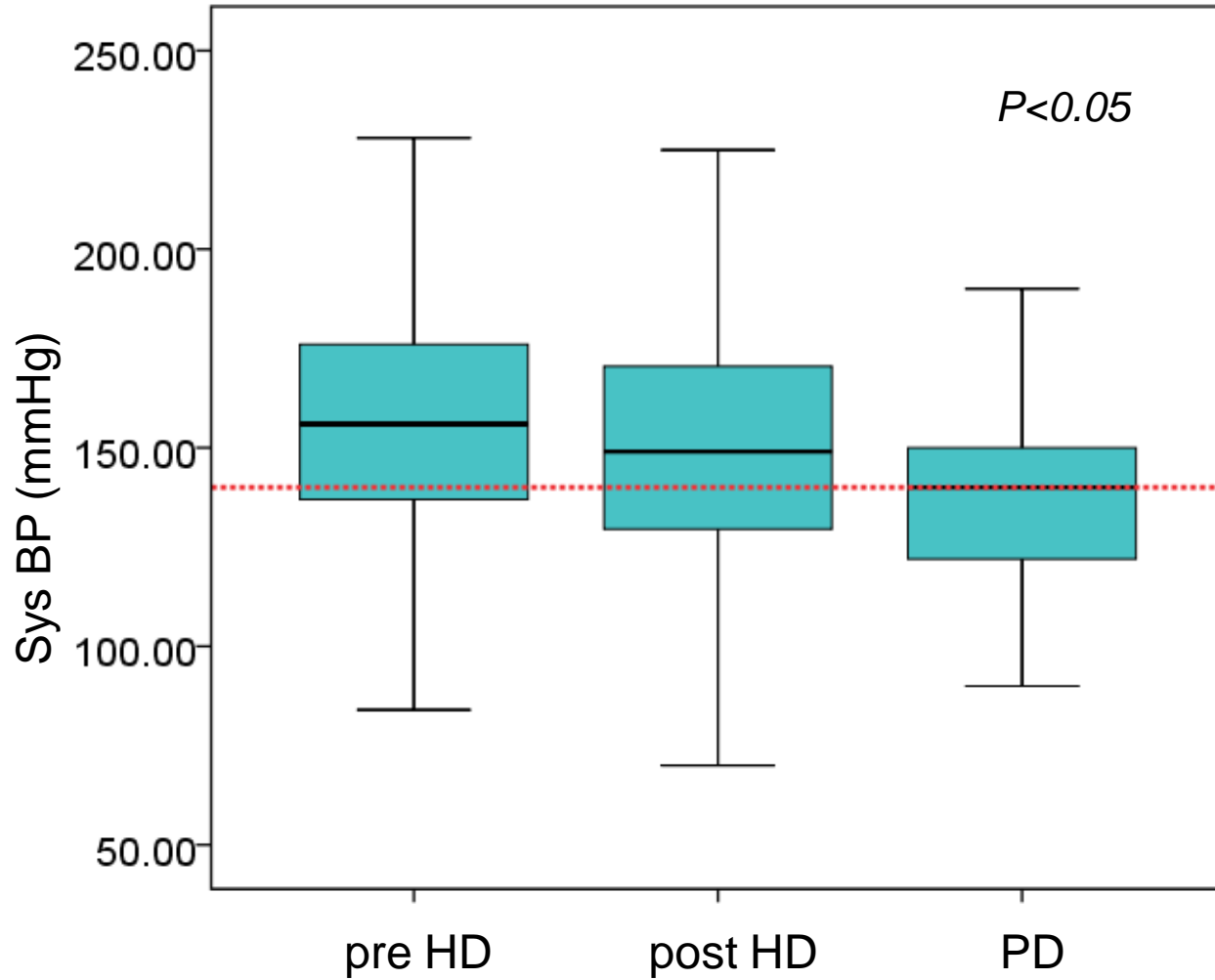
- ▶ Body composition analysis were performed
 - HD patients: pre-dialysis and post-dialysis
 - PD patients: while the peritoneum was empty.
- ▶ Device
 - Fresenius Body composition monitor (BCM),
50 frequencies (5 to 1000 kHz)



Results-fluid assessment

- ▶ Body composition analysis were performed on 167 HD patients & 99 PD patients





Pre-dialysis

33.5% patients had overhydration,
25.1% patients with OHpre >2.5L and an sys BP >140 mmHg. There is a high likelihood that hypertension in these patients is indicative of the gross FO observed.

