Annual Congress of the **Chinese Blood Purification Center Administration Committee**

April 7–10, 2010, Beijing

Selected Abstracts

Guest Editor

Tao Wei, Beijing

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The Effect of Recombinant Human Edostatin (Endosar) on Peritoneum Angiogenesis in Peritoneal Dialysis Rats

Z.Z. Zhao, Y. Cao, Z.S. Liu, J. Xiao, P. Wang

Department of Nephrology, The First Affiliated Hospital of Zhengzhou University, Zhengzhou, China

Corresponding author: Liu Zhang-suo;

zhangsuoliu@sina.com

Objective: To study the effect of recombinant human edostatin (Endosar) on peritoneum angiogenesis in peritoneal dialysis rats. **Methods:** Forty-two male Sprague-Dawley rats were used in the study. The uremic rats model was produced by 5/6 nephrectomy. We established the peritoneal dialysis rat model randomly from the uremic rats. Rats were then assigned into 5 groups: normal group (group 1; n=8), uremia group (group 2; n=8), uremia and peritoneal dialysis group (group 3; n=8), Endostar 10 mg/kg treatment group (group 4; n=8), Endostar 40 mg/kg treatment group (group 5; n=8). Rats in groups 3, 4, and 5 were treated with regular peritoneal dialysis. During peritoneal dialysis period, rats in groups 4 and 5 were given subcutaneous injection of Endostar every other day with a total of 14 injections. After regular peritoneal dialysis for 28 days, peritoneum tissues were taken for immunohistochemistry and reverse transcription – polymerase chain reaction (RT-PCR) to detect VEGF-A and bFGF mRNA and their proteins. Microvessel density (MVD) in peritoneum was assessed by immunohistochemistry using CD34 monoclonal antibody. **Results:** VEGF-A and bFGF mRNA and their proteins were found in peritoneal samples in the 5 groups. VEGF-A and bFGF mRNA and their proteins were significantly up-regulated in groups 2 and 3 ($P<0.05$) as compared with those in group 1, and became significantly down-regulated in groups 4 and 5 ($P<0.05$) as compared with those in group 3. In addition, the two mRNAs and proteins were less in group 5 ($P<0.05$) than in group 4. Rats in group 1 had none or only a few new microvascular vessels in peritoneum, but rats in groups 2 and 3 showed higher peritoneal MVD ($P<0.05$) than that in group 1. The peritoneal MVD became less in groups 4 and 5 than that in group 3 ($P<0.05$). **Conclusions:** Recombinant human endostatin (Endostar) can effectively inhibit peritoneal angiogenesis in rats. The effect of Endostar is dose-dependent. Endostar treatment down-regulates the expression of VEGF-A and bFGF mRNA and their proteins, which may be the pathway of angiogenesis inhibition in peritoneum by Endostar.

Key words: Recombinant human endostatin, VEGF-A, bFGF, angiogenesis, Microvessel density.

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Predictors of Clinical Outcome in Anuric Patients on Peritoneal Dialysis

X.H. Lin, J.Q. Qian, A.W. Lin, W. Fang, Z.H. Ni, A.P. Gu

Renal Division, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Objective: To investigate the predictors of clinical outcome in anuric patients on peritoneal dialysis (PD). **Methods:** Eight-six anuric PD patients treated in this division between January 1, 2003 and October 31, 2007 were enrolled in this retrospective cohort study with a median follow-up period of 25.3 months. According to their clinical outcome, patients were divided into death group and survival group. The ultrafiltration (UF) volume and other clinical indices such as age, blood pressure, dialysis adequacy (Kt/V, CCR), hemoglobin and serum albumin were compared between the two groups. A Cox proportional hazards model was used to determine the predictors to mortality. A Kaplan-Meier analysis was performed to compare the number of survival between patients with a baseline UF ≥ 1000 ml/24 h and those with a baseline UF < 1000 ml/24 h. **Results:** At the end of the study, 26 patients died, 10 patients transferred to hemodialysis, 4 patients transferred to transplantation, and the rest of 46 patients remained on PD. Cardiovascular disease and cerebrovascular disease were the leading cause of mortality. Longitudinal study showed that UF capacity gradually decreased with time in these patients, but Kt/V, CCR and albumin level were nearly stable. Univariate Cox regression analysis showed that baseline age, systolic blood pressure, albumin level, blood urea nitrogen (BUN), serum creatinine (Scr), UF volume and diabetic status were the risk factors for mortality. Multivariate Cox regression analysis showed that baseline age, albumin level and UF volume were the independent predictors for patient survival. The Kaplan-Meier analysis indicated that survival of patients with a baseline UF < 1000 ml/24 h was significantly worse than that of the patients with a baseline UF ≥ 1000 ml/24 h ($P<0.01$). **Conclusion:** Age, albumin level and UF volume were the independent predictors for patient survival in anuric PD patients, and the clinical outcome was worse in patients with UF < 1000 ml/24 h than in those with larger UF.

Key words: Peritoneal dialysis, Anuria, Clinical outcome.

Impact of Pain on the Life Quality in Long-Term Hemodialysis Patients

Y. Lu, L.M. Chen, J.H. Xia, Y. Sun, X.M. Li

Department of Nephrology, Chinese Academy of Medical Science, Peking Union Medical College Hospital, Beijing, China

Corresponding author: Chen Li-meng;

