HAEMODIALYSIS TECHNIQUES AND ADEQUACY 2

MP387
MONITORING OF FLUID OVERLOAD IN A DIALYSIS NETWORK

Paul Chumney1, Ulrich Moisil1, Peter Wabel1, Claudia Arrato1, Stefano Stuardi1, Marcus Menzer1 and Camillo Vollmeier1
1Fresenius Medical Care Deutschland GmbH, Bad Homburg, Frankfurt, Germany

Introduction and Aims: The fluid status of haemodialysis patients has been well established as major factor influencing both clinical outcome and treatment costs. So that headway can be made in defining the thresholds for fluid overload, identifying patients at greater risk of fluid overload and the design of optimal treatment strategies, an objective measurement of fluid overload (FO) is necessary. Consequently, a fluid management program (FMP) is being rolled out within NephroCare (Fresenius Medical Care) which operates dialysis services in over 750 clinics in the regions of Europe, Middle East, Africa and Latin America. A hydration status score (HSS) has been incorporated within a NephroCare Balanced ScoreCard (BSC) system to assess treatment quality.

Methods: The basis of the FMP is the BCM_Body Composition Monitor. The BCM allows an objective estimation of fluid overload (FO) and each clinic in the NephroCare network performs a measurement on a monthly basis. A patient card allows data to be transferred to a clinical information system. The HSS requires a measure of the relative fluid overload (RelFO) which is determined by dividing the FO by the extracellular water (ECW). This procedure normalises the patient’s fluid status compensating for patients of different body weight. It has been shown previously that there is a survival improvement in those patients where RelFO is maintained below 15%. (Wizemann et al. NDT 2009). Three ranges for the HSS apply namely less than 15% RelFO, 15% to 20% RelFO and above 15% RelFO. These ranges score the points 1, 0.5 and 0 respectively. We monitored growth of the FMP over the last 2 years and the assessed the recent distribution of FO in those patients measured in the network. Data were interpreted in terms of median and 25th to 75th percentiles.

Results: At the time of the August 2013 analysis, with the step rise due to data reported from Latin America the FMP was measuring 32,484 patients with BCM per month, equivalent to >1000 patients/day. See Fig 1. In August 2013, the median, 25th and 75th percentiles of FO were found to be 1.74 L (0.85 L to 2.71 L) as shown in Fig 2. RelFO were 10.74% (5.44% to 15.95%) respectively. Regarding the HSS in August 2013, 71% of patients were <15% RelFO.

Conclusions: The FMP is active in a majority of the NephroCare clinics. RelFO < 15% by sensitive new tool (BCM) is achieved in most patients. The 30% of patients with RelFO >15% provides some basis to challenge clinical judgement. The HSS component of the BSC allows patients with high FO to be identified and corrective treatment to be planned through a peer review process.

MP388
NOCTURNAL HOME HAEMODIALYSIS - ACHIEVING MORE FOR LESS!

Gail Williams1, Rajesh Shrivastava1, James Chess1, Emma Catting1, Christopher Brown2, Elizabeth Baker3, Rachel Ashcroft1 and Ashraf Mikhail1
1Morriston Hospital, Swansea, United Kingdom

Introduction and Aims: Conventional dialysis is a life-savaging treatment but it’s not without its ill and many would consider transplantation as gold standard for our end-stage renal patients. Around 45% of patients on dialysis are not suitable for a transplant and many of those waiting will never receive one. We recognised the growing need for change; the need to improve the quality of life and the freedom of patients from the many restrictions of conventional dialysis. We believed that nocturnal dialysis, at home, was the answer. Selling its many benefits would be the challenge to both staff and patients. Nocturnal dialysis has proved to be a meaningful alternative for those facing a lifetime of dialysis. We believe that we can achieve more for our patients, their well being, longevity and quality of life - while making more efficient use of NHS resource. To establish a robust and safe protocol and guidance for patients biochemical markers and care.

Methods: A systematic approach was directed to the development of the programme. We built on the limited experience and evidence of others and developed our approach to maximise its benefits. Strong leadership, a dedicated multidisciplinary team, creativity and innovation were the key to pioneer and develop the programme.

Results: Twenty patients have been successfully trained to carry out nocturnal dialysis at home over 30 months. Nocturnal dialysis has proved to be extremely effective treatment approach, and there is tangible evidence for much improved markers which should translate to improved long term outcomes.

- Patient testimonials support the notion of better health and quality of life
- Better clinical target achievements
- Better compliance with dialysis and supportive therapies
- Better blood pressure control
- Improved bone minerals control to improve vascular health
- Improved haemoglobin
- Reduced need for medication

- More varied, healthy and less restrictive diet
- Reduced costs for the Health Service
- Improved haemoglobin
- Reduced need for medication
- Improved bone minerals control to improve vascular health
- Improved haemoglobin
- Reduced need for medication

Conclusions: The nocturnal experience has been an exciting opportunity and a challenge to both staff and patients. Nocturnal dialysis has proved to be a meaningful alternative for those facing a lifetime of dialysis. We believe that we can achieve more for our patients, their well being, longevity and quality of life - while making more efficient use of NHS resource. We have a clear vision, direction and purpose to build the programme and share our development.

- Enable all patients who could benefit from nocturnal dialysis to do so
- Challenge the limitations of conventional dialysis and explore hospital based nocturnal dialysis for patients who cannot have a home based therapy
- Are there now clinical uncertainties linking benchmarks to outcomes?
- What are the optimal targets for bone minerals and dialysis adequacy when treating nocturnal dialysis patients?

MP389
HEMODIALYSIS PARACTISE IN SERBIA AND GUIDELINES IMPLEMENTATION

Ljubica Djukanovic1,2, Zivka Djuric3, Violeta Knezevic1, Tatjana Lazarevic2, Stanimir Ljubenovic1, Rodoljub Markovic7, Violeta Raborenovic8, Jelena Marinkovic1 and Nada Dimkovic1,2
1School of Medicine, University of Belgrade, Belgrade, Serbia, 2Medical Academy, Belgrade, Serbia, 3Zvezdara University Medical Center, Belgrade, Serbia, 4Clinical Center Novi Sad, Novi Sad, Serbia, 5Clinical Center Kragujevac, Kragujevac, Serbia, 6Clinical Center Nis, Nis, Serbia, 7University Medical Center Zemun, Belgrade, Serbia, 8Military Academy, Belgrade, Serbia

Introduction and aims: What are the optimal targets for bone minerals and dialysis adequacy when treating haemodialysis patients? Are there now clinical uncertainties linking benchmarks to outcomes?

Methods: A systematic approach was directed to the development of the programme. We built on the limited experience and evidence of others and developed our approach to maximise its benefits. Strong leadership, a dedicated multidisciplinary team, creativity and innovation were the key to pioneer and develop the programme.

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- Challenge the limitations of conventional dialysis and explore hospital based nocturnal dialysis for patients who cannot have a home based therapy
- Are there now clinical uncertainties linking benchmarks to outcomes?
- What are the optimal targets for bone minerals and dialysis adequacy when treating nocturnal dialysis patients?
Introduction and Aims: Many national and regional guidelines for hemodialysis (HD) were published in the last few decades, and several studies, mainly from developed countries, examined the levels of compliance with the guidelines. The aim of the present study was to examine the characteristics of patients on regular HD in Serbia and to evaluate levels of deviation from these clinical guidelines.

Methods: The characteristics of patients and results of HD were assessed for a prevalent cross-sectional sample of around 50% of overall HD population in Serbia (2153 patients, 833 (38.7%) females, aged 18-90 (59±12.5) years, on regular HD for 0.5 to 35 (5.3±5.3) years). Hypertensive nephropathy (26.9%), glomerulonephritis (18.4%) and diabetic nephropathy (13.7%) were the most frequent causes of end-stage renal disease. The percentage of patients whose values failed to meet the targets was determined in the following areas: dialysis dose (Kt/V), anemia (hemoglobin 110 g/L), serum phosphorus (P04), serum calcium (Ca) and iPTH.

Results: The examined patients dialyzed 11.8±1.9 hours/week, most of them on bicarbonate HD and 14.4% on hemofiltration. Intradialytic weight gain varied between 0 and 9 (2.8±1.1) kg, mean systolic blood pressure (BP) was 162.6±21.3 mmHg, diastolic 77±10 mmHg. Mean Kt/V was 1.2±0.3, Hb 102±17 g/L, transferring saturation 30.2±16%, ferritin 565±543 mg/L, Ca 2.3±1.3 mmol/L, P04 1.6±1.6 mmol/L, PTH 459±593 pg/mL. Markers of viral hepatitis were present in 274 (12.7%) patients.