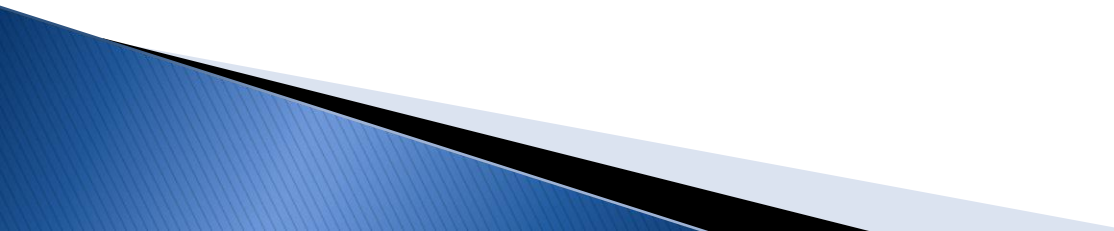
Post-dialysis

patients with OHpost $>1.1L$ and an sys BP >140 mmHg.

Patients hadn't got proper dry weight, need more water removal

- ▶ Body composition analysis by BCM helps us to assess the hydration status of dialysis patients more accurately and objectively. Guide the volume management more efficiently.

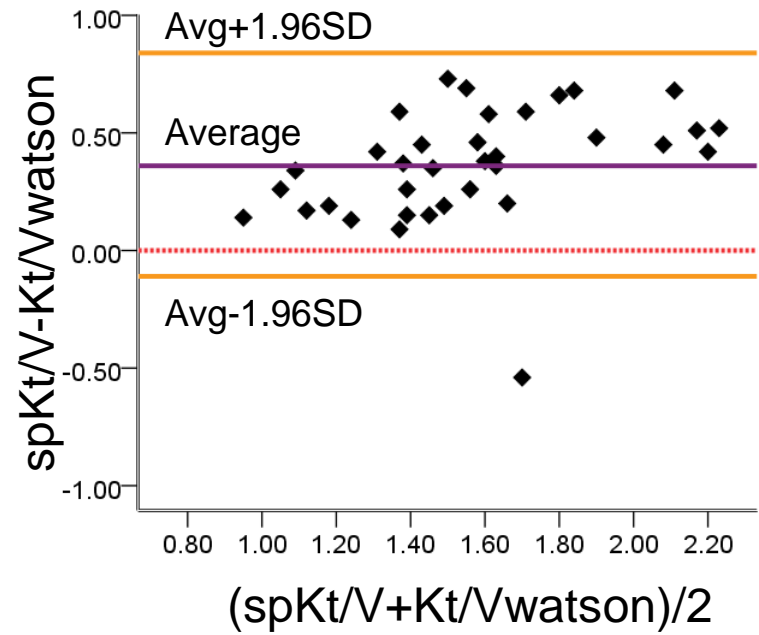
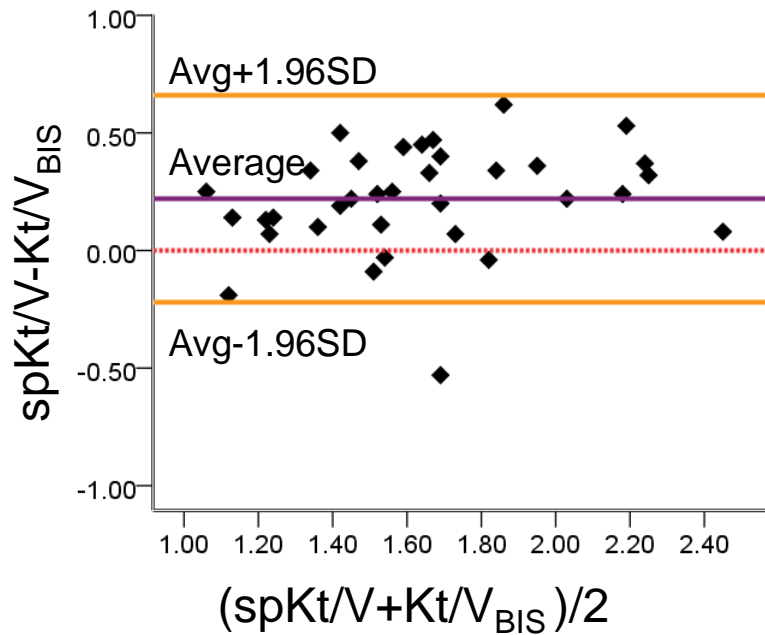
Accurate V assessed by BCM used
in online clearance monitor (OCM)

