CRRT APPLICATIONS

1. Etiology And Outcome Of Acute Renal Failure In 147 Children: A Single Center Experience

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Background: Acute renal failure (ARF) is common in critically ill children and characterized by a sudden but reversible increase of serum creatinine and nitrogenous waste products and by the inability of the kidney to regulate fluid and electrolyte homeostasis appropriately. The incidence in children seems to be increasing and the etiology of ARF has shifted from primary renal disease to multifactorial causes. Therapeutic strategies and prognosis depend on the underlying disease. **Objectives:** The aim of this retrospective study was to define etiology and clinical features of ARF in 147 children and to evaluate prognostic factors and the outcome after renal replacement therapy. Patients and **Methods:** Between 21 and 211, 147 pediatric patients (66 females, 81 males), were admitted to our hospital for ARF. Out of those, 26 (17.6 %) were newborns (median age 4 days, range 1-22 days) and 121 patients (82.4%) were children older than 1 month (median 3.21 years, range 1 month–18 years). Causes of ARF, accompanying medical conditions, pediatric-modified RIFLE criteria, treatment, indications and mode of dialysis as well as patient outcome were retrospectively analyzed. Descriptive statistics are presented as mean±SD and univariable levels were analyzed using a multivariable regression model. **Results:** While haemolytic uremic syndrome (n=42; 35%), sepsis (n=36; 3%) and dehydration (n=34; 28%) were the most common causes of ARF in children older than 1 month, renal vein thrombosis (n=11; 42%) as well as shock and asphyxia (n=1; 38%) were predominant reasons in newborns. Dialysis was performed in 12.5% (n=3, all CVVHD) of newborns and 55% (n=66, 37 CVVHD, 29 CVVHF) of children older than 1 month. Overall mortality was 23% (n=34) and was predominantly observed in the group of septic children following bone marrow transplantation (BMT; n=3, 88%). All BMT patients underwent dialysis treatment. Out of 66 dialyzed patients restitution could not be achieved in 15 cases (22.7%) and chronic dialysis treatment became necessary. **Conclusions:** Our overall results suggest a favorable outcome of ARF in children regardless the necessity of dialysis. In contrast, ARF in children following BMT and sepsis is associated with a 1% mortality rate. Improved understanding of the pathophysiology, early biomarkers of AKI, and better classification are required to optimize successful therapeutic efforts.

2. Correction Rate of Hyponatremia via Continuous Veno-venous Hemodialysis: A Formula Based on Dialysis Dose

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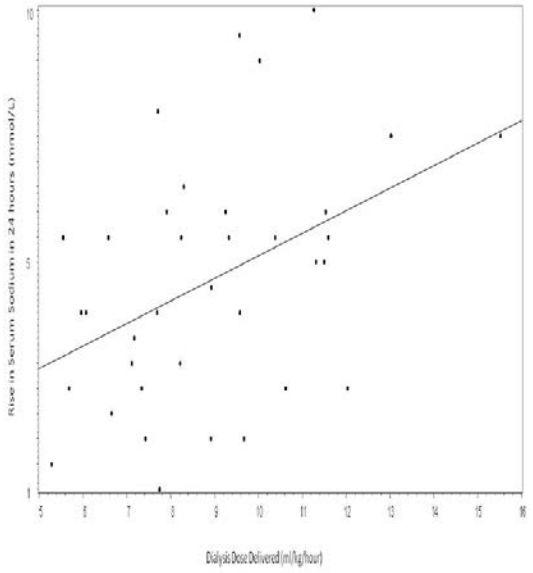
Hyponatremia is a prevalent electrolyte disturbance in hospitalized patients, and particularly when water excretion is hindered by renal impairment. Rapid

correction of serum sodium may result in the development of osmotic demyelination, typically noted at rates of correction that exceed 12 mmol per liter in 24 hrs or 19 mmol per liter in 48 hours. {Adrogue, 2 #322} In this study, we examined the effect of dialysis intensity on the rate of rise in serum sodium in patients with acute kidney injury initiated on continuous venovenous hemodialysis (CVVHD). Methods: Retrospective study of 35 critically ill patients with acute kidney injury and serum sodium less than 13 mmol/L at initiation of CVVHD. Results: Mean age was 64±13 years; 2 (56%) were male and 16 (44%) had baseline kidney disease. APACHE II score on ICU admission was 2±1, 23 (64%) were on mechanical ventilation and 2 (56%) were on vasopressor support. Serum sodium at time of CVVHD initiation was 125±4 mmol/L, creatinine 4.6±2 mg/dl, and BUN 91±32. In simple linear regression model, a 1 ml/kg/hr increase in dialysis dose (assessed by effluent rate) was associated with 4.5 mmol/L increase in serum sodium over twenty four hours (p=.9). Gender or baseline weight did not alter the above parameter estimate or the p value in a multivariable model. Conclusion: CVVHD can correct low serum sodium levels in a safe, effective, and controlled manner. Each 1 ml/kg/hr increase in dialysis intensity results in a 4.5 mmol/L rise in serum sodium.



3. Acute Kidney Injury; The Experience From The Other Side Of The World

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Introduction: AKI is commonly diagnosed and the mortality rate was extremely high. At least a third of AKI patients required dialysis however, CRRT is not widely available especially in under-developed countries. Hence, conventional hemodialysis was the only available option. **Objectives**: To define the clinical approach and determine the outcomes of our AKI patients. Method: This is a single centre, sub-urban satellite hospital's experience in the management of AKI patients. The 3-days mortality rate and renal outcomes were estimated and prognostic factors associated with clinical outcomes were also identified. **Results:** 75 patients were reviewed and their mean age was 52.9 +/- 14.5 years-old. Two-third were males

and 75 %s were Malays followed by 16 %s Chinese and 9 %s Indians. Twelve %s had concurrent coronary heart disease, more than half had hypertension and 48 %s had diabetes. 53.3 % were referred from intensive wards with pre- and intra-renal AKI noted in 21.3 and 73.3 %s respectively. Sepsis was diagnosed in 78.7 % and the pathogens were identified in 42.3 % of them. At the start of dialysis, the urea and creatinine were 3.4 (IQR 2.3) mmol/L and 474 (IQR 398) mcmol/L respectively. Metabolic acidosis was noted in 76 % and oliguria in 38.7 %. At least 85.3 % required dialysis and conventional HD was the most commonly prescribed while 22.7 % of the patients were started on CRRT. The 3-days mortality rate was 28 % and duration of ward stay was 11.5 (IQR 7) days. Patients referred from the intensive wards had higher mortality rate (37.5 versus 17.1 %s). They were also frequently started on dialysis (39 versus 25 cases, p=.1). Of those treated with dialysis, 68.8 %s survived and complete renal recovery was noted in 31.3 %s of them. Seventeen patients had partial recovery and seven were dialysis-dependent. CRRT had associated with shorter hospital stay (1 versus 3 days, p= .4) but not with better clinical outcomes. **Conclusion:** The overall 3-days mortality rate was 28 %s and higher in the intensive wards. Referral from intensive wards was the only factor associated with poor clinical outcomes and CRRT was not associated with an improved prognosis in our AKI patients.

	Intensive Wards	General Wards	p value
n (%)	4 (53.3)	35 (46.7)	-
Age	57.5 (IQR 25)	54 (IQR 21)	NS
Gender (M:F)	26:14	21:14	
Ethnicity (M:C :I)	31:7:2	25:5:5	
Co-morbid			
Diabetes	19	17	NS
Hypertension	22	18	NS
CAD	5	4	NS
Etiology			
Pre-renal (n, %)	6(15)	1 (28.6)	NS
Intra-renal (n, %)	34(85)	21 (6)	.2
Post-renal (n, %)	()	4 (11.4)	.3
Sepsis	35 (87.5)	24 (68.)	.5
Urea	3.8 (IQR 19)	29 (IQR 22)	NS
Creatinine	46 (IQR 168.5)	56.5 (IQR 49)	NS
Potassium	5 (IQR 1.6)	4.2 (IQR 1.4)	NS
Hemoglobin	1.5 (IQR 3.5)	9.5 (IQR 3.1)	NS
White Cell	15.3 (IQR 1.8)	12.3 (IQR 9.8)	NS
Platelet	22 (IQR 159)	223.5 (IQR 143.5)	NS
Albumin	27 (IQR 8.4)	26.6 (IQR 1.8)	NS
Acidosis	33	24	NS
Coagulopathy	18	11	NS
AKI 1	1	7	NS
AKI 2		2	NS
AKI 3	39	26	.3
Dialysis; Yes	39	25	.1
CRRT	16		< .1
LOS	13 (IQR 1)	1 (IQR 8)	NS
Mortality	15 (37.5)	6 (17.1)	.5

4. A Multicenter International Survey of Renal Supportive Therapy during ECMO: The Kidney Intervention During Extracorporeal Membrane Oxygenation (KIDMO) Group.