Email: climeng2000@yahoo.com.cn

Background: There are growing evidences that dialysis patients have a high burden of symptoms, including pain. However, the prevalence and severity of pain, and the effect of pain on life quality in long-term hemodialysis (HD) patients are yet unclear. **Objective:** To study the relationship between pain and life quality in patients on HD for more than 5 years. **Methods:** A total of 33 patients on HD for over 5 years treated in Peking Union Medical College Hospital were recruited. Their general conditions and biochemical data were collected. The pain was evaluated by Brief Pain Inventory, and their life quality was assessed by SF-36 scales. **Results:** The mean age of the patients was 60.7 ± 9.6 years old, with 25 females and 8 males. The average HD period was 9.5 ± 3.9 (5-17) years. A problem with pain which lowered their life quality was reported in 75.8% patients. Body parts involved in pain were diverse, and most patients complained of more than 2 painful parts (2.0 ± 0.9 /patient). The main painful parts lasted for more than 3 months included shoulder (51.5%), knee (36.4%), wrist (18.2%), hip (15.2%) and ankle (9%). Non-opioid analgesics were administrated in 24.2% patients. The average pain scale was 3.7 ± 1.9 (numerical scale 0-10). The intensity of the pain was only half relieved by medication therapy. There were no demographic, serological, or dialysis-related predictors, such as age, primary disease, hemodialysis period, KT/V, Ca, P, PTH and Hb, for pain. More severe pain got less SF-36 scores ($P < 0.05$), expect for mental health (MH). Severe pain had a tremendous negative impact on life quality. **Conclusion:** Pain is a significant problem in long-term HD patients, and has not been properly managed. The development of effective pain management strategies, including appropriate training and education, is necessary to improve the life quality in dialysis patients.

Effect of Bone Morphogenetic Protein-7 on Vascular Smooth Muscle Cells Calcification Induced by High Phosphorus *In Vitro*

Y. Yu, K.P. Lin

Department of Blood Purification, Fuzhou General Hospital, Fuzhou, China

Corresponding author: Yu Yi;

Email: yuyicn@126.com

Background: Up-regulation of core binding factor alpha-1 (Cbf α -1) in vascular smooth muscle cells (VSMCs) induced by hyperphosphatemia is considered to be one of the mechanisms for vascular calcification occurring in uremia, in which type III sodium/

phosphate cotransporter, Pit-1, is also involved. Here we studied the effect of bone morphogenetic protein-7 (BMP-7) on VSMCs calcification induced by high phosphorus medium *in vitro*. **Methods:** Rat VSMCs were cultured in normal phosphorus medium, high phosphorus medium, high phosphorus plus rhBMP-7 medium or normal phosphorus plus rhBMP-7 medium. Calcium deposition was quantified and visualized by Alizarin stain method at day 6. Pit-1 mRNA was determined by RT-PCR, and Cbf α -1 expression was semi-quantified by RT-PCR and western blot at day 3. **Results:** More calcium deposition was found in high phosphorus group than in normal phosphorus group. Compared with high phosphorus group, the calcium deposition in high phosphorus plus rhBMP-7 group was significantly reduced. High phosphorus stimulated the up-regulation of Pit-1 and Cbf α -1 in VSMCs, which could be inhibited by BMP-7. **Conclusions:** BMP-7 acts as an inhibitor to VSMCs calcification induced by high phosphorus *in vitro*, suggesting that BMP-7 may effectively reduce the vascular calcification induced by hyperphosphatemia in uremia patients.

Key words: Bone morphogenetic protein-7, Vascular smooth muscle cell, Vascular calcification; Phosphorus, Type III sodium/phosphate cotransporter, Core binding factor alpha-1

Relationship Between Fibroblast Growth Factor-23 in Peripheral Blood and Cardiovascular Events in Maintenance Hemodialysis Patients

K.L. Li¹, Y.N. He¹, B.G. Huo¹, K.B. Li¹, Y. Zhang¹, L. Zhao²

¹Department of Nephrology, ²Department of General Surgery, State Key Laboratory of Trauma, Burn and Combined Injury, Daping Hospital, Third Military Medical University, Chongqing, China

Background: Abnormal mineral balance is an early complication in patients with chronic kidney disease (CKD), and the altered calcium/phosphate balance is believed to be the risk factor for both cardiovascular complications and renal dysfunction. Studies have convincingly demonstrated that disturbed calcium/phosphate metabolism is involved in the cardiovascular morbidity and mortality in CKD patients, particularly in those with maintenance hemodialysis (MHD). Abnormal function of vitamin D metabolites, PTH and fibroblast growth factor-23 (FGF-23) is closely related to the impaired calcium/phosphate metabolism in CKD patients. The present investigation aimed to study the relationship between circulating FGF-23 concentration and cardiovascular complications in patients on MHD. **Methods:** A total of 155 CKD patients at stage 5 and treated in this hemodialysis center during the period from October 2006 to February 2010 were included in the study, and they were observed for 6 months. The patients were divided into cardiovascular event group (group 1, n=57) and non-cardiovascular event group (group 2, n=98). The two groups are comparable in their gender, age, CKD underlying diseases, blood pressure control, hemoglobin level, nutritional status, dialysis modality and dose, and drug use. Cardiovascular events included cardiac death (all death events except for death of defined non-cardiac causes), myocardial infarction (in the presence of pathological Q wave and increase of creatine kinase more than 2 times of the normal upper limit in association with increase of creatine kinase

MB above normal, or increase of CK more than 2 times of the normal upper limit without abnormal Q wave), pump failure of grade 3 or more, cardiogenic shock, ventricular fibrillation or ventricular flutter, cardiac rupture, and the need for cardiology intervention (such as coronary thrombolysis and stent placement). FGF-23 level was determined by ELISA (tested every 2 months in pre-dialysis pumping blood, and used the average serum FGF-23 level from 3 assays). Data were expressed as $\bar{x} \pm s$ *t* test, variance analysis and Pearson correlation analysis were used for the comparison between the two groups. **Results:** Peripheral blood FGF-23 levels were significantly higher in cardiovascular events group (656.7 $\pm$ 182.5 pg/ml) than in non-cardiovascular event group (472.3 $\pm$ 128.0 pg/ml, $p < 0.001$). Correlation analysis indicated that peripheral blood FGF-23 levels were closely correlated to the cardiovascular events in MHD patients ($r = 0.77$, $p < 0.001$). **Conclusion:** The increase of serum FGF-23 in MHD patients may cause secondary vascular calcification, and then lead to cardiovascular events. Therefore, higher serum FGF-23 in MHD patients may be an early warning indicator of cardiovascular events.