Conclusion: According to this analysis, critical points of HD practice in Serbia include low dialysis dose (42.1%), low Hb level (42.1%), hyperphosphatemia (28.3%) and low (40%) and high (21.5%) iPTH levels. The study suggests large possibilities to improve HD patient care in Serbia.

MP390
REGIONAL CITRATE ANTICOAGULATION USING A CALCIUM –FREE CITRATE – CONTAINING DIALYSATE IN CHRONIC HEMODIALYSIS

Ludvina Lebourg², Christophe Ridel², Hélène De Preneuf³, Frank Le Roy² and Thierry Pettier²
¹CHU Rouen, Rouen, France, ²CHU de Tenon, Paris, France, ³AURA, Paris, France

Introduction and Aims: Regional citrate anticoagulation (RCA) is a classical alternative to heparin use in acute hemodialysis. Its implementation is laborious in chronic hemodialysis.

Methods: This feasibility and safety study described a new simplified RCA technique using a calcium-free citrate-containing dialysate (Image 1). The diffuse transfer of citrate from the dialysate to the blood avoids the requirement of citrate infusion into the arterial line. The adequate infusion rate of calcium into the venous line is precisely determined in real time (according to a kinetic model) by adjusting it to the value of ionic dialysate on-line measured by the dialysis monitor. Fifty sessions with RCA (blood flow rate at 300, 350 and 400 mL/min) and 27 control sessions (in classical hemodialysis with heparin use) were performed in 17 chronic hemodialysis patients. The primary outcome was the success rate (percentage of the sessions finished at the expected time without circuit coagulation).

Results: The success rate was 98% (49 of 50 sessions). All ionized calcium (Ca) at dialyzer outlet were under 0.4 mM (the threshold for effective anticoagulation). The patient iCa increased from 1.00±0.08 to 1.16±0.10 mM (p<0.001) during the session (extreme values [0.84 – 1.38 mM] (Table 1)). Citratemia increased during the session (13.4±13.4 to 52.9±38.9 µM, p<0.001) but the values were always under the pathologic threshold of 130 µM. No citrate side effect was observed. The pH and HCO3- increased (respectively 7.43±0.05 to 7.50±0.05, p<0.001 and 19.9±2.34 to 24.9±2.33 mM, p<0.001) but no severe alkalosis was observed. Comparing sessions at QB = 300 mL/min using RCA (n = 28) and using low molecular weight heparin (n = 27), clotting parameters (venous pressure, transmembrane pressure, coagulation score) in RCA sessions and control sessions were not significantly different. The increase of patient total calcium was similar in the 2 groups. No difference was observed concerning the deparuration parameters.

Conclusion: This new simplified RCA technique in chronic hemodialysis is effective and safe. The development of a system to automatically adjust calcium injection according to the ionic dialysate should allow to implementing this technique in routine clinical practice.

MP391
IN VIVO POTASSIUM AND PHOSPHATE REMOVAL IN A WEARABLE ARTIFICIAL KIDNEY DEVICE

Maarten Wester², Frank Simorini², Jeroen P. Kooman², Walther H. Boer³, Karin G. F. Gortmers¹ and Jaap A. Jolkes¹
¹University Medical Center Utrecht, Utrecht, The Netherlands, ²Nanodialysis BV, Oirschot, The Netherlands, ³Maastricht University Medical Center, Maastricht, The Netherlands

Introduction and Aims: In NEPHRON+, an EU consortium, a wearable artificial kidney device (WAKD) is being developed that can offer prolonged dialysis and increased clearance of toxins. The concept is based on continuous regeneration of a small volume of dialysate. For removal of K⁺ and PO4⁻ ion-exchangers are used. Here we report in vivo results in healthy goats instrumented with the WAKD. We studied efficacy of K⁺ and PO4⁻ adsorption and explored whether equilibration of the ion-exchangers at physiological Ca²⁺/Mg²⁺ and hydropic [NaCl] could prevent Ca²⁺ and Mg²⁺ adsorption and net [Na⁺] release, respectively. Effects on pH and [HCO₃⁻] were studied.

Methods: A sorption unit was incorporated in the dialysate circuit containing 111 g sodium polystyrene divinylbenzene sulfonate (RES-A) and 55 g iron oxide hydroxide (FeOOH) beads for respective K⁺ and PO4⁻ removal. Sorbents were equilibrated and regenerated with a solution containing NaCl, CaCl₂ and MgCl₂. A central venous catheter was inserted in the jugular vein. Blood was pumped (110 mL/min) over a 0.2m² Polyflux dialyzer and dialysate was recirculated (50 mL/min) over the sorption unit in counter current direction. Unfractionated heparin was used for anticoagulation. K⁺ and PO4⁻ removal were estimated from the K⁺ and PO4⁻ extraction across the dialyzer. Plasma total calcium (Ca), total [Mg] and [Na⁺] and arterial pH and [HCO₃⁻] were monitored. 5 experiments were performed in 2 goats.

Results: Cumulative K⁺ and PO4⁻ adsorption were 9.9±1.3 and 6.5±1.5 mmol in 3h, respectively (Fig. A). This is comparable to the adsorption estimated in vitro experiments (10.7±2.1 and 4.7±1.1 mmol, respectively) [Wester ea, NDT 2013]. Adsorption capacity remained constant during consecutive dialysis sessions. [Ca] was stable (Fig. B), but [Mg] showed a slight decline (0.07±0.05 mmol in 3h, p<0.042)

MP388 Table 1 Comparative Costs (Pounds / patient / yr)

<table>
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<th>Conventional</th>
<th>Nocturnal</th>
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<td>Dialysis</td>
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MP389

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Takashi Akiba1 and Michio Mineshima1

Albumin were collected at 0-5 min, 5-10 min, 10-15 min after start of HD treatment.

Methods: Utilizing it. The aim of this study is to develop the more precise dialysis dose monitor, that it is possible that albumin may cause an error particularly in early phase of light having a wavelength of 280nm. However, albumin also absorbs ultraviolet light so monitored by urea-like solute concentration in the spent dialysis fluid using ultraviolet power microscopes (Scanning Electron (SEM) and Atomic Force (AFM)).

Results: By ETRF membrane separation, small molecule concentrations such as urea were not changed, but albumin, β2 microglobulin and α1 microglobulin were removed below detection limit. Difference UV spectrum of before and after separation (Fig.1) had a peak at 280nm, which was referred from albumin, was observed. Output potential measured by prototype spent dialysis fluid photometric monitor was not correlated with albumin concentration. These results indicate that estimation of albumin leakage and improvement of dialysis dose monitor is possible by pretreating of protein removal from spent dialysis fluid.

Conclusions: More precise dialysis dose monitoring and albumin leakage estimation are possible by spent dialysis fluid monitoring technique with a pretreatment of protein removal.

**Preliminary Study of Albumin Leakage Quantification by Spent Dialysis Fluid Monitoring Technique**

Ken-ichiro Yamamoto1, Kei Eguchi1, Shinya Hirakawa1, Jun Murakami1, Takashi Akiba1 and Michio Mineshima1

Tokyo Women’s Medical University, Tokyo, Japan

Introduction and Aims: Recently, dialysis dose during the dialysis treatment is being monitored by urea-like solute concentration in the spent dialysis fluid using ultraviolet light having a wavelength of 280nm. However, albumin also absorbs ultraviolet light so it is possible that albumin may cause an error particularly in early phase of treatment. On the other hand, it may be possible to quantify the albumin leakage by utilizing it. The aim of this study is to develop the more precise dialysis dose monitor, which is also able to estimate albumin leakage by fractionation of spent dialysis fluid.

Methods: Test solution in the spent dialysis fluid containing a relative large amount of albumin were collected at 0-5 min, 5-10 min, 10-15 min after start of HD treatment. Test solutions were fed into the outside of an ultrafilter that is one of endotoxin retentive filter (ETRF). CF-609N, at a flow rate of 500mL/min. By ETRF membrane separation, small molecule concentrations such as urea were not changed, but albumin, β2 microglobulin and α1 microglobulin were removed below detection limit. Difference UV spectrum of before and after separation (Fig.1) had a peak at 280nm, which was referred from albumin, was observed. Output potential measured by prototype spent dialysis fluid photometric monitor was not correlated with albumin concentration. These results indicate that estimation of albumin leakage and improvement of dialysis dose monitor is possible by pretreating of protein removal from spent dialysis fluid.