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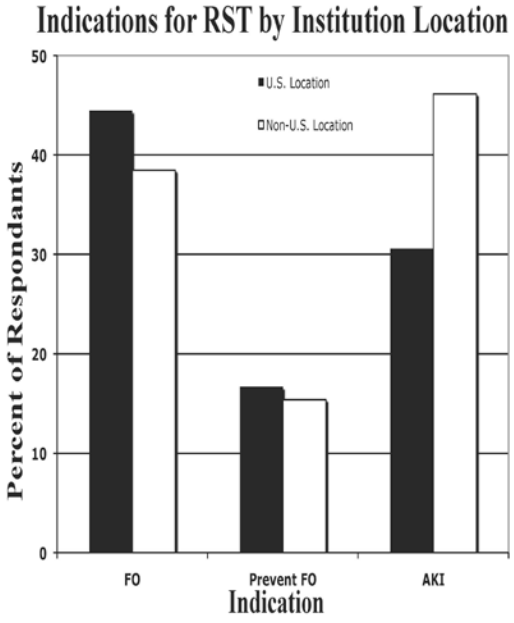
Background: Literature on Renal Support Therapy (RST) on ECMO is limited to single center experiences. This study's goal was to obtain background data from worldwide centers regarding RST practices during ECMO support.
Design and Methods: A cross-sectional survey of center practices with regards to RST during ECMO. The study was carried out with IRB approval via electronic survey using REDCap Survey (Vanderbilt University School of Medicine, Nashville TN). The 29 question survey was distributed to medical directors via the ECLSNet ListServe eclsnet@rufus.origenbio.com).
Results: A total of 65 of 21 international ELSO centers responded of which 8% were US sites, 4.6% were Canadian, 1.8% were European and 4.6% were from Australia or New Zealand. 94% of centers reported caring for neonatal or pediatric patients but only 4% cared for adults on ECMO. 46% of centers reported both cardiac and respiratory indications for ECMO, 27.7% reported cardiac support only, 24.6% reported respiratory support only. With regards to RST interface with ECMO, 23% reported not using any RST during ECMO, 21.5% only used an in-line hemodiafilter, 5.8% only used a RST machine connected to the ECMO circuit and 4.6% used both methods.
The treatment or prevention of fluid overload (FO) was the most frequent indication for RST reported comprising 59% of the cohort. There was a non-significant trend ($p>.5$) toward non-US centers reporting acute kidney injury (AKI) as the primary indication for RST. RST indication differed by indication for ECMO with AKI predominating (42%) in the group on ECMO for cardiac support. The predominant clearance method utilized was convective (SCUF 43% + CVVH 18%) and was dependent upon RST interface (in-line filter vs machine). Nephrology was the most common author of RST prescription (63%) as compared to critical care, and was significantly different ($p<.1$) between US centers (83%) and non-US centers (11%).



Conclusions: Despite a 5% prevalence of AKI on ECMO by current definitions, nearly 25% of centers do not use RST during ECMO. Fluid overload is the

predominant indication for RST during ECMO in this cohort, with AKI most prominent in non-US centers and those performing primary cardiac support. Nephrology is the primary author of RST prescriptions worldwide but most markedly in US centers. Further work by this group hopes to elucidate more specific details regarding FO and AKI in this population and the association with outcomes.

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5. Continuous Veno-Venous Haemofiltration (CVVH) In Infants in PICU Using The Proprietary Prismaflex ® Device And HF20 Haemofilter And Circuit

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CVVH in infants is difficult because there is little available technology allowing low extracorporeal circuit volume. We started a programme using the Prismaflex® hemofiltration machine and HF2® filter/circuit (extracorporeal volume 6 mL) in infants.
14 infants, age 1 week to 19 months (3.5-11 kg), were treated over 3 months from June 29 to December 211, 1 for acute renal failure and 4 for inborn errors of metabolism. We monitored negative fluid balance; fall in plasma urea/creatinine/ammonia/organic acids, circuit life, circuit pressures. Vascular access was through peripheral cannulation in 12 patients via an ECMO circuit in two patients. 112 treatment sessions, were performed over 99 patient-days (range 1-25 sessions, mean 8, and 1-24 days of treatment, mean 6.7 days per patient). Heparin was used as anticoagulant in all patients. We also changed two patients to citrate. Blood flow was 3-8.3 ml/kg/min (2 ml/min minimum). CVVH with prefilter replacement fluid was standard. Effluent was 2% of blood flow. Negative or neutral fluid balance was always achieved and plasma creatinine, urea, ammonia and organic acid values fell to steady-state within 3 hours. Access pressure, filter pressure, venous return pressure and trans-membrane pressure were always within acceptable ranges. Reasons for changing circuits included routine at 72 hours, other interventions, clotting in the access pressure pod (31 cases), rising TMP (2 cases), scale malfunction, extended power failure and cracked filter (1 case each). One adverse clinical event of and intra cerebral haemorrhage occurred during treatment with CVVH. 7 patients died from their primary disease.
The Prismaflex HF2 circuit is efficacious in infants as small as 3.5 kg. Filter life is comparable to reports in older children and adults.

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6. Continuous Veno-Venous Haemofiltration (CVVH) In Infants and Children In PICU Using The Proprietary Prismaflex® Device And ST60 Haemofilter And Circuit

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Continuous Renal Replacement Therapy in infants and small children is difficult because there is little available technology allowing low extracorporeal circuit volume. We started a program using the Prismaflex® hemofiltration machine and ST6® filter/circuit (extracorporeal volume 93 mL) in infants and small children. 1 infants and children, aged 9 months to 8 years (8-28

kg), were treated over 3 months from June 29 to December 211. 8 patients were treated with CVVH and 2 with CVVHDF. Four patients had an admitting diagnosis of sepsis, four patients had liver failure, one patient had respiratory distress post bone marrow transplantation and the tenth patient had Langerhans Histocytosis. Effectiveness of treatment was measured by negative fluid balance, fall in plasma urea/creatinine/ammonia/organic acids, circuit life, circuit pressures. Eight patients had a peripherally inserted double lumen vascular access device and two patients were connected to an Extra Corporeal Membrane Oxygenation (ECMO) circuit. 52 treatment sessions were performed over 61 patient-days (range 1-26 sessions, mean 5.2, with 1-27 days of treatment, mean 6.1 days per patient). Heparin was used as anticoagulant for all patients, however, one patient was changed to citrate. Blood flow was 2.5 – 6.1 ml/kg/min. CVVH with prefilter replacement fluid was standard. Effluent was 2% of blood flow. Negative or neutral fluid balance was always achieved and plasma creatinine, urea, ammonia and organic acid values fell to steady-state within 3 hours. Access pressure, filter pressure, venous return pressure and trans-membrane pressure were always within acceptable ranges. Reasons for changing circuits included routine change at 72 hours, filter clotting with rising TMP or cessation of treatment to facilitate a scan or surgical procedure. No adverse clinical events occurred as a result of CVVH. The Prismaflex ST 6 circuit is efficacious in infants as small as 8 kg. Mean circuit life for all reasons was 22.45 hours.

7. Outcomes of Patients with End Stage Renal Disease (ESRD) Under Chronic Hemodialysis Requiring Continuous Renal Replacement Therapy (CRRT) and Patients without ESRD in Acute Renal Failure Requiring CRRT

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Purpose: The purpose of this study were to (1) evaluate short-term patient survival and (2) compare the survival of conventional hemodialysis (HD) patients needing CRRT with the survival of non-end stage renal disease (ESRD) patients in ARF requiring CRRT.

Methods: We evaluated adults (> 18 years) requiring CRRT who were treated in the intensive care unit (ICU) of Kosin University Gospel Hospital, Busan, Korea from January 1, 29 to December 31, 21. A total of 1 (24 ESRD, 76 non-ESRD) patients received CRRT during the study period. Patients were divided into two major groups: patients with ESRD requiring chronic dialysis and patients without ESRD (non-ESRD) with ARF. Predictors of all-cause death were examined using Kaplan-Meier analysis and Cox proportional hazards analyses in both treatment groups.

Results: Across all patients, the median survival time was 56 days, and the 9-day survival rate was 44.6%. For non-ESRD patients, the 9-day survival rate was 41.6%. For ESRD patients, the 9-day survival rate was 55.3%. Multivariate Cox proportional hazards analyses demonstrated that conventional HD was not a significant predictor of mortality [hazard ratio (HR) .334, 95% confidence interval (CI) .63–1.763, P = .196], after adjustment for age, gender, presence of sepsis, APACHE score, use of

vasoactive drugs, number of organ failures, ultrafiltration rate and arterial pH. **Conclusion:** The survival rates of non-ESRD and ESRD patients requiring CRRT did not differ, and conventional HD may be not a significant predictor of mortality.