Key words: Fibroblast growth factor-23, Chronic kidney disease, Maintenance hemodialysis, Cardiovascular events.

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Influence of Water-Sodium Control on Cardiovascular Disease in Young Chinese Maintenance Hemodialysis Patients

H. Li, S.X. Wang

Blood Purification Center, Beijing Chaoyang Hospital,
Capital Medical University, Beijing, China
Corresponding author: Wang Shi-xiang;
Email: wxy1988@263.net

Background: Cardiovascular disease (CVD) is a most common complication and a main cause of death in patients with end stage renal disease (ESRD), accounting for 45%-50% of death in ESRD patients [1, 2]. Foley et al [3] emphasized that 80% patients on maintenance hemodialysis (MHD) had cardiovascular complications. In Chinese patients, the prevalence of CVD in young MHD patients is as high as 63.8%, and its characteristics are similar to those in middle- and old-aged MHD patients. Ultrafiltration volume is an important risk factor for hypertension and CVD in these patients [4]. Left ventricular hypertrophy (LVH) is an important prognostic symptom for CVD in ESRD patients [5, 6]. It remains unclear whether efforts to correct fluid overload in young MHD can reverse LVH. This prospective single-center Chinese cohort study evaluated left ventricular mass index (LVMI) evolution in fluid overloaded young MHD patients with or without water-sodium control therapy. **Methods:** A total of 106 young patients aged between 22 and 44 years on MHD treated in the Blood Purification Center of Beijing Chaoyang Hospital, Capital Medical University in China were enrolled in this prospective, control study. Patients were included in this study if they were on MHD aged more than 18 years and less than 45 years and with stable clinical condition for at least 3 months. Hemodialysis schedule was 3 times per week and 4h per dialysis session. Patients were excluded from this study if they had severe ischemic heart disease (such as myocardial infarction, severe heart failure due to coronary artery disease) or other heart disease (such as rheumatic heart disease, congenital car-

diopathy) before being recruited in this study, severe inflammation or infection, or normal urine volume (urine volume > 1000 ml/24 h). Patients were divided into 3 groups according to the percentage of interdialytic weight gain [PIDWG (%) = 100% $\times$ (predialysis weight-dry weight)/dry weight] at baseline condition. Patients with PIDWG > 5% received health education to restrict water-sodium intake strictly (Group I, $n = 36$). Other patients with comparable fluid status (PIDWG > 5%) did not receive health education to restrict water-sodium intake strictly (Group II, $n = 36$), and those with PIDWG < 5% (Group III, $n = 34$) were served as controls. Echocardiographic examination was performed to evaluate LVMI at baseline, and after 3, 6 and 12 months. Follow-up of the patients lasted for 12 months. **Results:** At baseline condition, there was no significant difference in clinical data of age, gender, etiology of renal failure and nutritional state among the 3 groups. PIDWG, systolic blood pressure (SBP), diastolic blood pressure (DBP), and the number and daily dose of hypotensive drugs were significantly lower in Group III than in Group I and II (PIDWG was 7.57 $\pm$ 1.27%, 7.56 $\pm$ 1.27%, and 3.59 $\pm$ 0.79% in group I, II and III, respectively; SBP was 154.75 $\pm$ 12.26, 153.86 $\pm$ 12.86 and 139.44 $\pm$ 4.47 mmHg in group I, II and III, respectively; DBP was 90.69 $\pm$ 6.40, 89.89 $\pm$ 6.29 and 84.74 $\pm$ 5.67 mmHg in group I, II and III, respectively; the number of hypotensive drugs taken was 2.31 $\pm$ 0.47, 2.28 $\pm$ 0.45 and 1.65 $\pm$ 0.49 in group I, II and III, respectively; the daily dose of hypotensive drugs was 4.39 $\pm$ 0.77, 4.31 $\pm$ 0.52 and 3.21 $\pm$ 0.95 in group I, II and III, respectively). The prevalence of LVH was 75.0%, 72.2% and 55.9% in Group I, II and III, respectively. LVMI was correlated with PIDWG ($r = 0.779$, $P < 0.01$). After water-sodium control for 12 months, SBP, DBP, and the number and daily dose of hypotensive drugs were significantly decreased in group I. In group II, SBP and DBP increased after 12 months, but without significant differences compared with their baseline values. The number and daily dose of hypotensive drugs in group II were significantly increased after 12 months. In group III, SBP, DBP, and the number and daily dose of hypotensive drugs had no significant differences after 12 months compared with their baseline values. In group I after 12 months, SBP, DBP, and the number and daily dose of hypotensive drugs were significantly lower than those in group II. However SBP, DBP, and the number and daily dose of hypotensive drugs had no significant differences between group I and group III after 12 months (SBP was 140.06 $\pm$ 7.20, 157.92 $\pm$ 9.55 and 139.68 $\pm$ 4.18 mmHg in group I, II and III, respectively; DBP was 83.56 $\pm$ 6.70, 91.03 $\pm$ 5.64 and 83.88 $\pm$ 6.40 mmHg in group I, II and III, respectively; the number of hypotensive drugs was 1.78 $\pm$ 0.42, 2.61 $\pm$ 0.49 and 1.68 $\pm$ 0.47 in group I, II and III, respectively; the daily dose of hypotensive drugs was 3.31 $\pm$ 0.82, 5.06 $\pm$ 0.86 and 3.24 $\pm$ 0.92 in group I, II and III, respectively). In Group I, PIDWG significantly decreased from 7.57 $\pm$ 1.27% at baseline to 3.92 $\pm$ 0.65% after 12 months ($t = 20.871$, $P < 0.01$), and LVMI decreased from 148.9 $\pm$ 37.5 g/m² at baseline to 121.3 $\pm$ 44.1 g/m² after 12 months ($t = 13.628$, $P < 0.01$). In group II, LVMI was significantly increased from 147.6 $\pm$ 37.6 g/m² at baseline to 155.5 $\pm$ 35.5 g/m² after 12 months ($t = 6.399$, $P < 0.01$), but without significant change in PIDWG compared with their baseline values. In group III, PIDWG and LVMI showed no significant changes after 12 months compared with their baseline values. The prevalence of LVH was decreased from 75% at baseline to 50% after 12 months ($\chi^2 = 4.800$, $P < 0.05$) in group I, and was increased from 72.2% at baseline to 91.7% after 12 months ($\chi^2 = 4.600$, $P < 0.05$) in group II, but was statistically unchanged (55.9% at baseline, and 52.9% after 12 months) in Group III. The prevalence of cardiovascular disease had no differences after 12 months among the 3 groups (2.8%, 5.6% and 2.9% in group I, II