Conclusions: More precise dialysis dose monitoring and albumin leakage estimation are possible by spent dialysis fluid monitoring technique with a pretreatment of protein removal.
Methods: Multiple measurements with wBIS were performed (Hydra 4200 Xitron Technologies) pre- and post-HD treatment. Whole body ECV was calculated using Xitron equation. Intradialytic change in ECV (ΔECV) equals pre_HD ECV - post_HD ECV. Patients were classified in three groups: 1) control group (CG) no intradialytic hypotensive events, 2) intradialytic decrease in systolic blood pressure group (ASBP ≥20 mmHg) at any time and 3) IDH group as defined as presence of symptoms and of nurse intervention, and decrease of systolic blood pressure ≥20 mmHg (K/DOQI). UFV and UFR were obtained from the dialysis machine. UFR normalized to pre_HD weight (NUFR) was used for analysis. Linear regression models were built to relate NUFR to divergence. Groups were compared by unpaired t-test.

Results: Fifty seven HD patients (34 male, 54.9±13.6 years; Table 1) contributed 736 observations. There were no statistical differences between the control and the ASBP ≥20 mmHg (K/DOQI; p<0.001) respectively. The correlation coefficients (R²) between NUFR and divergences were 0.38 (p=0.0001), 0.42 (p=0.0001) and 0.30 (p<0.001) respectively.

Conclusions: This study shows that increasing UFR influences the accuracy of whole body bioimpedance measurement. Apparent underestimation of intradialytic change in ECV using wBIS at high UFRs is due largely to removal of plasma water from the central body compartment (trunk) as a result of different resistance/volume ratios in trunk and limbs. Larger decreases in the trunk ECV than in the limbs is accompanied by little increase in the trunk resistance and therefore of less increase in whole body resistance. This result in increasing divergence with more severe IDH during HD was associated with relatively higher UFRs than in control group so that a larger divergence was observed in IDH group. Measurement of the divergence may be useful to predict IDH during HD treatment.

Introduction and Aims: Generally accepted quantitative criteria of HD efficiency such as Kt/V are based upon the kinetic modeling of uremic markers, mainly single-pool and double-pool models of urea kinetics. At the same time very few experimental methods are available for the study of uremic markers elimination during HD treatment. Most of them involve taking numerous (minimum 5–7) blood samples and total dialyze collection [1], which is impractical, time consuming and not well for patients. In our opinion a more useful approach to this problem is to monitor the concentration of basic uremic markers in effluent dialysate with special sensors connected to the outlet of a dialysis machine.

Methods: In this research we used a dual-wavelength optical spectral sensor based on ultraviolet (UV) light-emitting diodes (wavelengths 262 and 287 nm) for online monitoring of uric acid (UA) concentration in effluent dialysate during HD. The sensor allows to measure the time profiles of UA concentration Cau(t) with extremely high temporal resolution (down to 5 sec). It should be noted that UA was chosen as having the strongest UV absorption among low-molecular weight waste products, and we relied upon the fact that the kinetics of uric acid elimination during HD is similar to the kinetics of conventional uric markers such as urea and creatinine.

Results: The time profiles of UA concentration were measured for the group of 10 patients with the help of the sensor. For validation the samples of effluent dialysate were taken at 0, 30, 60, 150 and 240 min of HD and lab tests for UA were carried out; the relative error was less than 10%. For all patients the concentration curves (Fig. 1) were fitted according to the double-pool model by the function Cau(t)=A1 exp(-t/τ1) + A2 exp(-t/τ2)+A3 and according to the single-pool model. In all cases the double-pool model gave much better approximation of the experimental data. The constant τ1 that reflects the transfer of low-molecular weight substances through the membrane was in the 90–150 min interval for different patients; the constant τ2 that reflects the intercompartment transfer was in the 5–35 min interval. These values correspond well with the results reported by other researchers using conventional methods [1]. All constants, including A3 that defines UA generation rate, were calculated from the sensor data, no additional blood samples were needed. Fig. 1. The time profile of UA concentration in effluent dialysate measured with the help of the dual-wavelength sensor, results of the lab tests for UA and curve fitting according to the two-pool model for one of the patients.

Conclusions: The presented method and the optical sensor have been proved to be simple, safe, comparatively low-cost and very effective to study the kinetics of UA. Uremic markers other than UA could be investigated using this approach if a different set of working wavelengths and a spectral algorithm is used [1]. Burgelman M., Vankholder R., Fostex R., Ringoir S. Estimation of parameters in a two-pool urea kinetic model for hemodialysis. Med. Eng. Phys. 1997; 19: 69-76.
ECW/TBW INDEX IS RELIABLE PARAMETER FOR DRY WEIGHT MONITORING IN HEMODIALYSIS PATIENTS

Mariusz Kuszta1, Tomasz GołąbBoskiewski1, Krzysztof Letachowicz1, Przemysław Konishiński2, Grzegorz Witkowski2, Paweł Poznański3, Wacław Weyde1 and Marian Klinger1
1Wroclaw Medical University, Wroclaw, Poland, 2Fresenius Nephro Care, Wroclaw, Poland, 3University Hospital, Wroclaw, Poland

Introduction and Aims: Achieving desired dialysis adequacy parameters like Kt/V as well as proper dry weight (DW) to control volemia are important goals in hemodialysis (HD). Bioimpedance analysis (BIA) has been proposed as an accurate way for estimating DW, however among many generated output data, like resistance (R), TBW etc, no single parameter has been recommended. Recently combination of biochemical and bioimpedance parameters like Kt/V (R at 50 kHz) has been proposed as better single index of adequacy.In this study, we aimed to monitor BIA parameters reflecting body fluid and DW in hemodialysis patients without clinical features of overhydration during 6 month follow-up to identify the most reliable single parameter.

Methods: Since Jan 2012 to Jan 2014 in two HD centres (one academic and one commercial) 317 pts were on standard HD program (high-flux, 3x a week) for more than 6 months. Among them 28 uremic patients (18 F; 10 M) with mean age 64.5±11.1 y, meeting follow-up inclusion criteria: lack of clinical signs of hypervolemia (no congestion or edemas), pre-HD blood pressure <150/90mmHg, maintained diuresis, lack of malnutrition, interdialytic weight gain <0.5kg and repeated BIA measurement during 6 months. Each patient was evaluated before HD session every 6 weeks by means of BIA measurement using portable apparatus BCM (Fresenius) and presence of symptoms of fluid overload (ECW/TBW index). Hidden subclinical fluid overload was noticed in BIA within 6 months since ECW, TBW, DBP slightly raised while BMI declined. Usefulness of Kt/V could be questionable due to observed variations of resistance.

Results: The frequency of intra-dialysis hypotension and the degree of subjective symptoms were not changed. The nutritional status was well maintained in all follow-up periods in spite of aging. The calculation of aortic arch was worsened with time during observation period. However, the calculation rate was decelerated after the dialysate switch to AF (AoACS score change rate: 1.04%/year vs. 0.60%/year).

**MP400**

**THE ISOVOLUMETRIC CIRCUIT EXCHANGE DURING CRRT IN SMALL CHILDREN**

Jolanta Sołtyśiak1, Alfred Warzywooda2, Anna Musielak2, Danuta Ostalska-Nowicka2 and Jacek Zachwieja2

1Poznan University of Medical Sciences, Poland, Poland, 2Poznan University of Medical Sciences, Poland, Poznanski4326, Poland

**Introduction and Aims:** Continuous replacement therapy (CRRT) is the treatment of choice for supporting critically ill pediatric patients. It allows continuous and programmed fluid and toxin removal. However in very small children, at the time of initiation of the therapy, as well as, during multiple circuit changes, many life threatening complications may occur like hypotension, cardiac instability and bradykinin release phenomenon. Circuits exchanges may also lead to blood loss, over- or dehydration which may further negatively influence final patient survival. In small children, the programmed circuit exchange is accompanied by full or partial blood return which may lead to acute overhydration, hypertension, cardiac arrest or pulmonary oedema. Shortly after the following reconnection the situation reverses, and is characterized by acute hypotension, dehydration or hemodilution. It may lead to blood loss and will require more blood transfusion or circuit priming with blood. To reduce previously mentioned complications we recommend the isovolumetric circuit exchange protocol, which is of great importance especially in small children on CRRT.

**Methods:** The isovolumetric circuit exchanges, which implemented the simultaneous blood return and new circuit refilling (Prismaflex, Gambro), was performed in our Pediatric Dialysis Center in almost 15 children for a total of 40 exchanges. The patients were from 6 days to 12 months old, with body weights less than 10 kg. In neonates weighing less than 5kg, the two central catheters were used with minimum size 22G for arterial access, and 18G for venous access. In elder patients the double-lumen accesses were used. The circuit-to-circuit exchange technique was achieved by transferring blood from the patient to a new CRRT system while blood from the current CRRT system was returned to the patient. Both machines are started simultaneously with identical blood flow rates and identical circuit volumes, which results in an isovolumetric exchange. The data are reported as the mean ± standard deviation (SD). The continuous variables were tested using the analysis of variance (ANOVA) with Tukey post hoc test.