	ESRD (n=24)	Non-ESRD (n=76)	P value
Age, years	53.6 ± 31.6	49.5 ± 28.2	.324
Admission to CRRT, day	6.4 ± 8.5	8.4 ± 28.7	.819
APACHE II score	89.2 ± 34.9	89. ± 32.5	.982
Medical setting (%)	2 (83.3)	54 (71.1)	.293
No. of organ failure	1.4 ± .8	1.8 ± .9	.131
Serum BUN (mg/dL)	59.2 ± 33.9	53.2 ± 28.5	.391
Serum creatinine (mg/dL)	6.5 ± 4.	3.5 ± 2.3	.2
Leukocyte (× 13/μL)	12.6 ± 5.1	14.6 ± 1.2	.351
Hemoglobin (g/dL)	1.3 ± 1.7	1.4 ± 2.1	.71
Platelet (× 13/μL)	126.2 ± 5.5	15.6 ± 82.2	.534
Serum albumin (g/dL)	2.5 ± .6	2.7 ± .5	.179
UFR (mL/kg/hr)	22.4 ± 4.6	21.7 ± 4.4	.69
Sepsis (%)	12 (5)	48 (63.2)	.251
Cardiac dysfunction (%)	14 (57)	3 (38)	.91
Death (%)	1 (41.7)	43 (56.6)	.22

8. Correction of Severe Hypernatremia With Continuous Renal Replacement Therapy Using Regional Citrate Anticoagulation

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A 27 years old pregnant woman with systemic lupus erythematosis was admitted at 33 weeks gestation with chest pain, headache, and vomiting and diagnosed with eclampsia. Her neurologic status deteriorated rapidly and an emergent cesarean section was performed. Imaging revealed a large left-sided intra-parenchymal hemorrhage with mass effect and she returned to the OR for evacuation where a large ruptured arterio-venous malformation was discovered. For neurologic protection, hypertonic saline was intermittently administered to keep the serum sodium 155-16mmol/L. Creatinine was .9mg/dL on admission and rose to 2.57 by hospital day 7. As her renal function declined, she was less able to regulate her sodium balance and the serum sodium rose to 18's by hospital day 13 and was refractory to hypotonic fluids. In order to bring the serum sodium down in a controlled fashion, continuous renal replacement therapy (CRRT) was initiated on day 16 with regional citrate for anticoagulation (RCA). Initial dialysate was custom-made to contain a sodium concentration of 147meq/L (versus the standard sodium concentration of 117meq/L). Trisodium citrate was kept at a constant rate of 15 ml/hour to avoid variability in sodium delivery. After 2 hours, the sodium had decreased from 18 to 176. At 3 hours, the sodium dropped to 173 and the replacement solutions were modified to contain a sodium concentration of 174meq/L (Normal

saline + 2meq of NaCl). After an additional two hours, the sodium fell further to 167mmol/L, and replacement fluids were adjusted to contain 184meq/L of sodium, the dialysate was modified to contain a sodium of 172meq/L, and the patient was given 2mL of 3% saline. The serum sodium then increased to 172mmol/L and remained 172-174 for the next 1 hour. The sodium content of the dialysate and replacement fluids were adjusted down on a daily basis in order to reduce the serum sodium slowly over the next 7 days. Intracranial pressure and cerebral perfusion pressures were monitored continuously and remained within target. On day 7 of CRRT, serum sodium had reached 147, however she had no neurologic improvement and the decision was made by the family to withdrawal care. While ultimately the patient's underlying neurologic injury was devastating, this case demonstrates that in the setting of severe hypernatremia, sodium can be safely reduced in a controlled manner with custom-made hypertonic dialysate and replacement solutions.

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9. Clinical parameters to determine the optimal timing of CRRT in critically ill patients with acute kidney injury

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Purpose: The aim of this study was to evaluate the clinical parameters to determine the optimal time for continuous renal replacement therapy (CRRT) in critically ill patients with severe acute kidney injury (AKI). Methods. A single center retrospective study was performed using data from 166 AKI patients who received CRRT in intensive care unit (ICU) between October 27 and January 21. We compared mortality rate at 9 days after the initiation of CRRT, ICU-free and CRRT-free days between "early CRRT" and "late CRRT" groups stratified by blood urea nitrogen (BUN), serum creatinine, urine output and RIFLE criteria. **Results:** The 9-day mortality rate was significantly lower in the early group compared with the late group when stratified by median value of BUN at the start of CRRT and mean hourly urine output during 6 h, 12 h, and 24 h before CRRT. In addition, the 9-day mortality rate was also significantly lower in patients who received CRRT in the "injury" stage of RIFLE criteria compared with those in "failure" or "loss" stage. ICU-free and CRRT-free days during the first 28 days were significantly longer in the early group when stratified by median level of BUN. However, in terms of creatinine, ICU-free and CRRT-free days were significantly shorter in the early group compared with the late group. CRRT-free days during the first 28 days were also longer in early group stratified by median value of mean hourly urine output during 6 h, 12 h before CRRT. After adjusting for covariates, 9-day mortality was independently lower in the early group defined by median level of BUN (OR=1.65 (1.1-2.47), p=.15) and mean hourly urine output during 12h before CRRT (OR=1.56 (1.5-2.33), p=.27). **Conclusion**: Our data suggest that early CRRT may have a survival benefit in critically ill patients with severe AKI, and BUN and urine output

at the initiation of CRRT may be important parameters to determine the optimal time for CRRT.

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10. Identifying Predictors of Outcome Following CRRT Discontinuation in Pediatric ICU Population

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Background: In critically ill pediatric patients, renal replacement therapy (RRT) improves short-term survival in severe acute kidney injury (AKI), yet there remains little consensus regarding timing of initiation or discontinuation of RRT. Only two studies have specifically examined predictors of successful discontinuation of continuous RRT (CRRT), and neither study included pediatric patients. We sought to determine if several readily-available clinical parameters could predict clinical outcomes following CRRT discontinuation. **Methods:** Retrospective single-center study of 115 children who required CRRT in the PICU from July 26 to March 211. Data collection included degree of fluid overload (FO) at CRRT initiation and discontinuation; duration of therapy and urine output (UOP) prior to CRRT discontinuation. The primary endpoint was patient outcome following CRRT discontinuation, defined as dialysis dependence, dialysis independence or death. ANOVA was used for normally distributed data and Kruskal-Wallis tests for non-normally distributed data. Multiple logistic regression modeling was performed. **Results:** Outcomes following CRRT discontinuation were as follows: 32 (28%) patients died, 21 (18%) required intermittent dialysis and 62 (54%) did not require dialysis. In unadjusted analyses, there were significant differences between the 3 outcome groups when comparing mean values of FO at discontinuation (p=.5), age (p=.3) and length of CRRT (p=.4). Of 6 clinical parameters, only urine output in the 8 hours prior to discontinuation produced significant results following adjustment; for 1 mL/kg/hour increase in UOP, the OR of dialysis independence compared to death was 2. (95% CI 1.2-3.4). **Conclusions:** Our study represents a first step in understanding the characteristics of pediatric patients with severe AKI that predict post-CRRT survival and need for ongoing renal replacement. We identified that urine output in the 8 hours preceding CRRT discontinuation was associated with dialysis-independent patient survival. Although preliminary, this finding suggests that readily-available clinical parameters can inform clinical decision-making about the timing of CRRT discontinuation, and provides the rationale for prospective clinical trials.

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11. Pharmacodynamic Properties of Imipenem in Continuous Venovenous Hemodialysis (CVVHD)

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Background: Sepsis is the leading cause of death in acute renal failure and recent publications highlight the survival benefit of early appropriate antimicrobial therapy. We hypothesized that dialytic clearance of antibiotics might undermine

effective antimicrobial therapy. In an IRB-approved observational study, we measured imipenem levels in critically ill patients receiving continuous hemodialysis. **Methods:** Inclusion: Adult patients with acute or chronic renal failure receiving CVVHD in the ICU. Exclusion: ESLD, pregnancy. Patient data including age, gender, current and admission weight, and CVVHD dose were recorded. Sampling: After the fourth dose of antibiotic during uninterrupted CRRT, trough, 3 minute post infusion peak and second trough blood and effluent samples were drawn. **Drug analysis:** Free and effluent imipenem levels were measured by RP-HPLC. Data analysis: Imipenem levels and patient data were used for PK and PD calculations. The pharmacodynamic parameter of interest was %T > MIC, where MIC is defined by CLSI breakpoints for imipenem (Sensitive 1 ug/ml; Intermediate 2 ug/ml; Resistant > 4ug/ml for Enterobacteraceae). The probability of target attainment for >5%T > 4xMIC was calculated for each breakpoint. Statistical testing was performed using JMP 9. Parameters with a p-value less than .3 on univariate analyses were included in multivariate linear regression analyses. Results: Complete data was available from 17 subjects dialyzed with the NxStage Express (n=6) or Gambro Prismaflex (n=11). Probability of Target Attainment was 88% for an MIC of 1ug/ml, 29% for an MIC of 2 ug/ml, and % for MICs of 4 and above. Univariate analyses suggested a relationship between %T > MIC and CVVHD dose (either total or weight-based), gender and weight gain since admission, but not severity score. A multivariate linear regression incorporating weight change, gender and CRRT dose demonstrated a significant and negative relationship between CRRT dose and %T > MIC, which was preserved for %T > 2ug/ml, 4ug/ml and 8 ug/ml. Discussion: Our data suggest that not all critically ill subjects treated with concomitant CRRT and imipenem achieve a conservative pharmaco-dynamic target for susceptible Enterobacteraceae, and only 29% achieve target for intermediate-susceptibility organisms. The significant negative association between CVVHD dose and pharmacodynamic parameters suggests the potential for intensive dialytic therapies to undermine antimicrobial therapy.