and III, respectively, $P>0.05$). **Conclusions:** A high prevalence of LVH relating to fluid overload was present in young MHD patients. Control of fluid overload by water-sodium restriction decreased blood pressure and the number and daily dose of hypotensive drugs, and improved LVH in young MHD patients.

Key words: Renal dialysis, Hypertrophy, Left ventricular, Water-sodium control, Youth.

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Implication of Plasma Pentraxin 3 in Peripheral Arterial Disease in Hemodialysis Patients

Y.J. Zhou, Z.H. Ni, J.W. Zhang, W.M. Zhang, L.Y. Gu, G.J. Shen, Y.M. Wang, J.Q. Qian

Nephrology Division, Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Corresponding author: Ni Zhao-hui;

Email: profnizh@126.com

Objective: To clarify the risk of peripheral arterial disease (PAD) in patients treated in this hemodialysis center, and to evaluate the role of pentraxin 3 (PTX3) in the development of PAD. **Methods:** The patients treated with hemodialysis (HD) for more than 3 months were recruited. Ankle-brachial index (ABI) was used for the estimation of PAD. PTX3 was measured by ELISA. Other clinical data were also collected. Logistic regression was used to estimate the association between PAD and PTX3 as well as other potential risk factors.

Results: A total of 116 chronic HD patients were enrolled. The incidence of PAD in this dialysis center was 18%. Plasma levels of PTX3 were significantly higher in patients with evidence of PAD than in those without PAD (5.55 ± 2.63 ng/ml vs. 2.32 ± 1.29 ng/ml; $P<0.001$). Univariate analysis showed a negative correlation of ABI values to plasma PTX3 levels ($r = -0.548$, $P<0.001$), high-sensitivity C-reactive protein (hsCRP), age, blood glucose and triglyceride. ROC curve of PAD showed that the AUC of PTX3 was 0.901 ($P<0.0001$). With the cut-off value of PTX3 at 4.06 ng/ml, the diagnostic sensitivity and specificity for PAD were 81% and 91.5%, respectively. ROC curve of PAD showed that AUC of hsCRP was 0.640 ($P<0.05$). With the cut-off value of hsCRP at 3.33 mg/l, the diagnostic sensitivity and specificity for PAD were 57.1% and 56.8%, respectively. Logistic regression found that plasma PTX3 was associated with the risk factors for atherosclerosis caused PAD (OR=9.755, 95% CI: 2.359~19.354, $P=0.001$). **Conclusion:** The prevalence of PAD was higher in this cohort of HD patients than in general population. There was a significant correlation between plasma PTX3 levels and the presence of PAD in HD patients, suggesting that plasma PTX3 level may have a role in the atherosclerotic process of PAD. The sensitivity and specificity of PTX3 are higher than those of hsCRP.

Key words: Pentraxin 3, High-sensitivity C-reactive protein, Ankle-brachial index, Hemodialysis, Peripheral arterial disease, Risk factor.

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Assessment of Volume Status in Peritoneal Dialysis Patients: Value of Multiple-Frequency Bioimpedance Analysis, Echocardiography, NT-ProBNP, and Clinical Assessment Score

H. Xu¹, Y. Zeng², H. Bai², Z.J. Zhou¹, Y. Cui¹, W. Yang¹, Y. Sun¹, X.M. Li¹, X.W. Li¹

¹Department of Nephrology and ²Department of Cardiology, Peking Union Medical College Hospital, Chinese Academy of Medical Science and Peking Union Medical College, Beijing, China

Objective: Assessment of body fluids in dialysis patients is an important issue in the treatment of renal failure. Technical systems for an accurate and practicable fluid management of dialysis patients are urgently needed. This study focused on the systematic analyses of the detection limit of several candidate methods for fluid management including multiple-frequency bioimpedance analysis (BIA), echocardiography, N-terminal pro-brain natriuretic peptide (NT-proBNP) and clinical assessment score. **Patients and Methods:** We conducted a cross-sectional study on 75 stable peritoneal dialysis (PD) patients (35 men and 40 women; mean age 58.7 ± 15.4 years; 25 with diabetes). Patients were divided into 3 groups: normal blood pressure group (group A, $n=23$), hypertension (BP<140/90 mmHg) controlled with anti-hypertension medication group (group B, $n=28$), and hypertension (BP $\geq$ 140/90 mmHg) with 2 more anti-hypertension medications group (group C, $n=24$). Multiple-frequency BIA, echocardiography, serum NT-proBNP, and clinical assessment score were applied in parallel during the study. BIA was used to be the fluid status index of PD patients. **Results:** The values of extracellular water/body surface area (ECW/BSA) measured by BIA were significantly higher in group C (12.7 ± 2.2 L/m²) than in group A (10.9 ± 1.0 L/m²) and group B (11.6 ± 1.4 L/m²) ($p<0.001$), but were not significantly different between groups A and B. LV mass index (LVMI) measured by echocardiography was significantly different among the 3 groups (116.1 ± 4.3 g/m², 137.9 ± 54.8 g/m² and 161.8 ± 46.1 g/m² in group A, B and C, respectively; $p<0.05$). The ratio of early transmitral velocity to tissue Doppler mitral annular early diastolic velocity (E/Ea) was significantly different among the 3 groups (12.8 ± 4.7 , 14.9 ± 6.8 , and 17.4 ± 8.7 in groups A, B and C, respectively; $p<0.05$). Plasma NT-proBNP was not significantly different in the 3 groups. ECW/BSA positively correlated with LVMI ($r=0.535$, $p<0.001$) and E/Ea ($r=0.408$, $p=0.008$). **Conclusions:** ECW/BSA positively correlates with LVMI and E/Ea. Multiple-frequency BIA, LVMI and E/Ea measured by echocardiography have been regarded as the candidate methods for fluid status evaluation.