**Results:** The complete exchange was occurred in several minutes, with the longest duration amounting to 3 minutes, depending on total circuit volume and catheter flow capabilities. The mean arterial pressure (MAP) during circuit-to-circuit exchange is shown in table 1. There were not any significant changes in MAP values before and after CRRT starting. The heart rate was also stable. No patient required additional administration of catecholamines. The additional blood transfusion was not needed. Conclusions: The circuit-to-circuit exchange procedure is very smooth, easy and safe and has no influence of patient cardiac stability and does not require any increase in vasoactive drug dose. This exchange method limits the time the patient is without hemofiltration, prevents the need for additional exposure to donor red blood cells, and reduces hemodynamic instability at the initiation of CRRT. We recommend the isovolumetric circuit exchange protocol as a method of choice in programmed circuit exchange procedure during CRRT in small children.

**MP401**

**THE ISOVOLUMETRIC CIRCUIT EXCHANGE DURING CRRT IN SMALL CHILDREN**

**MP402**

**DO WE NEED STDKT/V?**

Tugce Goeksel1, Hervé Garnier1, Maria Fitzterfield1 and Helmut Mann1

1Institute for Applied Nephrology E.V. (INTERNEPH), Aachen, Germany

**Introduction and Aims:** Kt/Vvurea as a measure of dose of dialysis (normal value > 1.2), is calculated using approximation formulae which have been derived from a mid-week two days mid-week day cycle, formal kinetic model (Gotch,), which only is applicable for 3 dialysis sessions/week. Since in 5 - 25% of the patients frequency of dialysis sessions is different from 3 times/week, it is a matter of debate how Kt/V in those patients on regular artificial kidney therapy should be evaluated. For this purpose several new short formulae called standard Kt/V (stdKt/V) have been proposed with normal values > 2.0.

**Methods:** The formal urea two compartment kinetic model of Stiller calculates Kt/V based on a weekly cycle and therefore is independent from the frequency of dialysis sessions/week and inter-dialytic time interval. The Stiller model also provides data on protein catabolic rate (PCR), time average concentration (TAC) and on prescribed vs delivered clearance. In this study 5 dialysis sessions/week. For any frequency of dialysis sessions/week dose of dialysis therapy in terms of Kt/Vurea (recommended dose >1.2), should be calculated using formal urea kinetics based on a weekly cycle instead of using approximation formulae which are dependent on the inter-dialytic time interval and only are valid for 3 dialysis sessions/week.

**Results:** In 3x4 h dialysis Kt/V-Stiller and spKt/V are 1.44 and 1.45. StdKt/V is 1.98 (Ley) and 2.10 (FHIN). In 6x2 h dialysis Kt/V-Stiller is 1.58, spKt/V is 0.85 and stdKt/V is 2.90 (Ley) and 2.99 (FHIN) respectively. In the Stiller model PCR is 1.00 and 1.14 (g/kg x day) and TAC 14.95 and 15.15 mmol/l. In 3x4h and 6x2h circuit formal kinetics corresponds to delivered clearance.

**Conclusions:** For any frequency of dialysis sessions/week dose of dialysis therapy in terms of Kt/Vurea (recommended dose >1.2), should be calculated using formal urea kinetics based on a weekly cycle instead of using approximation formulae which are dependent on the inter-dialytic time interval and only are valid for 3 dialysis sessions/week.

**MP403**

**BIOLOGICAL MAPPING OF HEMODIALYSIS INSTALLATION USING CLEAR D-TECT™, A NEW GENERATION BIOLUMINESCENCE METHOD**

François Babinet1, Bénédicte Allard1, Velianaodorovas, Céline Hamont1 and Rachida Begri1

1Établissement de Santé ECHO, Nantes, France, 2Gambro Hospal SAS, Meyzieu, France

**Introduction and Aims:** Microbiological control in dialysis fluids is performed using culturing on poor nutrient media such as R2A with incubation time of 7 days at 20°C. Samples should be sent within 72h, refrigerated to a laboratory for microbiological testing. Hemodialysis centers in remote regions have difficulty for getting validated...
microbiological results, as sample transport requires more than 72h. Additionally, bacterial culture delays availability of results. Faster on-field methods for assessment of microbial contamination can be useful in hemodialysis centers. 2nd generation biomembrane sensors allow real time surveillance of microbial contamination in water systems. Based on quantification of cellular ATP, Clear D-tek™ kit (Luminultra Ltd, distributed by Gambro Hospital) for ultrapure water analysis, quantifies total living and non culturable microorganisms. The sensitivity of the method provides quantitative results even for ultrapure fluids with undetectable culturable bacteria. Results are obtained in less than 10 minutes on-site. Oversea hemodialysis center is supported by telemedicine for medical surveillance and technical expertise on existing equipment. Having no possibility to get microbiological results in time for opening the new center, the use of Clear D-tek method was proposed for microbial investigation of the dialysis fluids production and distribution. This work presents results from microbiological investigations performed during 3 months using Clear D-tek method for on-site monitoring of dialysis fluids quality.

Methods: Dialysis fluids samples are collected from different points of the water treatment installation and the dialysate after first and second ultrafiltration. Samples are analyzed within the dialysis center immediately after collection using Clear D-tek kit. The method is based on the measurement of cellular ATP (cATP) on 30ml of fluid. After calibration, cATP results are expressed in pg/ATP/ml and are used as indicators of the total living bioburden of the sample. Microbial investigations were repeated during a 3 months period after starting operation of the dialysis installation.

Results: After a first complete chemical disinfection of the installation, microbial analysis were performed on different points of the pretreatment, the reverse osmosis distribution loop and the dialysate after first and second ultrafiltration. Results showed logic evolution of microbial flora within the dialysis production and distribution chain with significant microbial content in the pretreatment and a quantifiable decrease in the dialysate after first and second ultrafiltration. For a first time, the decrease of microbial content between the 2 filters on the dialysate could be demonstrated using a microbiological analysis tool, which confirms the efficiency of the additional ultrafilter. Repeatability of results was observed during the surveillance. Introduction of chlorination in the hospital water network introduced a 1 logarithm reduction in the microbial load in the pretreatment.

Conclusions: Microbiological analysis using Clear D-tek kit is a useful tool for on-site monitoring of microbial contamination in ultrapure water production and distribution systems in dialysis. This technology showed reliable and reproducible results and confirmed the possibility to use the installation in case of urgency, while waiting culture results. The methods demonstrated the interest of the second ultrafilter on dialysate. Increased sensitivity of the method is providing interesting information on microbial content in ultrapure fluids, not studied until now.

Abstracts
Nephrology Dialysis Transplantation

**Abstract MP404**

**THE CLINICAL SIGNIFICANCE OF FACTOR XI A MEASUREMENTS IN HEMODIALYSIS PATIENTS, THE FAX HD STUDY**

Mije Dekker1, M Taks1, Cjorn Konings1 and V Scharnhorst1
1 Catharina Hospital, Eindhoven, The Netherlands

**Introduction and Aims:** To prevent coagulation of the extracorporeal circuit, dalteparine (low molecular weight heparin) is administered to hemodialysis patients at the start of every dialysis. Dalteparine dosages are based on target weight, under 50kg: 2500 IE and above 5000 IE, and adjusted to the occurrence of clinical events. The desired anti-Xa activity at 15 minutes is between 0.5-1.0 IU/L. The aim of this study was to determine the percentage of patients who reaches desirable anti-Xa activity, and the relation between non-therapeutic anti-Xa values and clinical events.

**Methods:** In this prospective study, anti-Xa, APTT and PT were measured before and after dialysis and 15 minutes after dalteparine administration. Dialysis characteristics, medication use, target weight and clinical events (coagulation or bleeding) were scored.

**Results:** We included 109 hemodialysis patients, of which 53% reached the desired anti-Xa values between 0.5-1.0 IU/L. The highest subtherapeutic percentages (60%) was observed in the 1250 IE dalteparine group. A correlation was observed between higher anti-Xa values and higher dalteparine dosages. The higher dalteparine dosages were not related with a higher percentages of patients reaching a desirable anti-Xa activity, only with a higher percentage of patients with an anti-Xa activity above the therapeutic range.