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12. Citrate Kinetics in Septic Shock Patients with Liver Dysfunction During Continuous Venovenous Hemodiafiltration

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Background: Citrate anticoagulation is more and more popular in continuous renal replacement therapies. However, few data are available on citrate kinetics in patients with septic shock. In order to study whether citrate accumulates in septic shock patients with liver

impairment, we studied plasma and ultrafiltrate levels during continuous veno-venous hemodiafiltration (CVVHDF). **Methods:** A routine determination of citrate in plasma and dialysate using a modular analyser (Architect c8, Abbott Italia) was set up by adapting a commercial citrate lyase method. This method was modified by lowering the sample volume, with a curve linear up to 4 mmol/L. Citrate concentrations were measured undiluted in systemic plasma (range .1-4 mmol/L) and with 1:2 sample dilution in circuit plasma or ultrafiltrate (range .2-8 mmol/L). In vitro we studied the distribution of blood citrate between intra- and extracellular compartments. Ex vivo we studied citrate levels in systemic and circuit plasma and in ultrafiltrate (at , .5, 1, 3, 6, 9, 12, 24, 48 and 72 hrs) of 12 septic shock patients with liver dysfunction on CVVHDF. **Results:** In order to evaluate blood distribution of citrate between intra- and extracellular compartments, we found in vitro a significant correlation (r .9997, y = .66 + 1.2x, n 36) between the plasma measured and the predicted citrate concentrations for an exclusive extracellular distribution (taking into account the hematocrit value).
Ex vivo median systemic citrate levels were .9 (.6-.12) mmol/L (time) and .23 (.18-.31) mmol/L during CVVHDF. Median sieving coefficient for citrate was .95 (.88-1.2), and did not change with different blood flow (from 1 to 15 ml/min) and effluent volume (from 135 to 51 ml/hour). Net citrate removal by filter significantly correlated with the effluent volume (r .85). Median citrate load entering in patient bloodstream was as low as 13.6 (9.1-19.6, n 68) mmol/hour. Citrate tests in systemic blood increased daily cost of citrate anticoagulation from 2.96 to 3.51 Euro. However, due to longer filter survival and reduced hemorrhagic complications saving costs could be potentially relevant if test availability allowed a more extended use of citrate anticoagulation. **Conclusion:** Kinetics study demonstrated that citrate did not accumulate in septic shock patients with liver dysfunction, where citrate losses in the ultrafiltrate can be efficiently modulated by increasing the effluent volume.

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13. Fulminant wilson's crisis: plasmapharesis vs. Mars

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Introduction: Wilson's disease presents with chronic hepatic and neurologic dysfunction. In rare cases, it can present with fulminant liver failure and multiple organ dysfunction (including renal failure, hemolytic anemia, coagulopathy). Patients have blood high levels of copper and the initial therapy of fulminant Wilson's crisis is directed at decreasing copper levels. Since copper is albumin bound, we evaluated 2 modalities of extra-corporeal copper clearance: Molecular Adsorbant Recirculating System (MARS) and plasmapheresis. This case report will explore the efficacy of copper clearance utilizing both modalities. **Methods:**
A 25-year-old woman with known Wilson's disease on trientine dihydrochloride presented with fulminant Wilson's crisis due to medication noncompliance for the previous 1 year (acute hemolytic anemia, fulminant liver failure, acute kidney injury). Both MARS and plasmapheresis

were utilized for copper clearance. Blood Copper, Haptoglobin, and Ceruloplasmin levels were monitored before and after each treatment. **Results:** Treatments alternated between MARS and plasmapheresis. MARS sessions consisted of 8 hours of albumin dialysis each followed by CVVHDF. Plasmapheresis sessions replaced 1.2 times the plasma volume with fresh frozen plasma. Copper reduction ratios for each modality are shown in the table. Hemolytic anemia did not improve until after 3 total treatment sessions (2 MARS and 1 plasmapheresis). The patient was bridged to liver transplantation following a total of 5 sessions (3 MARS and 2 plasmapheresis). In this case, average copper reduction ratios were MARS vs. plasmapharesis were similar (18.6% vs. 26.9%, p=.5). **Conclusion:** Both MARS and Plasmapheresis can be used to for copper clearance in Wilson's crisis. Side effects of FFP replacement in plasmapheresis are not seen with MARS. Either modality can be used as a bridge to liver transplant.

	1st M	2nd M	3rd M	1st PP	2nd PP
Copper pre-therapy (mcg/dL)	183	115	86	154	81
Copper post-therapy	154	85	74	115	58
Copper Reduction Ratio	15.8 %	26.1 %	13.9 %	25.3 %	28.3 %

14. Comparison of Electrolyte Replacements with and without Prismasol® Replacement Fluid

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Purpose: Prismasol® premade replacement fluid is more physiologic containing potassium, magnesium, and calcium as compared with pharmacy-compounded sodium chloride replacement fluid (standard therapy). The purpose of this study was to evaluate electrolyte replacement needs comparing Prismasol® and standard therapy. **Methods:** This study was performed at The Ohio State University Medical Center from August 21-February 211. Data was prospectively collected and matched with historical controls. Patients receiving standard therapy prior to implementation of Prismasol® were case-matched to the first 26 Prismasol® patients. Patients were only given Prismasol® for a maximum of 7 days due to limited supply of the product during the pilot. All continuous renal replacement therapy (CRRT) patients at our institution have standardized electrolyte replacement protocols for potassium (K), magnesium (Mg), calcium (Ca), and phosphorus (Phos). The number electrolyte replacements given was collected during both Prismasol® and standard therapy. Each replacement was defined as follows: potassium chloride 4mEq, magnesium sulfate 2 grams, calcium chloride 2 grams, sodium phosphate 15 mmol. The number of times the physician wrote orders to change the replacement fluid was also collected. **Results:** There were 26 patients in each group (11 cardiothoracic surgery and 15 from the medical intensive care unit). The CRRT duration for Prismasol® was a mean of 84.8 hours compared to 15.9 hours with standard therapy. Of the Prismasol® patients, 14 received a product with 2

meq/L of K and 12 received 4 meq/L of K. Those with the lower concentration of K required 52 mEq K replacement/day versus 7 mEq K replacement/day with the higher concentration (p<.1) [overall Prismasol® average 31mEq]. The mean number of replacement fluid changes with Prismasol® was 1.4 per CRRT course compared to 5.38 with standard therapy (p<.1). **Conclusion:** Providing a more physiologic replacement fluid such as Prismasol® significantly decreases the number of electrolyte replacements required. Utilizing the higher K Prismasol® product significantly reduces K replacements specifically as compared to a lower K product. Additionally, the number of replacement fluid orders was diminished by using Prismasol® potentially decreasing physician, nursing, and pharmacy work load and allowing for less fluctuation in electrolytes and acid-base status for the patient.

	Standard Therapy (n=26)	Prismasol® (n=26)	p value
K replacement/ day	63 mEq	31 mEq	<.1
Mg replacement/ day	1.8 grams	.84 grams	.3
Ca replacement/ day	1.25 grams	.62 grams	.17
Phos replacement/ day	4.11 mmol	5.22 mmol	.6

15. Pharmacokinetics of Meropenem in Children Receiving Continuous Renal Replacement Therapy

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Purpose: Meropenem (MP) is a broad-spectrum antibiotic frequently prescribed in children receiving continuous renal replacement therapy (CRRT). Comorbid conditions present in critically ill children alter pharmacokinetic (PK) profiles and are associated with sub-therapeutic antibiotic dosing. Furthermore, the low molecular weight and small volume of distribution of MP permit extensive extracorporeal removal. The purpose of this study was to evaluate target attainment of standard MP dosing in critically ill children receiving CRRT. **Methods:** Estimates of essential PK parameters (volume of distribution, renal clearance, metabolic clearance, and sieving coefficient) were extracted from published literature and used to generate an in silico MP PK model (MW/Pharm, Mediware, Groningen, the Netherlands). The prospective pediatric CRRT (ppCRRT) database was used to provide realistic clinical covariates including patient weight, residual renal function, and dialysis dose. Target attainment was defined as 8% time above the minimum inhibitory concentration (T > MIC) at 4 µg/ml (MP susceptibility breakpoint for P. aeruginosa). T > MIC for median and upper quartile (Q3) effluent rates were evaluated at the adult dose of 2 mg/kg (max of 1 mg) every 12 hours. **Results:** 31 patients from the ppCRRT database had complete data sets available for evaluation. The patients were divided into 5 age groups (< 1, 1-5, 5-1, 1-15, and > 15 years of age).

Median estimated glomerular filtration rate based on serum creatinine (updated Schwartz formula) ranged from 19 – 24 ml/min/1.73m2, and median effluent rate ranged from 1832 – 2877 ml/min/1.73m2 (Q3 of 2327 – 497 ml/min/1.73m2) between age groups. T > MIC was decreased in younger age groups, but adequate for children above 15 years of age. Q3 effluent rates caused a 6 -14% reduction in T > MIC. (See table). **Conclusion:** Extracorporeal clearance and high effluent rates may render MP dosing recommendations of 2 mg/kg inadequate for younger age groups receiving CRRT. These in silico PK/PD models will need to be verified prospectively in children receiving MP and CRRT.