The Effect of α -ketoacid on Calcium/Phosphate Metabolism in Maintenance Hemodialysis Patients

L. Jia, W.L. Chen, J. Shi

Department of Nephrology, Wuhan Central Hospital, Wuhan, China

Corresponding author: Chen Wenli;

Email: bicwl@163.com

Objective: To evaluate the effect of α -ketoacid combining with low phosphorus/protein diet on calcium/phosphate metabolism and nutritional status in hemodialysis patients. **Method:** A total of 40 hemodialysis patients were investigated and followed-up for half a year. Cellulose acetate membrane was used for dialysis (calcium 1.5 mmol/L in dialyzate). They were randomly assigned to a low phosphorus/protein diet supplemented with α -ketoacid (ketoacid group) or a routine protein diet supplemented with calcium carbonate (routine group). Serum calcium, phosphate and iPTH were assayed. Serum albumin (Alb), hemoglobin (Hb), body mass index (BMI), and mid-arm muscle circumference (MAMC) were also measured after the treatment for 6 months. **Results:** In routine group, serum calcium, phosphate, $\text{Ca} \times \text{P}$ product and iPTH levels increased significantly ($P < 0.01$). In ketoacid group, serum calcium also increased ($P < 0.01$), but phosphate level decreased ($P < 0.01$), $\text{Ca} \times \text{P}$ product increased slightly, iPTH remained stable in a low level ($P < 0.01$). Serum Alb, Hb, BMI and MAMC increased significantly both in the 2 groups ($P < 0.01$), but these values had no significant differences before and after the treatment in the 2 groups. **Conclusion:** Low phosphate/protein diet supplemented with α -ketoacid seems to relieve malnutritional status and improves calcium/phosphate metabolism in hemodialysis patients.

Key words: Hemodialysis, Calcium/phosphate metabolism, α -ketoacid, Low phosphorus/protein diet, Malnutrition.

Blood Purification Therapy After Cardiac Surgery in Patients with Chronic Renal Failure

X.X. Pan¹, Q.L. Fan¹, Y. Geng, M.L. Feng, L. Yao, L.N. Wang*

Division of Nephrology, The First Affiliated Hospital of China Medical University, Shenyang, China

¹Contributing equally to this study

*Corresponding author: Wang Lining;

Email: Inwang56@medmail.com.cn

Objective: To summarize the effect of continuous veno-venous hemodiafiltration (CVVHDF) after cardiac surgery in patients with chronic renal failure. **Methods:** During the period of Jun. 1999 to April 2008, 19 patients with pre-operative renal failure underwent CVVHDF after operation, including 11 men and 8 women with the age from 54 to 82 years and mean age of 67.68 ± 6.96 years. Pre-

operative complications included hypertension in 6 cases, diabetes in 9 cases, and chronic obstructive pulmonary emphysema in 4 cases. The cardiac diseases for operation were coronary artery lesions in 2 branches in 5 cases, coronary artery lesions in 3 or more than 3 branches in 9 cases (1 case with aortic valve lesion), coronary artery lesion in left main stem in one case, mitral valve combined aortic valve lesions in 2 cases, mitral re-stenosis after closed mitral commissurotomy in 2 cases, and aortic valve lesion associated with coronary artery disease in one case. The Left ventricular ejection fraction (LVEF) was 32% to 68%, with an average value of $(54.53 \pm 10.19)\%$. All patients manifested chronic renal failure before surgery, in which 13 cases were at compensation stage, 4 cases with azotemia, and 2 cases with uremia. CVVHDF started at 19-95 hours after surgery when serum creatinine was $300-654 \mu\text{mol/L}$, and maintained for 8 to 45 hours/session for 3-12 times. After CVVHDF, regular hemodialysis was continued. A double lumen central venous catheter settled during cardiac surgery was used for vascular access. Bedside hemodialysis filtration was conducted using PRISMAflex system, and the ultrafiltration was slow with blood flow 100-180 ml/h, replacement fluid flow 2000 ml/h, and dialysis fluid flow 2000 ml/h. The dialysate contained 1.5% lactate peritoneal dialysis solution (solution A) and 5% NaHCO_3 (solution B) which were simultaneously infused at 125 ml/h. The replacement fluid composed of 3000 ml isotonic saline, 1000 ml 5% glucose, 10 ml 10% calcium gluconate and 3.2 ml 25% magnesium sulfate. Low molecular weight heparin was used as anticoagulant. Activated clotting time (ACT) was measured every 2 hours. The dosage of heparin was adjusted according to ACT, ultrafiltration rate, venous pressure and transmembrane pressure. ACT value was controlled at $>140\text{s}$ to 180s (150%). Heparin-free dialysis was administered for patients with stress ulcer or severe bleeding tendency. **Results:** After the first dialysis for 6 hours, heart rate, central venous pressure (CVP), creatinine, BUN decreased significantly ($P < 0.05$), as compared with those before dialysis. Heart rate reduced from 103.21 ± 9.76 beats/min to 94.05 ± 7.86 beats/min, CVP dropped from 21.37 ± 5.65 cmH_2O to 12.32 ± 3.00 cmH_2O , creatinine decreased from $484.16 \pm 78.41 \mu\text{mol/L}$ to $376.68 \pm 62.87 \mu\text{mol/L}$, and urea nitrogen decreased from 19.63 ± 4.27 mmol/L to 14.79 ± 3.36 mmol/L. Mean arterial blood pressure (MAP) and arterial oxygen partial pressure (PaO_2) significantly increased compared with those before dialysis ($P < 0.05$). After the dialysis, MAP increased from 61.95 ± 6.44 mmHg to 70.42 ± 7.40 mmHg, and PaO_2 increased from 68.68 ± 10.36 mmHg to 79.84 ± 10.46 mmHg. An 82-year-old woman with coronary heart disease and a 72-year-old man after mitral valve replacement died of multiple organ failure. Two cases of 67 and 71-year-old men with coronary heart disease, and one 73-year-old woman after double valve replacement gave up for further treatment with non-medical reasons after continuous renal replacement therapy for 2, 4 and 2 sessions, respectively. A 72-year-old patient with coronary heart disease died of cardiac arrest one month after surgery. Five of the rest 13 patients received regular dialysis. Eight patients discharged from the hospital with renal function and urine volume to pre-operative levels without dialysis anymore. **Conclusion:** For cardiac surgery patients with chronic renal failure, the early initiation of CVVHDF after cardiac surgery can promptly correct the water and electrolyte disturbance, improve cardiac function and pulmonary edema, and promote the clearance of many inflammatory factors to avoid damage to other organs. CVVHDF treatment can improve the prognosis and survival in patients with renal dysfunction undergone cardiac surgery.