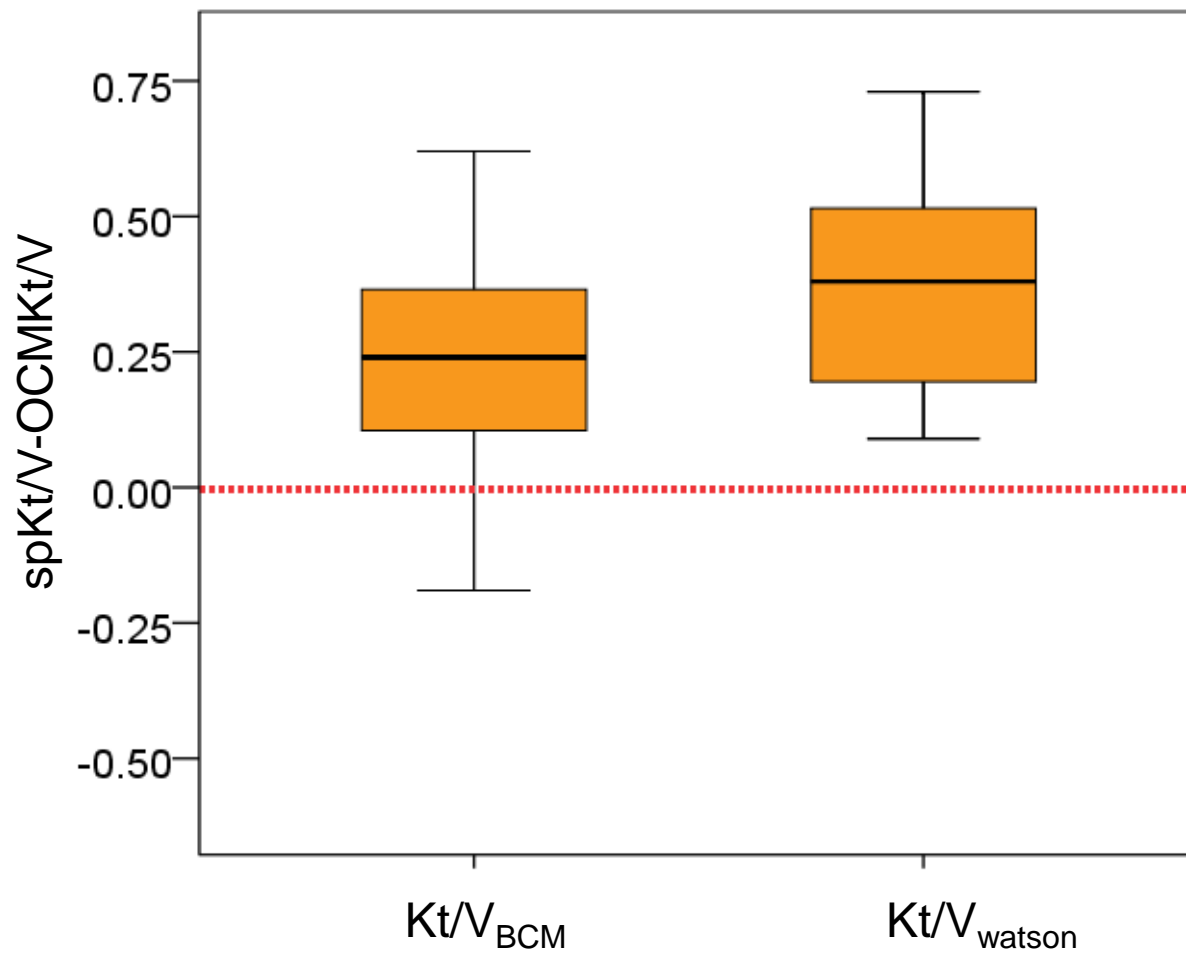
- ▶ TBW represents the urea distribution volume and is used for the determination of dialysis adequacy Kt/V
 - ▶ BCM offers significantly better precision for the determination of TBW in both healthy subjects and patients with abnormal fluid status.
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Methods

- ▶ Kt/V were checked by OCM using the V from bioimpedance measurements in 35 HD patients
- ▶ Blood-based $spKt/V$ (the Daugirdas formula) were calculated from pre and post-dialysis urea at the same session