Age Group	Median Weight (kg)	T > MIC (median effluent rate)	T > MIC (Q3 effluent rate)
< 1 year	3.6	38%	28%
1-5 years	13.8	58%	52%
5-1 years	24.2	62%	52%
1-15 years	45.	88%	74%
> 15 years	59.9	94%	82%

16. Evaluation of the Potential Adverse Effects Associated with Calcium Carbonate Precipitate During Continuous Veno-Venous Hemofiltration (CVVH)

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Purpose: This study evaluated the potential adverse effects associated with exposure to calcium carbonate precipitate in Accusol 35 Solution (Accusol 35) during CVVH. The clinical use of Accusol 35 has been associated with occasional formation of calcium carbonate precipitate in the tubing set during therapy. **Methods:** 14 dogs were anesthetized, instrumented, and received CVVH with the test (6) or negative control article (8) for 6 hr. The test article was Accusol 35 with induced precipitate formation prior to CVVH, containing visible particles and sub-visible particles 36X higher than the maximum concentration specified in European Pharmacopoeia (EP). The negative control article was Accusol 35 conforming to EP specification. One-half the dogs in the negative control article group received a central venous injection of Sephadex G-5 beads (1 mg/kg) following CVVH as positive control. Select cardiovascular (CV) parameters (systemic and pulmonary arterial pressures, central venous pressure, heart rate and cardiac output) were monitored continuously, and stroke volume and systemic and pulmonary vascular resistances were calculated at pre-determined times throughout CVVH. Arterial samples were obtained for blood gas analysis. Samples of the test and negative control articles were obtained hourly during CVVH for determination

of pH and subvisible particles. Dogs were euthanized and lung tissue samples were examined histologically. **Results:** All CV parameters remained stable and no differences were observed between the test and negative control articles. Sephadex beads caused an increase ($p<.1$) in mean pulmonary arterial pressure due solely to a similar increase ($p<.1$) in pulmonary vascular resistance. No differences in blood gases were observed between the test and negative control articles. Sephadex beads caused a decrease ($p>.5$) in PO2 and an increase ($p>.5$) in PCO2. No differences in lung histology were observed between the test and negative control articles. The lungs from all dogs given Sephadex beads contained multiple intravascular particles in large caliber blood vessels. **Conclusion:** CVVH performed on anesthetized dogs for 6 hr using Accusol 35 containing visible and sub-visible particles 36X higher than the maximum concentration specified in EP, resulted in no adverse effects on CV parameters, blood gases, and lung histology as compared with Accusol 35 containing no visible particles and sub-visible particles that were within EP specification.

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17. Carboplasmapheresis and Continuous Renal Replacement Therapy (CRRT) in the Treatment of Amanita Phalloides Poisoning

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Military Medical Academy

Introduction: Amanita phalloides poisoning is the most common cause of lethal mushroom poisoning (lethality > 2% in adults and > 4% in children). Carbohaemoperfusion is a routine treatment in mushroom poisoning for many years already. We have applied carboplasmaperfusion (CPP), aiming at extracting the aminitine toxins from patient's plasma. We have performed continuous vein-venous high flux haemodiafiltration (CVVHDF) for the sake of prevention from hepatic and renal failure. **Methods:** We have carried out an early carboplasmapheresis in four patients with amanita phalloides intoxication, which poisoning has been proven by clinical and toxico-chemical tests. In addition to carboplasmapheresis we have carried out CVVHDF for 12 hours per day. We have performed the procedures via a system for continuous renal replacement therapy (CRRT). We have performed plasma separation via plasma filter Haemoselect M ,3, and subsequently plasma has been conducted via carbofilter ADSORBA 3 C. We have utilized the same system and high flux Diacap Acute filters for the performance of CVVHDF. **Results:** Upon the first course of carboplasmapheresis, there has been observed clinical and laboratory detoxication in two of our patients and no hepatic failure observed. Two more CVVHDF procedures have added to the favorable outcome. There has been observed an early hepatic failure in the other two patients, so we had to apply three more carboplasmapheresis and CRRT therapies. The patients have been released from the hospital at the 7th or 18th day, following clinical remission. Upon control monitoring at first month after release from hospital, those two patients with early hepatic failure have proven to be clinically healthy and the results from their laboratory tests to be within the reference range. **Conclusions:** Carboplasmapheresis treatment in cases of mushroom poisoning is a modern therapy, which several studies report to be successful when applied in clinical practice. This

treatment main advantage, as compared to classic carboperfusion, is sparing the thrombocytes from the damaging influence of active charcoal, and more effective extraction of aminitine toxins from patient's plasma.

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18. Clinical Profile of Patients with AKI requiring CRRT in a Tertiary Care Multispecialty Hospital in Southern India

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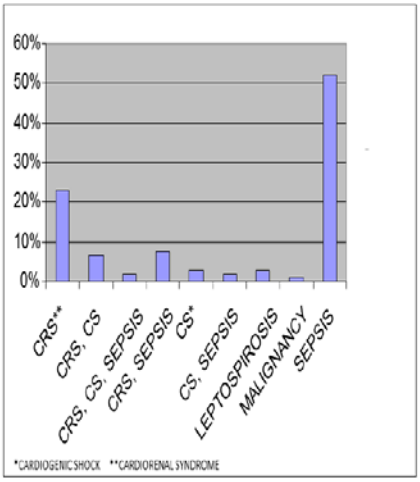
Aim: To study the clinical profile in patients with AKI undergoing crrt
nclusion criteria: hemodynamically unstable patients with AKI requiring multiple ionotropic support .
AKI : as defined by AKIN criteria
exclusion criteria: hemodynamically stable patients with AKI study: single centre prospective study of 14 patients with AKI requiring crrt sample size : 14 mean age: 59.63 + / - 29.37 males: 67 mean age 62.57 +/ - 39.43 females: 37 mean age 53.5 + / - 31.95 speciality wise admission aetiology of AKI: sepsis/crs/leptospirosis/pregnancy mean creatinine at admission: 2.49 +/- 1.97 mean sofa score: 12.8 +/- 3.26 indications for initiation of crrt mean crrt days: 2.63 +/- 1.51 average blood flow : 97.6 ml / min average dialysate flow : 998.1 ml / hour average replacement fluid flow : 992 ml / hour anticoagulation: heparin/citrate/ no heparin mean average circuit life : 2.6 +/- 2.1 days outcomes dependent / dialysis free complications of crrt mean creatinine@admission in mg/dl : 2.49 +/- 1.97 mean creatinine @discharge in mg/dl : 2.79 +/- 1.99 mean hospital stay in days : 13.1 +/- 12.9 mean icu stay in days : 9.13 +/- 8.88 mean crrt duration in days : 2.63 +/- 1.51



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19. Efficacy of continuous haemodiafiltration using a polymethylmethacrylate membrane haemofilter （PMMA-CHDF）in the treatment of sepsis and acute respiratory distress syndrome(ARDS)

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Objective: CHDF using with a polymethymethacrylate membrane is currently widely applied for non-renal indications in Japan, this technique is used in the treatment not only of patients with sepsis but also of those with cytokine-induced critical illness such as ARDS and pancreatitis. The main underlying mechanism governing cytokine removal through PMMA-CHDF is the adsorption of cytokines to the hemofilter membrane and this characteristic was not observed in the other membrane material.

This study aimed to investigate the clinical efficacy of PMMA-CHDF in the treatment of a patients with sepsis and ARDS. **Methods:** Thirty- five patients diagnosed with sepsis (ARDS[n=1], Pyelonephritis [n=5], Cholangitis [n=5], Tsutugamusi in Scrub typhus disease[n=1],Snake Mamushi bitten[n=1], haemophagocytic syndrome[n=1],anti neutrophil cytoplasmic antibody(ANCA)lung disiese[n=1],beriberi heart disease[n=1] and unknown causes[n=8])were enrolled in this study between August 21 and November211.The common cause for ARDS in elderly patients aspiration pneumonia in elderly patients. Our study group composed 15men and 2women, aged 35 -85 years (median age 68years). **Results:** Before initiating treatment with the PMMA-CHDF,the average APACHE Ⅱ score of these patients was 17.5+/-3.6 ,whereas the average SOFA score was 6.5+/-1.3. The duration of PMMA-CHDF treatment was5.2+/-2.3days. Following initiation of PMMA-CHDF teatment, early improvement of haemodynamics was observed,along with an increase in the urine output. The average survival rates of patients were75.6%. The low survival rate among diseases 35% belonged to the Unknown group. The highest survival rate for patients with ARDS was 95%.Moreover,the urine output significantly increased in survival group. **Conclusion:**The present study suggests that cytokine-oriented critical care using PMMA-CHDF might be effective the treatment of sepsis and ARDS, particularly,in the treatment of ARDS associated with aspiration pneumonia in elderly patients.

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20. Prophylactic Peritoneal Dialysis Improves Clinical Outcomes in Children Following Open-Heart Surgery with Cardiopulmonary Bypass

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Purpose: To investigate the impact of prophylactic peritoneal dialysis (PD) on clinical outcomes after open-heart surgery in children with complex congenital heart disease. We hypothesize that compared to passive peritoneal drainage and diuretic therapy, prophylactic PD will lead to improved clinical outcomes including shorter duration of mechanical ventilation (primary endpoint). **Methods:** We performed a prospective before-and-after cohort study of 52 consecutive children at high risk for post-cardiopulmonary bypass (CPB) fluid overload. 27 patients that received diuretic therapy and passive peritoneal drainage (-PD) (before Jan 211) were compared to 25 patients that did not receive diuretics and were initiated on prophylactic PD (+PD) within the first 6hrs of admission (per new CICU protocol starting Jan 211). **Results:** There was no difference in demographics, CPB time, surgical diagnoses, lactate or hemodynamic variables between groups. +PD demonstrated significantly less positive fluid balance after CICU admission at both 24hrs [+PD -24.3mL/kg (IQR -6.2,3) vs. -PD 17.5mL/kg (IQR -24.8,61.7), p=.3] and 48hrs [+PD -88mL/kg (IQR-132.1,-54.2 vs. -PD -45.8mL/kg (IQR -82.3,-12.4), p=.4]. 24hr urine output was similar between groups but higher in -PD at 48hrs [+PD

7.3mL/kg (IQR 44.8,16.9) vs. -PD 172.6mL/kg (145.3,216.2), p=<.1]. 24hr PD output was similar between groups but greater in +PD at 48hrs [+PD 223.5mL/kg (IQR 194,274.1) vs. -PD 128.3mL/kg (IQR 98.5,146.5), p=<.1]. +PD had less fluid intake at 24hrs [+PD 176.4mL/kg (IQR 142.5,245.6) vs. -PD 231mL/kg (IQR 188.8,29.1), p=.6]. The mean inotrope score over first 24hrs was lower in +PD (13±4 vs. 17±7, p=.5). Chest closure occurred sooner in +PD [24hrs (IQR 2,4) vs. 63hrs (IQR 44,72), p=< .1] and mechanical ventilation tended to be shorter in +PD [71hrs (IQR 49,135) vs. 125hrs (IQR 7,195), p=.1]. Incidence of acute kidney injury, as measured by doubling of baseline serum creatinine, was 44% +PD vs. 26% -PD (p=.25). There was no difference in incidence hyperglycemia or electrolyte abnormalities between groups. There was one episode of suspected peritonitis in +PD. **Conclusions:** Following CPB, prophylactic PD was well tolerated and associated with lower inotrope and fluid requirements during the first 24hrs. It improved fluid balance, safely facilitating improved outcomes such as earlier chest closure and possibly shorter duration of mechanical ventilation.