Clinical Analysis of Intradialytic Hypertension in Maintenance Hemodialysis Patients

J. Zhang, M. Wang, Y. Yan, M.S. Cai

Department of Nephrology, People Hospital of Peking University, Beijing, China

Objective: In some hemodialysis patients, blood pressure rises further during ultrafiltration (UF). We analyzed the clinical data of intradialytic hypertension (IDH) in maintenance hemodialysis patients. **Methods:** We retrospectively studied the clinical records of 23 maintenance hemodialysis patients with intradialytic hypertension in a single blood purification center in the past 18 months. They were treated with repeated intensive UF, dialysate of lower calcium concentration or adjustment of antihypertensive medications. The outcome of these therapeutic measures was analyzed. **Results:** In this study, 23 (17.5%) of 131 maintenance hemodialysis patients had IDH. After a period of intensive UF, predialysis systolic blood pressure (SBP) (136.5 ± 15.8 mmHg vs. 126.9 ± 11.1 mmHg, $P < 0.05$), intradialysis mean arterial blood pressure (MAP), postdialysis SBP (165.9 ± 14.5 mmHg vs. 126.1 ± 12.0 mmHg, $P < 0.01$), diastolic blood pressure (DBP) (91.6 ± 13.1 mmHg vs. 72.8 ± 9.3 mmHg, $P < 0.01$) and MAP (116.4 ± 12.1 mmHg vs. 90.6 ± 7.9 mmHg, $P < 0.01$) decreased in 18 patients, with a significant decrease of IDH prevalence ($81.7 \pm 11.7\%$ vs. $15.8 \pm 4.9\%$, $P < 0.01$). The dialysate containing Ca^{2+} 1.25 mmol/L decreased predialysis and postdialysis BP and controlled IDH in 2 patients. In 3 patients adjusted antihypertensive drugs dosage or types, both predialysis BP and postdialysis BP were controlled, with the absence of IDH. **Conclusions:** Volume overload may play a major role in the pathophysiology of intradialytic hypertension in maintenance hemodialysis patients. Rigid regulation of intravascular volume, adjustment of antihypertensive medications, and change of electrolyte in dialysate may be useful for control of intradialytic hypertension.

Key words: Intradialytic hypertension, Maintenance hemodialysis, Treatment, Volume overload, Calcium concentration in dialysate.

Survey on 25(OH)D₃ Insufficiency and Deficiency in Maintenance Hemodialysis Patients

Y. Qian, X.N. Chen, H. Ren, W. Zhang, P. Zhu, N. Chen

Renal Division, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Objective: Little is known about the magnitude of vitamin D insufficiency and deficiency in maintenance hemodialysis (MHD) patients in China. This study analyzed serum vitamin D level in MHD patients, and evaluated the relationship between serum vitamin D and other parameters including mineral metabolism, nutrition and dialysis adequacy. **Methods:** We examined serum levels of 25(OH)D₃ in 195 MHD patients never receiving Vitamin D supplement or not

taking these preparations in 2 weeks before the measurement. We measured serum intact parathyroid hormone (iPTH) by radioimmunoassay, serum Ca, P, AKP, pre-albumin and albumin in the clinical laboratories in this hospital, and calculated urea nitrogen reduction rate (URR) and Kt/V by using Daugirdas formula. **Results:** The mean 25(OH)D₃ level was 56.55 ± 17.62 ng/ml in MHD patients, which was within the normal range. The prevalence of vitamin D insufficiency was only 3.59%, and no vitamin D deficiency was detected. No significant difference in serum 25(OH)D₃ level was found between diabetic and non-diabetic patients, neither between male and female patients. Multivariable regression analysis showed positive correlation between serum 25(OH)D₃ level and Ca. **Conclusion:** This study indicates that vitamin D insufficiency is rare in Chinese MHD patients. Measurement in summer time and regular supplement of vitamin D in the early stage to MHD patients may partly influence the results.

Key words: Vitamin D, Insufficiency, Maintenance hemodialysis.

