

# VOLUME MANAGEMENT IN DIALYSIS PATIENTS

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## BACKGROUND

Fluid volume is an independent and important mortality predictor in patients undergoing regular dialysis treatment (Wizemann et al., NDT 2009). The achievement of a normal hydration state is one of the major targets of haemodialysis therapy. The abnormal hydration state has its clinical implications. Complications occur.

## OBJECTIVE

To highlight the importance of correct determination of the patient's dry weight, proper setting of ultrafiltration and dialysis parameters to prevent complications during dialysis treatment.

## METHODS

### DRY WEIGHT AND FLUID VOLUME IMPAIRMENT

- Definition – the lowest weight tolerated by the patient, absence of hypotension, cramps and edema
- Hyperhydration – edema, effusions, hypertension, acute or chronic failure of the left ventricle, stroke
- Hypohydration – risk of severe ischemia during ultrafiltration in patients at risk, chronic hypertension associated with increased CV risk

### METHODS USED TO DETERMINE THE DRY WEIGHT

- clinical evaluation of physician, data on patient's blood pressure measured at home
- ultrasound techniques – measuring the gauge, collapsibility index of the inferior vena cava
- blood volume monitoring – e.g. Crit-line
- bioimpedance spectroscopy analysis – e.g. BCM
- radiological, radionuclide and MRI methods

### ULTRAFILTRATION

- water and small molecules filtration through a semipermeable membrane, formation of the dialysate
- filtration is driven by the pressure gradient
- runs in HD, HDF, HF procedures
- dialyzers have a so called ultrafiltration coefficient (KUF)
- dialyzers can be divided according to the capacity of the ultrafiltration – low/high flux (KUF <10, >20 ml/h/mmHg)
- TMP (transmembrane pressure) depends on the UF and type of the dialyzer
- UF = TMP x KUF

### UF RATE ACCORDING TO THE METHOD MODALITY

- CVVHD: 50 – 200 ml/h, 24 hours a day
- SLEDD: 100 – 500 ml/h, 8 – 10 hours a day
- iHD, iHDF: usually up to < 1,000 ml/h, max. 5 litres in one session
- ISOLATED UF: < 1,500 – 2,000 ml/h, 1-2 hours

### COMPLICATIONS

- HYPOTENSION** – common complication of rapid fluid removal by ultrafiltration; the risk of hypotension depends on the UF rate and it significantly increases with higher UF rate  
**cause** – incorrectly determined dry weight, low sodium concentration in the dialysis solution, the high temperature in the dialysis solution  
**symptoms** – weakness, nausea, vomiting, spasms, chest pain, sweating, in the presents of atherosclerosis it can result in poor organ perfusion and AVF closure  
**action** – stopping or slowing down the UF – activation of minimal ultrafiltration, Trendelenburg position, rapid IV application of normal saline, BP and pulse control, further actions on the physician discretion  
**prevention** – restriction of the weight gain between dialyses, correct determination of the dry weight, appropriate concentration of sodium in the dialysis solution, profiling of sodium and ultrafiltration, lowering the temperature of the dialysis solution, to consider antihypertensive medication
- SPASMS** – the lower limbs most commonly affected, associated with hypotension  
**action** – rapid IV application of 100-200 ml of normal saline, minimal UF, lower extremities positioning, BP and pulse control, further actions on the physician discretion – MgSO<sub>4</sub>, NaCl 10%  
**prevention** – low elevations in between the dialyses, setting and profiling of sodium
- HYPERTENSIVE REACTION**  
 some patients respond to dialysis by blood pressure elevation  
**cause** – compensatory response to fluid removal, excessive increase in blood viscosity due to ultrafiltration, high calcium concentration in the dialysis solution, removal of certain antihypertensive agents with dialysis

**symptoms** – headache, vomiting, symptoms of left-sided heart failure

**actions** – fast-acting antihypertensives – Cordipin, Tensiomin

### SETTING THE ULTRAFILTRATION PARAMETERS

- ULTRAFILTRATION PROFILE**
  - standard preset profiles individually selected profile
  - can be adjusted during dialysis
- ISOLATED ULTRAFILTRATION / DRY ULTRAFILTRATION /**
  - used to remove fluid from the patient's body
  - no dialysate flows through the dialyzer
- MINIMAL ULTRAFILTRATION**
  - activation during dialysis when complications occur