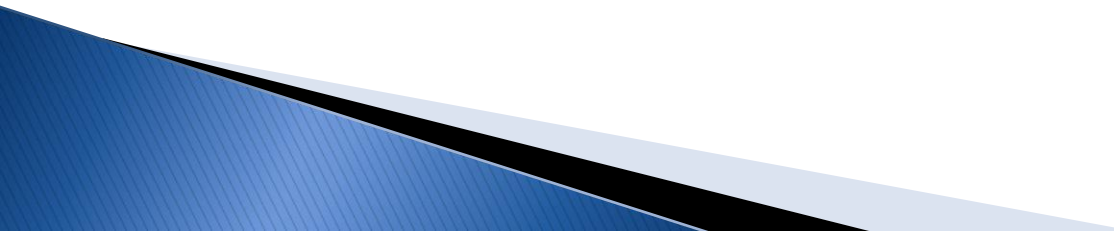
Bland-Altman analysis





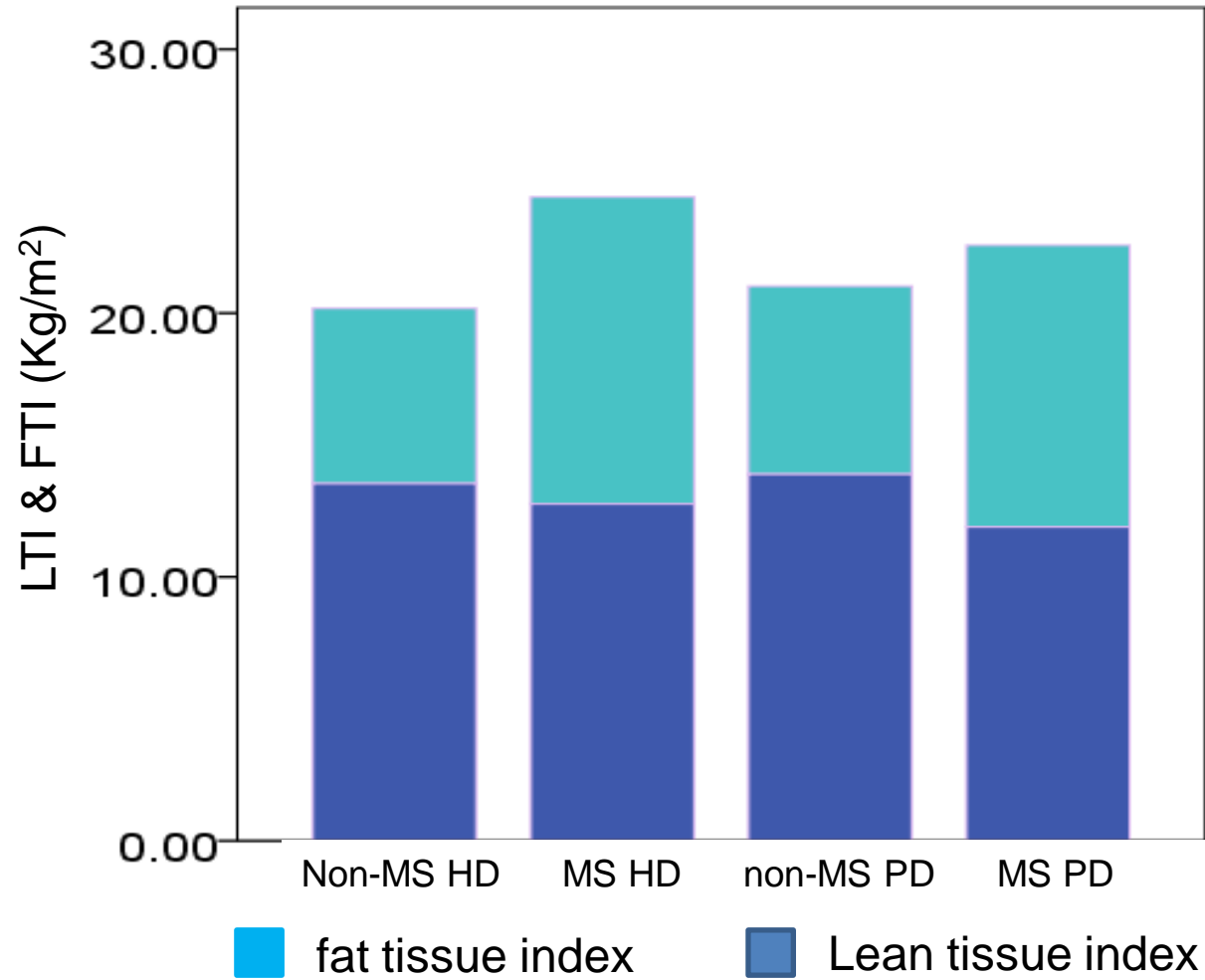
Body composition changing in
maintenance dialysis patients with
metabolic syndrome (MS)

Methods

- ▶ MS was diagnosed by 2005 IDF definition on 93 HD patients & 24 PD patients
 - ▶ Body composition analysis by BCM tested on these patients
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Results

- ▶ 28 HD patients (30.11%) were diagnosed as MS
- ▶ 14 PD patients (41.67%) were diagnosed as MS



- ▶ Dialysis patients with metabolic syndrome have excessive fat (particularly the visceral fat) accumulation, while nutritional parameters as muscle mass, SGA score and serum albumin and body water didn't change a lot.

Summary

- ▶ Body composition analysis by bioimpedance technique can help us on
 - Assess hydration status, guide volume management
 - Provide accurate V used in online clearance monitor
 - Assess nutritional status