Bone Mineral Density and Influence of Abdominal Aortic Calcification in Maintenance Hemodialysis Patients

L.Y. Gan, M. Wang

Renal Division, People's Hospital, Peking University, Beijing, China

Objective: To observe bone mineral density (BMD) at different sites in maintenance hemodialysis (MHD) patients, and the influence of abdominal aortic calcification on BMD detection. **Methods:** In this observation study, BMD at lumbar spine (L1-L4), femoral neck and radial were measured by dual energy X-Ray absorptiometry (DEXA) in MHD patients. Major clinical and laboratory indices such as patients' age, body mass index (BMI), dialysis duration, albumin corrected calcium (corrected Ca), serum phosphorus (P), calcium-phosphorus product ($\text{Ca} \times \text{P}$), C reactive protein (CRP), intact parathyroid hormone (iPTH), and alkaline phosphatase (ALP) were examined and collected. Stepwise multiple linear regression analysis was used to identify the risk factors for abnormal BMD. All patients underwent plain radiographs of lateral abdomen to detect abdominal aortic calcification. The influence of abdominal aortic calcification on BMD measurement was analyzed. **Results:** We collected 62 MHD patients (30 males and 32 females), who were on MHD for 27.7 ± 29.78 months. The mean T-scores from lumbar spine, femoral neck and radial were -0.80 ± 1.65 , -1.12 ± 1.15 , and -1.80 ± 2.06 , respectively. Radial T-score was significantly lower than that of lumbar spine ($P = 0.011$). The prevalence of osteoporosis in lumbar spine, femoral neck and radial were 14.5%, 16.1% and 38.7%, respectively, and the prevalence of osteopenia were 35.5%, 35.5% and 19.4%, respectively. Sex, age and BMI correlated with lumbar and femoral neck T-scores independently, and ALP correlated with radial T-score independently. In 62 MHD patients, there were significant correlations among the T scores from different sites. In the MHD patients with abdominal aortic calcification, however, lumbar T-score was not correlated with radial T-score. **Conclusions:** In MHD patients, the value of BMD is correlated with patient's sex, age, BMI and ALP.

Abdominal aortic calcification may interfere with the measurement of lumbar BMD by DEXA.

Key words: Bone mineral density, Abdominal aortic calcification, Dual energy X-Ray absorptiometry (DEXA).

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Analysis of the Relationship Between Lipoprotein and Thrombogenesis in Uygur Ethnic on Maintenance Hemodialysis

K. Ma, L. Zhang, J. Liu, J.H. Chen

Nephrology Department, The First Affiliated Hospital of Xinjiang Medical University, Urumqi, Xinjiang, China

Objective: Because of the higher prevalence of dyslipidemia among Xinjiang Uygur population, we explored the relationship between lipoprotein and thrombogenesis in Uygur ethnics on maintenance hemodialysis (MHD). **Methods:** We recruited 229 MHD patients and assigned them into Uygur or Han groups, and thrombogenesis or non- thrombogenesis groups. Thrombogenesis was examined within 3 weeks after arteriovenous fistula operation. The cause of thrombogenesis was analyzed in association with their ethnic, gender, age, hemoglobin, thromboxane, and serum lipids. **Result:** The prevalence of thrombogenesis in the 3 weeks after fistula operation was 5.0% and 14.3% ($X^2=5.110$, $P=0.024$) in Han and Uygur, respectively. There were no significant differences in gender, age, hemoglobin, thromboxane between Han group and Uygur group. However, serum lipoprotein A was significantly different between Han group and Uygur group. Serum lipoprotein A was 354.9 ± 312.4 mg/L in Uygur group, and was 273.21 ± 244.35 mg/L in Han group ($X^2=5.326$, $P=0.021$). **Conclusion:** Higher serum lipoprotein A level may be the cause of higher prevalence of thrombogenesis after arteriovenous fistula operation in Uygur MHD patients.

Key words: Lipoprotein, Thrombogenesis, Maintenance hemodialysis.

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Concurrent Use of Bioelectrical Impedance and On-Line Blood Volume Monitoring for the Evaluation of Dry Body Weight in Hemodialysis Patients

J.S. Xu, J.X. Zhang, L.W. Cui, L. He, T. Wang

Department of Nephrology, The Fourth Hospital of Hebei Medical University, Shijiazhuang, China

Objective: To explore the concurrent use of bioelectrical impedance and on-line blood volume monitoring for the evaluation of dry body weight (DW) in patients on hemodialysis, who reached the DW clinically. **Methods:** The control group (group A) included 240 healthy volunteers from urban area of Shijiazhuang, comprising 120 males (age 43.36 ± 10.21 years) and 120 females (age 44.66 ± 13.46 years). They manifested no hypertension and heart, liver and kidney

diseases, edema, and metabolic disorders. The patient group (group B) composed of 40 patients, who were on maintenance hemodialysis (MHD), reached the DW based on clinical evaluation, and had equal gender distribution with the average age of male 45.55 ± 10.77 years and female 43.70 ± 13.88 years. Their hemoglobin and albumin were higher than >90 g/L and >35 g/L, respectively. Patients were further subdivided by bioelectrical impedance into subgroup B1 (reached the DW, $n=8$) and subgroup B2 (not reached the DW, $n=32$). TBW% and ICW/TBW% were measured in group A and group B by using Maltron BioScan 916, and $\Delta BV\%$ was monitored by using Fresenius 4008s BVM system in patients before subdivided into subgroup B1 and B2. The DW of the patients in subgroup B2 was cautiously lowered under the monitoring of BVW until the value met that assessed by bioelectrical impedance. The $\Delta BV\%$ data were then recorded, and the patients with these data were singled out from subgroup B2 and redesignated as subgroup B2'. Meanwhile, patient's main complaints, symptoms, blood pressure and heart rate were closely observed and recorded. TBW%, ICW/TBW% and $\Delta BV\%$ were given as categorical data. Comparisons among groups were made by unpaired t-test. $P<0.05$ was considered to be significant. Data were processed by the SPSS software package. **Results:** 1. No intergroup differences in age, height, body mass index and plasma albumin were found when males and females were compared separately between groups A and B ($P>0.05$). 2. TBW%, ECW/TBW% and ICW/TBW% were significantly higher in subgroup B2 than in the control group ($P<0.05$). Compared with group A, subgroup B2' had similar TBW%, ECW/TBW% and ICW/TBW% after cautiously lowering their DW. 3. $\Delta BV\%$ in subgroups B2 and B2' had no significant difference, as compared with that in subgroup B1 ($P>0.05$). **Conclusion:** 1. In some MHD patients who achieved DW clinically, the postdialysis TBW% was still higher than that in the healthy population. Bioelectrical impedance analysis is more accurate than clinical assessment in the evaluation of DW. 2. Both bioelectrical impedance and on-line blood volume monitoring of the $\Delta BV(\%)$ can be independently used for the evaluation of the DW, however, the former method seems to be more accurate. Concurrent use of the two methods may render the evaluation of DW safe and accurate.