**Conclusion:** Dalteparine dosages are highly variable among hemodialysis patients, with only 53% of patients in the therapeutic range. If anti-Xa activity guided dalteparine dosage leads to a higher percentage of patients within the target range, needs to be determined in further research studies.

**Abstract MP405**

**NO EXTRACELLULAR SUPEROXIDE DISMUTASE (EC-SOD) RELEASE WITH HEPARIN-GRAFTED HEMODIALYSER MEMBRANE**

Jacek Borawski1, Joanna Gozińska-Lapinska1 and Beata Naumki1
1 Medical University, Białystok, Poland

**Introduction and Aims:** EC-SOD is a potent protective and antioxidant enzyme assembled in a large amount with glycosaminoglycans of the vascular wall. It is released from the endothelial stores by heparin, which may be potentially harmful to blood vessels. We evaluated the influence of heparin-free dialysis on plasma EC-SOD activity during a single HD session in comparison to a standard HD procedure.

**Methods:** 19 clinically stable patients on chronic 3 x a week HD for at least 4 months were enrolled in this crossover study. First HD session was performed with single-use low flux polysulfone membranes and a traditional bolus of enoxaparin at an iv dose of 0.54 (0.29 - 0.73) mg/kg. After a week, another HD session was performed in the same subjects with the use of the surface-treated dialyzers with unfractioned heparin-grafted polyacrylonitryle membrane. HD (T0), after 10 min (T10) and 120 min (T120) of its duration. Plasma EC-SOD was quantified with a novel Detect® Superoxide Dismutase (SOD) Colorimetric Activity Kit, Arbor Assays, USA.

**Results:** Plasma EC-SOD activity during enoxaparin HD changed and was: T0 0.74 ± 0.24 U/ml, T10 1.06 ± 0.40 U/ml, T120 0.91 ± 0.30 U/ml (ANOVA p = 0.012, F = 4.77); at T10 it was 43% higher than at T0 (Scheffe p = 0.013). The percentage increment T10 vs T0 was not associated with the heparin type: heparin-grafted polyacrylonitrile membrane dosage (Pearson r = -0.088, p = 0.721), EC-SOD remained stable during HeprAN HD. T0 0.69 ± 0.24 U/ml, T10 0.68 ± 0.17 U/ml, T120 0.64 ± 0.16 U/ml, ANOVA p = 0.317, F = 1.17.

**Conclusions:** Avoidance of systemic enoxaparin administration during HD procedures employing heparin-grafted HeprAN membrane may help to preserve the endothelial stores of the antioxidant and vasculoprotective enzyme EC-SOD.

**Abstract MP406**

**EARLY ESTIMATION OF PLASMA CONDUCTIVITY (PC) IN DIALYSIS PATIENTS: CORRELATION WITH SODIUM (SNA+) AND POTASSIUM (SK+) SERUM LEVELS**

Carlo A Lodi1, Alessandro Surace1, Elena Grandi1, Paolo Rovatti1, Elena Mancini1 and Antonio Santoro2
1 Gambro Dacso SpA, Medolla, Italy, 2 Sant’Orsola-Malpighi Teaching Hospital, Bologna, Italy

**Introduction and Aims:** Dialysis fluid composition may influence the treatment outcome, the body fluid distribution and accordingly the achievement of a correct dry body weight in hemodialysis (HD) patients. Hypertonic dialysis fluid will cause intracelluar dehydration with consequent increase in vasopressin release and thirst perception, resulting in a greater inter-dialytic weight gain and hypertension. On the contrary, hypotonic dialysis fluid will cause a water shift in the intracellular pool, hypovolemia and hypotension risk. The estimation of the plasma composition at the beginning of the HD session may be a great support for a correct dialysis fluid prescription. Unfortunately, in dialysis centers the initial serum concentration of the main ions can be estimated only by external instruments. We conceived a new method for an early estimation of PC by the dialysis machine itself. In order to evaluate the effectiveness of this estimation, the correlation between estimated PC and sNa+ and sK+ concentrations measured before treatment start was evaluated.

**Methods:** The patient initial PC was empirically estimated by a formula based on blood flow and dialysis fluid flow and conductivity upstream and downstream the dialyzer as soon as the diffusion process is stable. We retrospectively analyzed data from 250 HD sessions executed in 2012 and 2013 on 25 patients (mean age 74±11 years) at Sant’Orsola Malpighi Hospital. For each session pre dialysis sNa+ and sK+ were measured by means of an ion selective electrode. The initial PC was estimated by applying a posteriori the new proposed method on treatment data automatically stored by the machine. A regression analysis was conducted in order to evaluate the relationship between estimated PC, sNa+ and sK+. A Bland-Altman plot was finally applied to highlight possible estimation errors bias and to show 95% confidence interval of such errors.

**Results:** Relationship between PC and sNa+ and PC and sK+ are shown in Figure 1 and 2, respectively. The correlation resulted quite high for both sNa+ (R² = 0.75) and (sNa+ + sK+) (R² = 0.79). The concentrations' estimation error was not biased, with a null mean value and with 95% confidence intervals equal to ±3.36 mmol/l for sNa+ and ±3.13 mmol/l for (sNa+ + sK+).

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Conclusions: Early detection of the initial PC value, obtained after few minutes from diffusion process start without any manual intervention, allows minimizing plasma toxicity variation and is representative of the patient initial status. The calculated PC correlates very well with nSNa and nSk and the estimation errors are comparable with the accuracy of the instrumentation used to measure the benchmark values of these concentrations. The contemporary use of the two presented estimators could be useful to evaluate initial nSNa and nSk and to personalize the dialysis prescription consequently.

Methods: (1) The subjects were 7 patients on maintenance dialysis. An MFX-21U high-performance hemofilter was used, and the basic conditions were blood flow (QB) 250 ml/min, total dialyse flow rate (Qd) 600 ml/min, replacement fluid volume 50 L/s, and HDF for 4 h. We compared the β2-MG and s1-MG removal rates, amount of Alb leakage, and IS and Cres removal rates when 6 patterns were used: 1) an increase (in QB to 300 ml/min), (2) an increase in replacement fluid volume to 70 L/s, (3) performance of HDF for 5 h, (4) an increase in membrane area (2.1 to 2.5 m²), (5) performance of HDF with 5 L/s of replacement fluid, and 6) performance of post-HDF with 10 L of replacement fluid. (2) The subjects were 8 patients on maintenance hemodiafiltration, and we compared IS removal efficiency at a QB of 300 ml/min when HDF was performed using an ordinary circuit and an extended circuit.

Results: (1) Under the basic conditions the IS removal rate was 50.8 ± 5.1% and the Cres removal rate was 46.5 ± 7.5%. No significant increase in either the IS or Cres removal rate was seen when the conditions were changed by increasing QB, increasing the replacement fluid volume, prolonging the duration of HDF, increasing membrane area, etc. The IS removal rate at the pre-dilution replacement fluid volume of 5 L was 43.8 ± 7.3%, and the difference was significant (difference in Alb leakage: 50 L: 4.1 ± 5 L: 2.4 g). (2) When the ordinary circuit was used, the IS removal rate was 50.0 ± 8.0% and clearance was 33.8 ± 5.1 ml/min; with the extended circuit the IS removal rate was 49.6 ± 7.7%, and clearance was 36.6 ± 8.0 ml/min. There was a fairly large difference in clearance, but it was not significant. Alb leakage was 3671 mg with the ordinary circuit and 3423 mg with the extended circuit.

Conclusions: There is a statistically significant positive correlation between the removal performance of IS and the amount of albumin leakage. After changing the treatment method which used an extended circuit, the removal rate of IS was unchanged, but the IS clearance showed a 3.2% difference. The difference, however, was statistically insignificant. The fact that there was a difference in IS clearance by the two methods suggested that there is an adsorbed form of IS in the blood that readily separates from Alb and an adsorbed form of IS that does not readily separate from Alb.

MP408
ASSESSMENT OF REMOVAL EFFICACY OF PROTEIN-BOUND UREMIC TOXINS BY PRE-DILUTION ON-LINE HEMODIAFILTRATION
Kenji Sakurai1, Takeshi Saito1, Hiromi Hosoya, Fumi Yamauchi1, Takayoshi Kurihara1, Yumi Tanibayashi1 and Nohoko Ikebe1
1Hashimoto Clinic, Sagamihara Kanagawa, Japan

Introduction and Aims: About 95% of the protein-bound uremic toxins indoxyl sulfate (IS) and p-cresol (Cres) are bound to albumin (Alb), and it is difficult to remove them efficiently by dialysis. In this study we assessed the removal efficiency of IS and Cres by pre-dilution on-line hemodiafiltration (HDF) by changing various dialysis conditions. We also assessed the effectiveness of extending the dialysis circuit before the filter on the removal of IS. The purpose of extending the circuit before the filter and adding a chamber to create a double chamber was to prolong the time during which the blood was diluted with the replacement fluid and improve the mixing effect. Doing so was expected to increase the Alb and IS dissociation rate, and to improve the IS removal efficiency of HDF.