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21. Efficacy of direct hemoperfusion using polymyxin B-immobilized fiber in children under 1kg

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Background: We evaluated the efficacy of direct hemoperfusion using polymyxin B-immobilized fiber (PMX-DHP) in low-body-weight children. There are few reports of PMX-DHP for low-body-weight children because PMX-DHP is technically difficult to perform and there are no appropriate tools for these children. We report our experience of PMX-DHP in children under 1 kg with unstable circulatory dynamics and the efficacy of PMX-DHP in these children. **Methods:** Nine children (age, days-3 months; body weight, 1.2 to 6.6 kg) admitted to a single institution and treated with PMX-DHP from June 24 to June 212 were included. Underlying diseases were septic shock in 5 children and bowel perforation in 4 children. We used PMX-2R and PMX-5R and the dialysis machines KM-87 and TR-525, and set the blood flow (QB) at 2 to 4 mL/min. The period of treatment was 1 to 2 doses, 2 to 24 h per section. We evaluated the following parameters before and after treatment: mean arterial pressure (MAP), catecholamine index (CAI), ratio of the arterial partial pressure of oxygen to the fraction of inspired oxygen (P/F ratio), urine volume, pediatric logistic organ dysfunction (PELOD) score, and predicted mortality rate. Outcomes of interest were compared using the $\chi 2$ test for categorical data and Student t test for continuous data. Statistical analyses were performed using EXCEL21 and SPSS. **Results:** There were some complications, namely, hypothermia, intracircuit clot formation, and decrease in platelet count. No PMX-related deaths occurred. MAP values elevated from 34. ± 12.2 mmHg to within 2 h. The CAI decreased by >5% in 3 cases. No trend was observed for urine volume and P/F ratio. The PELOD score and predicted mortality rate significantly decreased from 43.2 ± 1.9 to 24.8 ± 6.1 and from 9.4% ± 22.9% to 37.7% ± 22.2%,

respectively. The prognosis at 28 days was as follows: alive, 6 patients and dead, 3 patients. **Conclusion:** PMX was safely performed in low-body-weight children. PMX could elevate their body pressure and improve their prognosis. Early induction of PMX might help in elevating the survival rate of low-body-weight children with poor prognosis.

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22. Fluid Overload and Fluid Removal in Pediatric Patients on Extracorporeal Life Support Requiring Continuous Renal Replacement Therapy

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Background: Extracorporeal life support (ECLS) is a life-saving therapy for pediatric patients with severe cardiac and respiratory failure. For patients on ECLS, the development of acute kidney injury (AKI), including fluid overload (FO), is associated with increased mortality. Continuous renal replacement therapy (CRRT) is frequently used to manage AKI in these patients, however, the optimal time to initiate CRRT, and the role of CRRT to remove fluid remains undefined. **Objective:** Determine the impact of FO at CRRT initiation and discontinuation on mortality in pediatric patients concurrently receiving CRRT and ECLS. We also examined the kinetics of CRRT-mediated fluid removal as a potential predictor of outcomes. We hypothesized that the ability to remove fluid and restore fluid balance with CRRT would be associated with improved survival. **Design/Methods:** Retrospective chart review of all ECLS patients requiring CRRT from July 26 to September 21. The degree of FO was determined using ICU admission weight, weight upon CRRT initiation, daily weights while on CRRT and weight at CRRT discontinuation. **Results:** Overall ICU survival was 34% for 53 patients during the study period. Median FO at CRRT initiation was significantly lower in survivors compared to non-survivors (24.5 vs. 38%, p=.6), as was median FO at CRRT discontinuation (7.1 vs. 17.5%, p=.35). After adjusting for % FO at CRRT initiation, age and severity of illness, the change in FO at CRRT discontinuation was not significantly associated with mortality (OR per 1% decrease in FO was .96, 95% CI .89-1.3). Further models incorporating the rate of fluid removal did not find this to be a significant predictor of mortality. Conversely, FO at CRRT initiation remained a significant predictor of mortality in all models. **Conclusions:** In pediatric ECLS patients with AKI requiring CRRT, FO at CRRT initiation significantly correlates with increased mortality, and this relationship appears to be independent of the ability to remove fluid while on CRRT. These results suggest that interventions(such as CRRT initiation) prior to the development of significant FO may lead to better outcomes than attempting fluid

removal after significant FO has already developed. Our findings underscore the need for prospective clinical trials to determine if fluid restriction strategies or earlier initiation of CRRT may lead to improved patient outcomes in pediatric patients on ECLS.

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23. Recurrent Encephalopathy in a Patient with End-Stage Renal Disease Following Excess Consumption of Energy Drink: Management with Continuous Renal Replacement Therapy

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Introduction: Most of energy drinks generally contain mixtures of caffeine, taurine, thiamine, riboflavin, pyridoxine, nicotinamide, and inositol. The potential dangers of these energy drinks remain undetermined especially in patients with renal dysfunction. We describe here a patient with end-stage renal disease (ESRD) undergoing maintenance hemodialysis, who had recurrent decreased mentality following excessive consumption of energy drinks and have been treated with continuous renal replacement therapy (CRRT). **Case:** A 53-year-old woman was referred to emergency room with sudden onset of seizure-like motion and decreased mentality. For 7 years, she had been on hemodialysis because of ESRD due to hypertension. According to the witness, the patient consumed 6 bottles of a caffeinated energy drink just before losing consciousness. On admission, her general examination was significant for hypertension and sinus bradycardia. There were neither mineral and electrolyte abnormalities in blood tests nor pulmonary edema on chest film. The brain MRI was normal except for small old infarctions in cerebellum. An initial EEG showed a sharp wave in left frontal area, which was a finding suggestive of a partial seizure disorder arising from left frontal area. She was treated with hemodialysis immediately, however, decreased mentality and seizure-like movement continued. CRRT was started, and her mentality became clear after 4 days of CRRT. The follow-up EEG revealed intermittent slow waves in both frontal areas without epileptic form discharges. The patient was discharged with instructions to abstain from the energy drinks. About 19 months later, she was brought to the emergency room again with drowsy mentality after a hemodialysis session at a private clinic. CRRT was applied for 3 days, and she recovered her mentality. Later, the patient stated that she had consumed 4 bottles of the energy drink right before her unconsciousness. **Conclusion:** We successfully treated an ESRD patient with recurrent encephalopathy following excessive ingestion of caffeinated energy drinks using CRRT. Although the pathogenic mechanism of encephalopathy following excessive consumption of caffeinated energy drinks has not been defined yet, questions regarding the optimal dose of energy drinks and proper CRRT treatment in patients with renal insufficiency should be raised.

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24. Effects on Timing of High-volume Hemofiltration In Elderly Patients With Septic Shock

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Background: High-volume hemofiltration (HVHF) may improve the prognosis of patients by non-selective removal of inflammatory mediators and cytokines and reducing the systemic inflammatory response on organ damage. Since the timing of HVHF may impacts on the prognosis of the patients, early intervention of HVHF is very crucial. **Objective:** To assess the effects of the timing of HVHF on the elderly patients with septic shock. **Methods:** 21 cases of elderly patients with septic shock (mean age 78 ± 6.8 years) were observed. According to the timing of HVHF (the rate of UF was 6ml/kg/hr), those patients were divided into two groups,Group A (n = 8) treated with HVHF during early 6 hours resuscitation and Group B (13 cases) treated with HVHF after early 6 hours resuscitation.The effects to be studied of HVHF were the changes of vital signs, the difference of APACHE-Ⅱ score, SOFA score, the dosage of vasoactive drugs in h, 24h, 48h, 72h and the survival cases of 28 days. **Results**: Treated with HVHF after 24h, 48h, 72h, APACHE-Ⅱ score in group A and group B were (23.5 ± 4.8,18.5 ± 4.,18.1 ± 4.3) and 26.8±4.2, 24.3±3.8、23.8±5.1）(P <.5) SOFA score (14.5 ± 2.8,13.5 ± 2.,12.1 ± 2.8) and (16.8 ± 2.6,15.3 ± 2.7,14.8 ± 3.1) (P <.5), the amount of vasoactive drugs [dopamine ug/kg/min] (1.5 ± 2.1,7.5 ± 1.8,6.1 ± 2.5) and (13.8 ± 2.,13.3 ± 2.,12.8 ± 3.1) (P <.5) respectively. In 28 days, the survival cases in group A and B were 3 and 4 (p>.5),and the death cases in group A and B were 5 and 9 (P> .5). Conclusions: Early HVHF may significantly lower the scores of APACHE-Ⅱ and SOFA and reduce the amount of vasoactive drugs, but not improve the short-term (28 days) survival prognosis. This suggested that early HVHF treatment can significantly improve the hemodynamics effects and reduce the amount of positive inotropic drugs to protect organ function in elderly patients with septic shock. In this study, the number of cases was small, so further study and observation of much more elderly patients should be done to find out more impacts on elderly septic shock patients with the timing of HVHF and the implementation process of inflammatory mediators, and to optimize the treatment of HVHF to improve the survival prognosis of the elderly septic shock patients.