Key words: Bioelectrical impedance, On-line blood volume monitoring, Total body water, Hemodialysis, Dry weight.

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Changes of Lipid Metabolism in Hemodialysis Patients Using High Flux Membrane

F.B. Xu, H.L. Liu

Department of Nephrology, Beijing Fuxing Hospital, Capital University of Medical Science

Background: This study was a prospective and randomized clinical trial over 12 months involving 55 stable hemodialysis patients treated with the dialysis of standard high-flux polysulfone dialyzer membrane or that of low-flux polysulfone dialyzer membrane, to determine whether high-flux dialysis can improve lipid metabolism. **Methods:** We observed 55 regular hemodialysis patients (24 males and 31 females) using low-flux F7HPS dialyzer, and assigned them into two groups. Patients in group A were changed to high flux hemo-

dialysis, their dialysis parameter remained unchanged except using high-flux FX60 dialyzer instead of low-flux F7HPS dialyzer. They were used ultrapure dialysate. Patients in group B still used the F7HPS dialyzer. Dialysis was conducted 4-5 hours per session and 3 times a week for the 2 groups of patients. Pre-dialysis blood samples were collected for assays of serum triglyceride (TG), cholesterol (CHOL), high density lipoprotein (HDL) and low density lipoprotein (LDL) at 0 and 12 months after the treatment. **Results:** Serum CHOL decreased significantly after change of dialysis from low-flux dialysis to high-flux dialysis ($4.56 \pm 0.23/\text{kg}$ vs. $4.25 \pm 0.19/\text{kg}$, $P < 0.05$). TG, HDL and LDL remained unchanged in the observation period. Comparing the lipid changing of group LFHD and group HFHD: cholesterol, triglyceride, high density lipoprotein and low density lipoprotein had no significant differences. CHOL and LDL decreased significantly comparing the group LFHD with group HFHD after one year ($P < 0.05$), but TG and HDL have no significant difference between two groups. When comparison was made between the 2 groups, CHOL, TG, HDL and LDL had no significant differences at the beginning. After the treatment for one year, CHOL and LDL decreased more in group A than in group B ($P < 0.05$), but TG and HDL had no significant differences between the 2 groups. **Conclusions:** The results indicate that shift from low-flux to high-flux hemodialysis can improve lipid metabolism in maintenance hemodialysis patients.

Key words: Lipid metabolism, High flux membrane.

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The Significance of Vitamin D Receptor (VDR) and Calcium-Sensing Receptor (CaSR) Expressions in Renal Secondary Hyperparathyroidism

W.B. Wang¹, L. Zhang¹, J.P. Da²

¹Department of Nephrology, ²Division of Pathology, China-Japan Friendship Hospital, Beijing, China

Corresponding author: Zhang Ling;

E-mail: zhangling5@medmail.com.cn

Background: It's well known that renal secondary hyperparathyroidism (SHPT) is associated with chronic renal failure, and parathyroidectomy is required for severe SHPT. To study the pathology

and proteins expression in the hyperplasia parathyroid is helpful to elucidate the pathogenesis of SHPT. **Objective:** To investigate the relationship between the expression of the 2 receptors vitamin D receptor (VDR) and calcium-sensing receptor (CaSR) and the proliferation activity in parathyroid (PT) tissues of SHPT. **Methods:** 1. Control group: Two normal parathyroid tissues were collected as group A from two patients with normal renal function. 2. SHPT group: Nine PT glands were collected from 9 patients with SHPT after parathyroidectomy. Based on the morphology changes after hematoxylin-eosin staining, the SHPT samples were divided into three groups: group B with diffuse hyperplasia, group C with nodular hyperplasia, and group D with adenoma hyperplasia. 3. Immunohistochemistry: Immunohistochemical stain using tissue microarray technique. 4. Quantification of immunohistochemistry signals: Each slide was observed under a light microscope, and ten areas ($\times 400$) were randomly selected. The VDR and CaSR signals were scored according to the percentages of positive cells and using the following criteria: grade 3 for more than 75%, grade 2, for 50-75%, and grade 1 for $< 25\%$. 5. Comparison and analysis of VDR and CaSR scores in the 4 groups. **Results:** Among the nine proliferation PT glands, one was diagnosed as diffuse hyperplasia, five were nodular hyperplasia and three were adenoma hyperplasia. 1. Expressions of VDR protein: VDR is mostly localized in nuclei in normal PT cells. The expression of VDR was $78 \pm 2.51\%$, $57.1 \pm 0.00\%$, $31 \pm 6.73\%$ and $23 \pm 2.06\%$ in group A, B, C, and D, respectively. The levels of VDR expression was related to the hyperplasia of parathyroid gland. 2. Expressions of CaSR protein: CaSR is mostly expressed on membrane and in cytoplasm. The expression of CaSR was reduced in SHPT group ($48 \pm 17.91\%$) compared to that of group A ($79 \pm 1.00\%$). The expression of CaSR was $51 \pm 0.01\%$, $47 \pm 9.81\%$ and $29 \pm 10.13\%$ in group B, C and D, respectively. In addition, the expression level was different in the same PT sample, probably reflecting the cells at different cell cycle stage. **Conclusion:** 1. The decrease of VDR and CaSR expressions appears to be the cause of refractory SHPT which is unresponsive to calcitriol pulse therapy. 2. Attempts to increase the expression of these receptors and to develop the receptor agonists as the medications should be the targets for SHPT therapy.

Key words: Vitamin D receptor (VDR), Calcium-sensing receptor (CaSR), Secondary hyperparathyroidism.

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