Methods: (1) The subjects were 7 patients on maintenance dialysis. An MFX-21U high-performance hemofilter was used, and the basic conditions were blood flow (QB) 250 ml/min, total dialyse flow rate (Qd) 600 ml/min, replacement fluid volume 50 L/s, and HDF for 4 h. We compared the β2-MG and s1-MG removal rates, amount of Alb leakage, and IS and Cres removal rates when 6 patterns were used: 1) an increase (in QB to 300 ml/min), (2) an increase in replacement fluid volume to 70 L/s, (3) performance of HDF for 5 h, (4) an increase in membrane area (2.1 to 2.5 m²), (5) performance of HDF with 5 L/s of replacement fluid, and 6) performance of post-HDF with 10 L of replacement fluid. (2) The subjects were 8 patients on maintenance hemodiafiltration, and we compared IS removal efficiency at a QB of 300 ml/min when HDF was performed using an ordinary circuit and an extended circuit.

Results: (1) Under the basic conditions the IS removal rate was 50.8 ± 5.1% and the Cres removal rate was 46.5 ± 7.5%. No significant increase in either the IS or Cres removal rate was seen when the conditions were changed by increasing QB, increasing the replacement fluid volume, prolonging the duration of HDF, increasing membrane area, etc. The IS removal rate at the pre-dilution replacement fluid volume of 5 L was 43.8 ± 7.3%, and the difference was significant (difference in Alb leakage: 50 L: 4.1 ± 5 L: 2.4 g). (2) When the ordinary circuit was used, the IS removal rate was 50.0 ± 8.0% and clearance was 33.8 ± 5.1 ml/min; with the extended circuit the IS removal rate was 49.6 ± 7.7%, and clearance was 36.6 ± 8.0 ml/min. There was a fairly large difference in clearance, but it was not significant. Alb leakage was 3671 mg with the ordinary circuit and 3423 mg with the extended circuit.

Conclusions: There is a statistically significant positive correlation between the removal performance of IS and the amount of albumin leakage. After changing the treatment method which used an extended circuit, the removal rate of IS was unchanged, but the IS clearance showed a 3.2% difference. The difference, however, was statistically insignificant. The fact that there was a difference in IS clearance by the two methods suggested that there is an adsorbed form of IS in the blood that readily separates from Alb and an adsorbed form of IS that does not readily separate from Alb.
to a protocol and calcium-free dialysate/infusate with reduced bicarbonate (28 mmol/L) was used. Systemic ionized calcium was checked regularly during the procedure (target above 0.9 mmol/L). The sodium and blood gas analysis was checked before and after the procedure. Administration of calcium was assessed by postdialyzer ionized calcium (target range 0.2–0.4 mmol/L) and visually after the procedure at dialyzer and both bubble traps on a (total clotting) to (no clotting) scale.

Results: 48 BHD (mean blood flow 247.28 ml/min), 48 postdialysis HDF (mean blood flow 296.15 ml/min) and 29 predialysis HDF (mean blood flow 281.140 ml/min) were performed. 15% citrate infusion rate was 47±5 ml/h in BHD, 46.7±5 ml/h in pre-HDF and 45±8 ml/h in post-HDF (p = NS). Less calcium substitution was needed in BHD (4±2 ml/h) as compared to pre-HDF (16±2 ml/h, p < 0.05) and post-HDF (16 ±2.6 ml/h, p < 0.05). Systemic ionized calcium was stable in all groups. There was a significant rise in pH, bicarbonate and sodium after the procedure in all groups, but no alkalosis (pH>7.5) or hypernatremia was observed. pH after the procedure was significantly lower in BHD (7.4±0.05) compared to pre- and postdialysis HDF (7.4±0.07 and 7.45±0.05, p < 0.01). No significant side effects were observed. Postdialyzer ionized calcium was within the target range in all groups (0.28±0.04 mmol/L in BHD, 0.32±0.05 mmol/L in pre-HDF, 0.3±0.04 mmol/L in post-HDF, p = NS). Visual anticoagulation assessment scores were similar in all groups (median value 5, interquartile range 0 for all groups).

Conclusions: Regional citrate anticoagulation using 15% citrate and calcium-free dialysate is feasible in HDF as well as in BHD in chronic dialysis patients and provides similarly good antithrombotic effect and safety. However, more calcium has to be added in HDF, but acidiosis is better corrected, probably due to the effect of infuse.

**MP411** EVALUATION OF CLEAR D-tect™ BIOLUMINESCENCE METHOD: A NEW CHEMICAL TOOL TO MONITOR IN 10 MINUTES THE MICROBIAL QUALITY OF HEMODIALYSIS WATER

Elisabeth Vanner1, Eodie Mattio1, Veliana Todorova1, Alan Ragon2 and Philippe Brunet1
1CHU Marseille, Marseille, France, 2CHU Marseille, Marseille, France, 3Gambro Hospita, Meyzieu, France.

Introduction and Aims: Microbial quality of dialysis water is monitored with 2 indicators: bacterial endotoxins levels and culture of bacteria. Plate counting is the standard method to estimate the number of viable cells present in the water sample, expecting that bacteria can give rise to CFU (Colony Forming Unit) under specific conditions of nutrient medium, temperature and time. Unfortunately there is no culture medium, temperature and time suitable for all bacteria. For these reasons the numbers of CFU underestimate the microbial contamination. Furthermore an incubation time of 7 days is recommended. Safety management of microbial risk requires a reliable and fast method to detect a microbial contamination of dialysis water. A new kit Clear D-tect based on bioluminescence measurement of ATP (Adenosine TriPhosphate) is an alternative technique to rapidly detect viable bacterial cells in ultrapure water samples.

Methods: ATP is a molecule of energy storage in all living cells. Concentration of ATP in water samples is a good indicator of total living microbial flora contamination. In water samples was evaluated. The method is based on the filtration of water sample through a small single use filter to collect bacteria and eliminate extracellular ATP. From the samples was evaluated. The method is based on filtration of water sample through a small single use filter to collect bacteria and eliminate extracellular ATP. Clear D-tect kit adapted for ATP measurement in ultrapure water produces photons of light. The bioluminescence signal measured by a luminometer can be calibrated using an ATP calibration reagent. The bioluminescence signal measured by a luminometer can be calibrated using an ATP calibration reagent. Clear D-tect kit seems to be a good indicator of bacterial flora in dialysis installations. It is a safe method of the assessment of carbohydrate metabolism in HD pts and step to optimize therapy in this group.

**Conclusion**: ATP measurements were not significantly different with 50 or 100 mL of water samples or regarding the 2 concentrations of luminase used. Very good linearity installation was performed.

**Results**: 48 BHD (mean blood flow 247.28 ml/min), 48 postdialysis HDF (mean blood flow 296.15 ml/min) and 29 predialysis HDF (mean blood flow 281.140 ml/min) were performed. 15% citrate infusion rate was 47±5 ml/h in BHD, 46.7±5 ml/h in pre-HDF and 45±8 ml/h in post-HDF (p = NS). Less calcium substitution was needed in BHD (±2 ml/h) as compared to pre-HDF (16±2 ml/h, p < 0.05) and post-HDF (16 ±2.6 ml/h, p < 0.05). Systemic ionized calcium was stable in all groups. There was a significant rise in pH, bicarbonate and sodium after the procedure in all groups, but no alkalosis (pH>7.5) or hypernatremia was observed. pH after the procedure was significantly lower in BHD (7.4±0.05) compared to pre- and postdialysis HDF (7.4±0.07 and 7.45±0.05, p < 0.01). No significant side effects were observed. Postdialyzer ionized calcium was within the target range in all groups (0.28±0.04 mmol/L in BHD, 0.32±0.05 mmol/L in pre-HDF, 0.3±0.04 mmol/L in post-HDF, p = NS). Visual anticoagulation assessment scores were similar in all groups (median value 5, interquartile range 0 for all groups).

Conclusions: Regional citrate anticoagulation using 15% citrate and calcium-free dialysate is feasible in HDF as well as in BHD in chronic dialysis patients and provides similarly good antithrombotic effect and safety. However, more calcium has to be added in HDF, but acidiosis is better corrected, probably due to the effect of infuse.