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25. CRRT experiences in ICU: A single center study in Korea.

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Background: AKI in the ICU is a serious complication can affect the patient outcome. After development of continuous renal replacement therapy (CRRT), it has been widely used for treating critically ill patients with AKI in ICU. The aim of this study was to evaluate clinical characteristics and prognostic factors in ICU patients with AKI requiring CRRT. **Methods:** Our cohort included 185 patients who received CRRT admitted to ICU at Dong-A University Hospital from January 28 to November 211. We retrospectively analyzed the demographic, clinical, and laboratory data. **Results:** The average age of the 185 patients was 59. ± 16.4 years and 96 patients were male (51.9%). The treatment duration of CRRT was 64 ± 47.7 hours. The overall mortality rate was 69.2%. 27 patients (14.5%) were AKI on CKD and 49 patients (26.4%) were diabetes. The mechanical

ventilation rate was 73.2%, vasoactive drug was 63.8%. The average SAPS3 was 78.4 ± 15.9 and the average APACHE II score was 26.5 ± 4.3. The variables influencing mortality on univariate analysis were SAPS3 and BNP, the number of organ dysfunction. **Conclusion:** Very important prognostic factors were SAPS3 and the elevation of BNP in this study. Large scaled, prospective randomized multi-center trials are needed to confirm the prognostic factor.

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26. Citrate in a Small Intensive Care Unit (ICU) in the Netherlands; The Better Way for Dialysis?

Els L Van Assche[1]
Elkerliek Ziekenhuis

Background: Renal replacement therapy (RRT) is performed in order to prevent and treat complications of acute kidney injury. Small ICU's are challenged to optimize the procedures. Since regional citrate anticoagulation is proven an effective and safe method for continuous RRT, we replaced the heparin protocol and introduced citrate as the new anticoagulants. **Methods:** We conducted a retrospective observational study to compare the citrate and heparin protocol. We studied mortality, filter survival time, transfusion of packed cells (PC) frequency and other complications during dialysis. We reviewed the medical records of the 63 patients who had continuous RRT from January 27 until September 211. We used our patient data management system to compare the data from the citrate group to the data from the heparin group. 18 patients were excluded with insufficient data and 22 filters which were interrupted intentionally were also excluded. **Results:** A total of 45 patients were included in this study, 21 in the heparin group and 24 in the citrate group. In the patients who received heparin, 112 filters were used, with a mean of 5 filters per patient and median filter time of 13 hours. In patients who received citrate, 66 filters were used, with a mean of 4 filters per patient and median filter time of 56 hours.
In the heparin group 86 transfusions were needed in 18 patients, 7 patients needed more than 2 PC during dialysis treatment. In the citrate group 26 transfusions were given to 11 patients; 3 patients needed more than 2 transfusions. Only the heparin protocol was interrupted, 8 times, for complications. The mortality in the ICU was worse in the citrate group; 54% compared to 26 % in the heparin group. **Conclusions:** Although mortality was higher in the citrate group, we found no complications so we consider citrate a safe anticoagulans for RRT. The higher mortality can be explained by the higher Apache scores. The median filter time proves citrate to be superior to heparin.

27. Ultrafiltration in Continuous Renal Replacement Therapy: Is Prescribed Delivered ?

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Background: Hypervolemia from aggressive fluid resuscitation in critically ill patients with acute kidney injury (AKI) may contribute to adverse outcomes. Continuous renal replacement therapy (CRRT) can effectively achieve fluid management goals in hemodynamically unstable patients with AKI. **Methods:** We collected data on physician prescription orders compared to actual delivered treatments to assess the delivered CRRT therapy in critically ill patients with AKI. 18 patients (mean age 53 + 17 years (SD); 12 males, 6

females), admitted to the Intensive Care Unit (ICU) from February to November, 211 with AKI requiring CRRT were monitored up to 5 consecutive days. All patients received CRRT using Prisma M1 set with AN69 hemofilter on citrate anticoagulation with an effluent rate of 25-3 ml/kg/hr. Data, including admission weight (WT), daily WT and daily fluid balance calculations, were obtained from electronic medical records and ICU flowsheets which were compared to physician prescription orders. **Results:** The mean pre-CRRT WT (99. + 25.6 kg) was markedly increased when compared to the mean admitting WT (8.2 + 24.9 kg). Mean net negative fluid balance achieved during the first 48 hours of CRRT was 36 mL, with a decrease in mean WT to 98+ 23.1 kg, however this was not statistically significant. By day 5, a mean reported fluid loss of 3.2 liters was associated with a significant mean weight reduction to 92.9+ 25.3 kg (p = .1). The mean prescribed ultrafiltration (UF) rate was 35.3+ 28.4 mL/hr while delivered UF rate was 52.7+ 48.6 mL/h(p=.2). On day 2, the mean fluid removal set on the Prisma machine was 6.5 L/day while mean net fluid removal was 6. L/day which was significantly lower (p=.3). In conclusion, actual delivered UF during CRRT treatments exceeded physician prescription orders. UF goals still need to be optimized.

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28. The Effect Of Continuous Renal Replacement Therapy In Patients With Acute Kidney Injury on the serum levels of biomarkers usually used to indicate renal function

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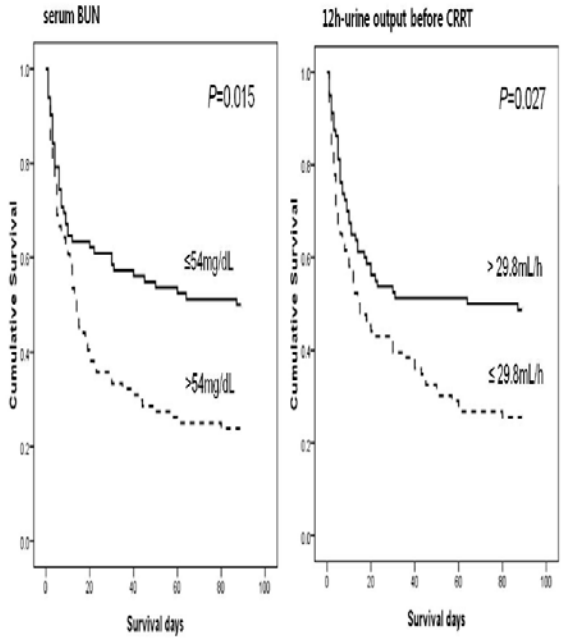
Objective: Continuous veno-venous hemofiltration(CVVH) can affect the serum concentrations of usually used biomarkers to indicate renal function, like creatinine(Cr), urea(UN) and cystatin C(Cys-C). In this study we investigate to what extent CVVH affects the concentrations of Scr,BUN and Cys-C independent on renal function change. **Methods:** Eleven patients with oliguric acute kidney injury (AKI) requiring CVVH were enrolled. Four of them received CVVH at dose of 2L/hr and 7 received CVVH at dose of 4L/hr. Samples were obtained from the afferent and efferent lines of the extracorporeal circuit and from the ultrafiltrate line at 4 different time points(,4,12 and 24h) for measurement of Cr, UN and Cys C. **Results:** Concentrations of Scr, BUN and Cys-C before CVVH (2 L/hr) were 4.84±2.51, 57.35±31.33mg/dl and 4.34±1.33 mg/L. Levels of Scr, BUN and Cys-C at 4,12 and 24h during CVVH (2 L/hr) gradually decreased from the baseline values. The decreases of Scr, BUN and Cys-C were 49.7%,42.5% and 28.1%(all P>.5). The mean sieving coefficient of Scr,BUN and Cys-C were .89, .78 and .32;the mean clearance of Scr, BUN and Cys-C were 29.7, 26 and 1.7mL/min. Concentrations of Scr,BUN and Cys-C before CVVH (4 L/hr) were 6.9±4.13, 94.3±57.4 mg/dl and 3.7±1.4 mg/L. Levels of Scr, BUN and Cys-C at 4,12 and 24h during CVVH (4L/hr) were gradually decreased from the baseline values. The maximum decreases of Scr,BUN and Cys-C were 57.8%(P=.39),51.% and 26.6%(all P>.5). The mean the sieving coefficient of Scr, BUN and Cys-C were .82, .97and .51;the mean clearance of Scr,BUN and Cys-C were 54.7, 64.6 and34.mL/min. Conclusion: Compared with Scr and

BUN, the alteration of levels of CysC caused by CVVH is slight, which suggests that it can be used to indicate the patient's renal function change in some extent during CVVH.