### DIALYSIS PROFILING

- profiling options – dialysate flow, dialysate temperature, resulting conductivity of Na, use of heparin, bicarbonate conductivity, ultrafiltration

### PATIENT EDUCATION

- individual for a specific patient, appropriate for his/her level of understanding
- 90 day program, primary nurse
- nursing care coordinator for nutrition
- educational material – diet and drinking regime
- in cooperation with physicians and family
- the core of successful education is a good understanding of the patient's lifestyle, his/her culture, eating habits and social conditions in which he/she lives

### PRINCIPLES OF WEIGHING THE PATIENT BEFORE AND AFTER DIALYSIS

The nurse is responsible for checking the weight and recording the measurement into the patient's medical records

- in the case of electronic transmission of data from the weighing scale control unit into Nefris application the nurse verifies correctness of the transfer into the dialysis protocol
- when weighing the patient by asking him/her the nurse verifies whether the normal weighing conditions are maintained, especially if the patient wears clothes with the same weight
- in patients with impaired mental abilities or in patients with prosthetic devices the normal weighing conditions are recorded in under permanent notes of the dialysis prescription in Nefris application
- use of scales with a ramp and a bed scale

### FLUID RESTRICTION

- fluid intake depends on the residual diuresis
- hidden water (fruits, sauces, soups, ice cream)
- how to calculate fluid intake properly (metering, weighing, smaller glass, soup into a cup, noting everything down)

### WATER CONTENT IN FOOD GROUPS

- fruits and vegetables 80-95 %
- potatoes up to 80 %
- chicken, beef 50-75 %
- fish 65-80 %
- ham 40-60 %
- bread 40 %
- chips 40 %

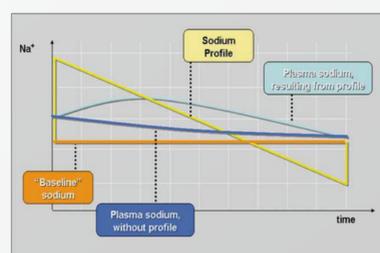
### RECOMMENDATIONS FOR THE PATIENTS

- avoid spicy, salty and sweet food
- rather drink drinks that are chilled, slightly sour or bitter
- ice cube, slice of lemon, candy to quench thirst (diabetics!)

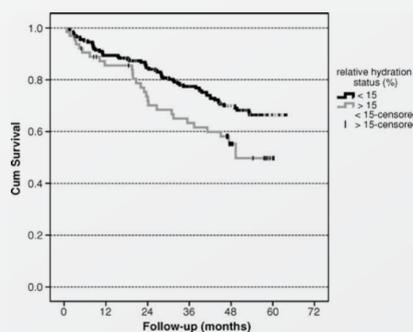
## CONCLUSION

With correct calculation of the dry weight we minimise possible complications associated with dialysis treatment. Prevention of hemodynamic instability is an integral part of quality care. It affects the patient's perception of quality of life, as any dialysis complication is not only risky for the patient but also it raises concerns about patient's treatment. In our patients, we reduce mortality and simultaneously increase the perception of quality of life.

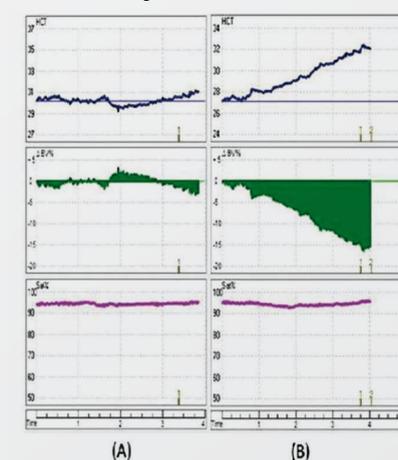
### Balance Neutral Profiles



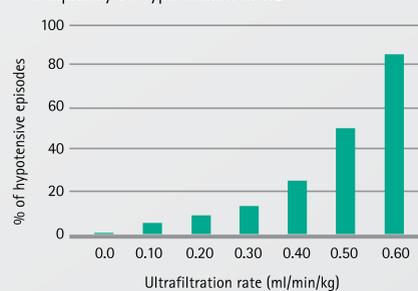
Survival of patients according to the patients fluid volume, from NDT, 2009, The mortality risk in HD patients, Wizemann



CRIT-LINE III TQA – BV measurements based on hematocrit changes



Risks of hypotension according to the UF rate  
Frequency of hypotension in HD



### Ultrafiltration principle