**MP412** EVALUATION OF STANDARD UREA K/T FOR FREQUENT HAEMODIALYSIS PRESCRIPTIONS

John K Leyoldt1, Angelito Bernard1, Matt Muller2, Thomas C Marbury3 and Bruce F. Culleton1
1Baxter Healthcare Corporation, Deerfield, IL, 2Baxter Healthcare Corporation, Round Lake, IL, 3Orlando Clinical Research Center, Orlando, FL.

Introduction and Aims: European Best Practice Guidelines on dialysis strategies (Tattersall et al, Nephrol Dial Transplant 2007) suggest monitoring weekly standard urea K/T (stdKt/V) to determine the adequacy of haemodialysis (HD) treatments when prescribed more frequently than thrice weekly. KDOQI guidelines (National Kidney Foundation, Am J Kidney Dis 2006) suggest calculating stdKt/V from either single-pool urea K/T (spKt/V) or equilibrated Kt/V; however, recent work has suggested more accurate equations for calculating both spKt/V and stdKt/V during frequent HD prescriptions. We determined the significance of using more accurate equations for calculating spKt/V and stdKt/V during HD applied 4 times per week.

Methods: Values of spKt/V and stdKt/V were repeatedly evaluated by measurement of pre-dialysis and post-dialysis urea concentrations (N=135) during an 8 week clinical trial in 20 patients. Net ultrafiltration volume was assessed by the difference between pre-dialysis and post-dialysis body weight. spKt/V and stdKt/V were first calculated using equations suggested by KDOQI guidelines; alternatively, these values were also calculated using more accurate equations for spKt/V (Daugirdas et al, Nephron Dial Transplant 2013) and stdKt/V (Daugirdas et al, Kidney Int 2011), respectively.

Results: The patients (11 M, 9 F) were 50±8 (mean±standard deviation) years of age and had a post-dialysis body weight of 81±17.3 kg. Net ultrafiltration volume was 2.5±1 L, treatment time was 4.0±1.2 h, and pre-dialysis and post-dialysis urea concentrations were 18.8±6.0 and 5.7±2.6 mmol/L, respectively. Values of spKt/V when calculated using equations suggested by KDOQI guidelines and more accurate equations were 1.47±0.29 and 1.49±0.36, respectively. Values of stdKt/V when calculated using more accurate equations suggested by KDOQI guidelines and more accurate equations were 2.97±0.30 and 3.04±0.31, respectively. Use of the equations suggested by KDOQI guidelines underestimated stdKt/V by 0.07±0.02 or 2.3±0.3%.
Conclusions: The use of equations suggested by KDOQI guidelines for calculating spKt/V and stdKt/V underestimate the true values. The clinical significance of using more accurate equations is modest during HD applied 4 times per week.

MP413 ASSESSMENT OF CORRELATION BETWEEN DIALYSIS NORMALIZED WITH LIVER VOLUME (KT/LV) AND HIGH METABOLIC RATE ORGAN MASS (KT/HMRO MASS) WITH DIALYSIS DOSE NORMALIZED WITH UREA DISTRIBUTION (KT/V) IN HEMODIALYSIS PATIENTS

Abbas Ali Zeraati1, Reza Hekmat1, Hamid Reza Reyhani2 and Farzaneh Sharifipoor3
1 Mashhad University of Medical Sciences, Mashhad, Iran, Islamic Republic of, 2Kidney Transplantation Complications Research Center, Mashhad, Iran, Islamic Republic of, 3Kidney Transplantation Complications Research Center, M, Iran, Islamic Republic of

Introduction and Aims: 

In this study, we determined the dialysis dose (Kt) based on liver volume (LV) and high metabolic rate organ mass (HMRO) and evaluated their correlation with dialysis dose normalized with area distribution volume (V) in hemodialysis patients.

Methods: At first Kt/V was calculated in 80 patients undergoing hemodialysis, then Kt (HMRO) and Kt (V) were obtained by Kt/V multiply with LV, HMRO and V, respectively. We also computed Kt/LV and Kt/HMRO. Pearson’s correlation analysis was used for determining correlation between variables.

Results: There were a significant positive correlation between Kt/V with LV (P = 0.0001, r = 0.86) and HMRO (P = 0.0001, r = 0.96) and a reverse correlation between Kt/V with LV and HMRO. Pearson’s correlation analysis showed a significant positive correlation between Kt/V with Kt (V) (P = 0.0001, r = 0.86), Kt (HMRO) (P = 0.0001, r = 0.94), and Kt (LV) (P = 0.0001, r = 0.90). There were a significant positive correlation between Kt/V with Kt (HMRO) (P = 0.0001, r = 0.98) and Kt (LV) (P = 0.0001, r = 0.97) (Figures1&2)

Conclusions: The results of research showed a strong direct correlation between Kt/V with (Kt/LV). Kt (HMRO), Kt (HMRO) and Kt (LV) indicating that biological variables LV and high HMRO might be appropriate for normalization of Kt.

Introduction and Aims: It is estimated that more than 1.2 million people worldwide suffer from end-stage renal disease (ESRD) frequently associated with the uremic syndrome that leads to an increase in the morbidity and mortality rate. Although the pathophysiological process is not completely understood, the retention of a high number of toxic compounds (s solutes) normally eliminated by healthy kidneys, seems to play an important role. Uremic toxins represent an heterogeneous group of substances which includes organic compounds and peptides both in their “native” form and modified by post-translational modifications. It is known that middle and high MW solutes play a key role in the uremic syndrome. However, standard HDF membranes are unable to deplete solutes with MW greater than 18 kDa. The aim of the study was to evaluate the performance of a new, more permeable dialytic membrane (Synclear 02) in term of middle MW toxin removal.

Methods: Ten ESRD patients were selected within SaLaTo study (that recruited 40 patients in 18 Sardinian dialysis centres), for a prospective, multicenter, randomized, crossover study in order to compare the extraction capability of two membranes used in HDF therapy: Synclear 02 (Supra treatment) and Polyphenylene super High Flux (pHF) (standard HDF treatment). After a 4-month washout stabilization period in on-line HDF, each patient was randomized to a sequence of treatments (HFR followed by SUPRA or viceversa) with each treatment applied over 6 months.

Plasma and pre-cartridge ultrafiltrate (UF) samples were used to determine Retinol Binding Protein (RBP), β2-microglobulin (β2M), n-1 acid glycoprotein (A1AG1), Tumor Necrosis Factor-α (TNF-α), Complement Factor D (CFD) and Leptin levels after 30 minutes extraction. Blood volume was estimated both at the start and at the end of first treatment period as well as at the end of the second, post-crossover period. In the long term, no statistically significant variations of pre dialysis levels were found (data not shown). The extraction capability was evaluated as percentage ratio between UF and plasma concentrations. Statistically significant differences between HFR and SUPRA extraction capabilities were found for RBP (4% vs 13%, respectively, p = 0.0003), β2M (67% vs 80%, p = 0.011), A1AG1 (0% vs 8% p = 0.0001) and Leptin (3% vs 10%, p = 0.0013).

Conclusions: The results of this study demonstrate that, compared to pHF, Sync 02 membrane offers a higher permeability to middle MW uremic toxins.

MP415 A SIMPLE AND FEASIBLE METHOD TO DETERMINE ABSOLUTE BLOOD VOLUME IN HAEMODIALYSIS PATIENTS IN CLINICAL PRACTICE

Susanne Kron1, Daniel Schnidt2, Leimbach3, Sabine Aign4 and Joachim Kron5
1Charité Universitätsmedizin Berlin, Berlin, Germany, 2Medical University of Graz, Graz, Austria, 3KfH-Nierenzentrum Berlin-Köpenick, Berlin, Germany

Introduction and Aims: Volume management is a central issue of dialysis pursing the normalization of patient’s total body water. But concerning haodynamic...
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Introduction and Aims: Acute Decompensated Heart Failure (ADHF) is the major reason for consulting a clinic in heart failure patients and every ADHF attack increases the mortality and morbidity of the patients. For years, loop diuretics have been used as a first step treatment in ADHF attacks. But, since diuretics have many side effects and, as shown in many studies, they are related to the high mortality and morbidity rate, new treatment methods have come into question. In recent years, ultrafiltration has been standing out as an alternative to diuretics. In our study we compared intravenous diuretic treatment with ultrafiltration in terms of efficiency and reliability in a patient group hospitalized because of ADHF in whom right ventricular dysfunction superpose over left ventricular systolic dysfunction (biventricular heart failure).

Methods: 30 patients, 10 in the ultrafiltration and 20 in the diuretics group, were included in our study. During the hospitalization, weight loss, total fluid loss, changes in kidney and heart functions and changes in biochemical parameters in two groups were compared. Patients were followed for 90 days.

Results: The values were measured when the patients were being discharged and in the ultrafiltration and diuretics groups weight loss was found as 6.86±2.3 kg and 7.47±5.5 kg, total fluid loss as 7.87±1.829 ml and 6.88±2.411 ml (p=0.052) and changes in serum creatinine levels as 0.04±0.05 mg/dl and -0.13±0.3 mg/dl (p=0.552) respectively. The difference wasn’t found as statistically meaningful. The median duration of the ultrafiltration treatment was 20.5 hours (interquartile range, 16 to 30). The rates of achieving decongestion clinically were similar in two groups. Echocardiographic parameters, other biochemical parameters, serum renin observed to evaluate neurohumoral activation and changes in aldosterone levels didn’t differ in two groups, either. As for the unwanted cases; the rate of hemodialysis usage was observed as 20 % in the ultrafiltration group and 5 % in the diuretic group, cardiac arrest and death rates were measured as 40 % in the ultrafiltration group and 10 % in the diuretic group. As the number of patients was small, the unwanted cases couldn’t be statistically evaluated. Weight change of the patients in 1 and 3 month, and their creatinine and electrolyte levels were also found similar. Changes from Baseline in Serum Creatinine at Various Time Points, According to Treatment Group.

Conclusions: In conclusion, it couldn’t be proved that ultrafiltration and diuretic treatments have superiority over one another in terms of weight loss, total liquid loss, achieving decongestion clinically, changes in kidney and cardiac functions and changes in renal and aldosterone levels in patient group. Although a statistical evaluation couldn’t be done, the fact that hemodialysis, cardiac arrest and death were observed more in the ultrafiltration group leads us to think that ultrafiltration is not as reliable as diuretics and more comprehensive studies are required to decide that it could be used in routine practice in the treatment.

COMPARING ULTRAFILTRATION AND INTRAVENOUS DIURETICS IN PATIENTS HOSPITALIZED BECAUSE OF ACUTE DECOMPENSATED BIVENTRICULAR HEART FAILURE

Aysel Sekir Koçkara1, Mansur Kay atas1, Can Huzmel1, Ferhan Candan1 and Mehmet Birhan Yilmaz1

Methods: 240 ml of ultra-pure dialysate were infused as post-dilution by the bolus function of a commercial dialysis machine (5008, FMC). The on-line infused bolus was administered immediately after the beginning of the dialysis session before ultrafiltration was started. The increase in relative blood volume (RBVpost-RBVpre) was measured using a relative blood volume monitor (BVM) and absolute blood volume was calculated as absolute blood volume in ml = bolus volume 240 ml x 100%/ increase RBV in %. Specific blood volume (blood volume per kg body mass at dry weight, in ml/kg) was compared to volume status assessed both clinically and by bioimpedance analysis.

Results: At the beginning of dialysis absolute blood volume in 30 stable patients was 6.51 ± 1.70 L corresponding to a specific blood volume of 80.1 ± 12.8 ml/kg. Absolute blood volume dropped to 5.84 ± 1.61 L or 72.0 ± 12.1 ml/kg at the end of the dialysis session. Specific blood volumes significantly correlated with gender and volume status. Intradialytic morbidi events occurred in 5 of 8 patients with specific blood volume below 65 ml/kg at the end of the treatment. No intradialytic morbid events were observed when specific blood volume remained above 65 ml/kg. The method is highly reproducible with a coefficient of variation of 3.97 %.

Conclusions: Absolute blood volume can easily be measured at the beginning of the dialysis session using current dialysis technology. Knowledge of absolute blood volume is a useful tool for avoiding intradialytic morbidi events and for targeted fluid removal to optimize blood volume at the end of the treatment. The routine use of this method might initiate the concept of ‘dry blood volume’ instead the current concept of ‘dry weight’. This would substantially improve patient’s long term outcome. With a software modification the technique could be completely automated without altering the hardware of currently available on-line dialysis devices. We recommend the implementation of this technique into all haemodialysis machines.

IS ONLINE CONDUCTIVITY MONITORING OF DIALYSIS ADEQUACY BETTER THAN CALCULATED DIALYSIS DOSE BASED ON UREA CLEARANCE

Balsam A Ahmed1, Caroline N Bejoisano2, Samra Abouchacra Samra Abouchacra1, Salama Z Al Faihan1, Khalid M Abdul Moniem1 and Hormaz Dastoor1 2Mafraq Hospital, Abu Dhabi, United Arab Emirates, 3Mafraq Dialysis Centre, Abu Dhabi, United Arab Emirates, 4Tawam Hospital, Al Ain, United Arab Emirates

Introduction and Aims: Current guidelines for hemodialysis adequacy are based on Kt/V, the fractional removal of urea per dialysis treatment, expressed as clearance (K) multiplied by treatment time (t) and divided by the urea distribution volume (V) which is a surrogate for urea, allows the repeated non-invasive measurement of Kt/V on each HD treatment. Our aim was to compare single pool Kt/V (SKt/V) results obtained from second generation Daugirdas’s formula with on line conductivity monitoring of Kt/V. Adequate delivered dose of solute removal (as assessed by urea reduction and calculation of Kt/V) is an important determinant of clinical outcome in chronic haemodialysis (HD) patients. This requires both prescription of an adequate dose of HD and regular assessment that the delivered treatments are also adequate. On line conductivity monitoring Kt/V (OCM Kt/V) measurement using sodium flux as a surrogate for urea, allows the repeated non-invasive measurement of Kt/V on each HD treatment. Our aim was to compare single pool Kt/V (SKt/V) results obtained from second generation Daugirdas’s formula with on line conductivity monitoring of Kt/V. Adequate delivered dose of solute removal (as assessed by urea reduction and calculation of Kt/V) is an important determinant of clinical outcome in chronic haemodialysis (HD) patients. This requires both prescription of an adequate dose of HD and regular assessment that the delivered treatments are also adequate. In this study we used Single pool Kt/V which overestimate dialysis efficiency compared with equilibrated Kt/V. Nevertheless the close correlation between the two parameters makes it easy to derive effective urea clearance from ionic dialyse. Since
it is reasonable to assume that urea distribution volume is constant in steady-state patients, once this has been exactly determined by means of the measurement of ionic dialysance, it is possible to calculate Kt/V on-line at each session without the need for any blood sampling or laboratory examinations, and at no additional cost.

**MP418**

**COMPARISON OF CENTRAL VENOUS PRESSURE WITH CARDIAC OUTPUT MEASURED BY NON-INVASIVE CARDIAC OUTPUT MONITORING IN PATIENTS WITH CONTINUOUS RENAL REPLACEMENT THERAPY**

Seongmin Kim¹, Joonseok Oh², Yonghun Sin², Joongkyung Kim² and Jinho Lee²

¹Bongseng Memorial Hospital, Busan, Republic of Korea, ²Bongseng Memorial Hospital, Busan, Republic of Korea

**Introduction and Aims:** Patients who receiving continuous renal replacement therapy (CRRT) due to their critical illnesses can be hemodynamically unstable because their peripheral resistance and blood volume changes frequently. Cardiac output (CO) is a key variable when describing and treating the cardiovascular system. Thermodilution via a pulmonary artery catheter is the most frequently used method, but it lacks accuracy. Non-invasive cardiac output monitoring (NICOM) measures CO based on chest bioimpedance. Validated data of NICOM in patients with CRRT are lacking. So we compared central venous pressure (CVP) with cardiac output monitored via NICOM system in patients with CRRT.

**Methods:** Stroke volume (SV) values using NICOM were recorded in patients with CRRT and CVP values were measured at the same time. The difference between measured and average values of CVP (ΔCVP) and SV (ΔSV) were calculated in each subject, because CVP values may be different depending on the person who measured. Correlation analysis was performed ΔSV with and ΔCVP.

**Results:** Twenty five subjects (12 males and 13 females; mean age, 70.3 ± 8.6 years) were enrolled. And mean treatment duration of CRRT were 6.3 ± 6.5 days. Seventeen of subjects were treated with inotropic agent and 11 of them were treated with mechanical ventilation. The SV and CVP values of subjects’ were measured 157 times. There were poor correlation with ΔSV and ΔCVP (R = 0.07, P = 0.37, Figure 1).

**Conclusions:** Stroke volume measured by NICOM and CVP showed poor correlation. NICOM may be not effective as non-invasive method for circulating volume monitoring in patients with CRRT.