RESEARCH IN AKI

29. Urine Biomarkers Predict Acute Kidney Injury in Term Neonates with Perinatal Depression

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Background: Acute kidney injury (AKI) is an independent risk factor for mortality in neonatal, pediatric and adult critically ill populations. As serum creatinine (SCr) is not ideal to diagnose AKI, urine AKI biomarkers may improve our ability to detect an injury early in the disease process. **Objectives:** To identify urine biomarkers that predict acute kidney injury (AKI) in term infants with perinatal depression (Apgar score <=7 at 5 minutes) **Study Design**: A nested case-control study was performed to comparing eight candidate urine AKI biomarkers between infants with and without AKI. **Methods:** After prospective data collection, 9 term infants were identified with AKI (rise in SCr of at least .3 mg/dl, or persistent elevation of SCr $\geq$ 1.5 for 3 days). Similar infants (N=24) who had at least 2 SCr levels, but had no AKI served as controls. Urine collected during the first 3 days of life was analyzed for Neutrophil-Associated Gelatinase Lipocalin (NGAL), Osteopontin (OPN) , Cystatin C (Cys C), Albumin, Beta 2 microalbumin, epithelial growth factor (EGF), uromodulin (UMOD), and Kidney Injury Molecule 1 (KIM-1). As gestational age can affect urine biomarker levels (regardless of AKI status), regression analysis was conducted to exclude gestational age as a confounder of both AKI and biomarker concentration. **Results:** Infants with AKI had higher urine Cys C levels compared to those without AKI [1123 (95% CI = 272, 4635) vs. 9 (39, 25) p< .4; AUC ROC = .82], Infants without AKI had higher UMOD [26.2 (95% CI = 17.4, 39.4) vs.11. (5.7, 21.4) vs. p< .3; AUC ROC = .77] and higher EGF levels [17.4 (95% CI = 12.7, 23.8) vs. 6.7 (4., 11.3) p = .3; AUC ROC = .82] than those with AKI. After controlling for gestational age, urine Cys C, EGF, and UMOD continued to be predictive of AKI.

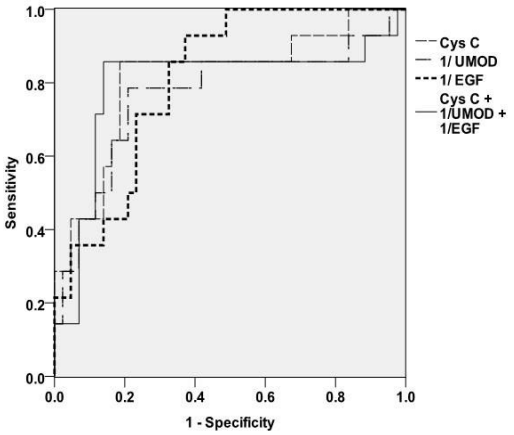

Fig 2. Area Under the Receiver Operator Curve for cystatin C, 1/EGF, 1/UMOD and combination of these 3 biomarkers.

Although not statistically significant, there appears to be differences in NGAL, KIM-1, OPN and albumin at different days between those with AKI and those without AKI. **Conclusions:** Urinary biomarkers can predict AKI term neonates with perinatal depression independent of gestational age.

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30. Prevention of Acute Kidney Injury in Hospitalized Children with Cystic Fibrosis

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University of Alabama at Birmingham

Introduction: Aminoglycosides (AGs) are commonly used to treat cystic fibrosis (CF) related lung infections. AGs are nephrotoxic and are an important risk factor for acute kidney injury (AKI) in hospitalized CF patients. In June 29, a new clinical protocol was implemented to reduce the incidence of AKI by standardizing monitoring and AG treatment in all CF patients admitted to Children's Hospital of Alabama for pulmonary exacerbations. **Hypothesis:** We hypothesized that the incidence of AKI in hospitalized children with CF would decrease after the implementation of this clinical protocol. **Methods:** A retrospective chart review was performed using data from the UAB/Children's of Alabama's Cystic Fibrosis Center database and hospital records for all admissions of CF patients with pulmonary exacerbations from July 27 to April 211.These data include demographics, co-morbidities, and serum creatinines (SCr). Hospitalized costs were obtained from the Children's of Alabama for cost analysis. AKI was defined as a rise in SCr of .3 mg/dl or 5% rise from a baseline value, according to the 211 Kidney Disease Improving Global Outcomes (KDIGO) AKI definition. Data analysis was performed using SPSS® software. IRB approval for the study was obtained. **Results:** The incidence of AKI was lower in the pre-protocol group 96/ 631 (15.2%) compared to the post-protocol group 113/ 475 (23.8%) ($p<.1$). Children in the pre-protocol group had less SCr values performed than those in the post-protocol group (2.1 vs. 5.4; $p<.1$). Length of stay for the two groups was similar (n.s.). The median hospital cost was higher for AKI vs. no AKI in the pre-protocol ($68,77 vs. $61,55 $p<.5$) and the post AKI eras ($7,378 vs. $8,816; $p< .5$). **Conclusions:** Despite protocols to decrease AG toxicity, the incidence of AKI in CF patients admitted for pulmonary exacerbations is alarmingly high. Our protocol, though designed to reduce the rates of AKI in this population, appears to have illuminated the problem and suggest that the incidence of AKI is higher than what is reported in the literature. Through increased screening with SCr, CF patients with AKI can be more readily identified, prevention of severe AKI can be avoided, and complications of AKI can be better managed. Studies are needed to find preventive strategies to reduce AKI, thereby decreasing

morbidity, and assess the cost-benefit ratio of such screening.

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31. Microsample Analysis of Serum and Urine Creatinine Measurements

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Background: Measurement of serum creatinine in newborns can be problematic for several reasons. In infants born with very low birth weight, volume loss from blood draws can account for significant blood loss limiting clinical and research measurements. In addition, bilirubin (known to be high in neonates) and medications can interfere with creatinine measurement by the Jaffe reaction. **Purpose:** We evaluated the differences in laboratory sampling between different methodologies (Mass Spectrometry (MS) vs. Jaffe). In addition, we evaluated the ability to reliably replicate results with variations in time from lab draw to sample measurement [immediate (within 2 hours), at 24 hours, and at 3 days). Finally we assessed how measurements may be influenced by the type of storage (Refrigeration -4 degree C vs. Freezer -8 degree C). **Methods:** We performed a prospective laboratory analysis using whole blood and fresh voided urine from 6 healthy adults who had neither kidney or liver disease, and were not taking medications known to interfere with creatinine determination. Each samples was processed using only 2 mcl of sample. The first method (MS) involved tandem Mass Spectrometry using multiple reaction monitoring and quantitated via stable isotope dilution. The second used Jaffe methodology on a Beckman machine. **Results:** There was a very high correlation (r= .996) between MS and Jaffe samples and a mean % differences between samples of 5.15 + 23.49 ng/dl. There was good correlations and limited % difference between measurement times and storage type in both MS and Jaffee. (Table 1).

	Method	% Difference (mean ; sd)	Correlation
Immediate vs. 24 hr Refrigerated	MS	-5.27 + 6.67	.996
Immediate vs. 24 hr Freezer	MS	-7.43 + 9.34	.997
Immediate vs. 3 day Freezer	MS	-11.36 + 9.95	.999
Immediate vs. 24 hr Refrigerated	Jaffe	2.89 + 12.68	.997
Immediate vs. 24 hr Freezer	Jaffe	-.24 + 2.34	.999
Immediate vs. 3 day Freezer	Jaffe	7 + 17.15	.999

Conclusions: Although variations exist between creatinine measurements using Jaffe and Mass Spectrometry there is a high degree of correlation even when performing these tests using microsamples. Samples were relatively unaffected after 24 hours in a refrigerator, freezing for 1 day or freezing for 3 days.

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32. The Effect of Poly (ADP-Ribose) Polymerase Inhibition on Aminoglycoside-Induced Acute Kidney Injury in Rats

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Background: Aminoglycosides cause nephrotoxicity in 1-2% of patients by generating reactive oxygen species (ROS), leading to DNA destruction and activation of poly(ADP-ribose) Polymerase (PARP). The ensuing decline in nicotinamide adenine dinucleotide (NAD) causes diminished cellular energetic capacity and necrotic tubular cell death. **Methods:** The effect of PARP inhibition on gentamicin-induced nephrotoxicity was studied in 2 female Wistar-Kyoto rats divided into treatment groups: control (no treatment or PARP-inhibitor-treated [3-amino benzamine, 3AB]); gentamicin-treated; and gentamicin+3AB treated. Kidney function, protein and gentamicin levels and urinary trypsin inhibitory activity (TIA) were measured. Tissue microscopic examination and immunohistochemical study for Proliferative Cell Nuclear Antigen (PCNA) were determined.
Results: The following results were obtained: Urea was 41.±5.8, 88.3±5.3 and 48.5±12.7 mg/dL in control, gentamicin and gentamicin+3AB-treated rats, respectively (p=.4). Proteinuria was 7.5±2.9 in controls, 41.2±18.1 in gentamicin-treated and 17.6±13.9 mg/24-hours in gentamicin+3AB-treated rats (p=.3). TIA was 528.75±357.9, 1365.±863.7 and 475.±194.4 inhibitory units/day in control, gentamicin and gentamicin+3AB-treated rats, respectively (p=.2). The number of macronuclei per 1mm2 was significantly higher in gentamicin-treated rats than in gentamicin+3AB treated rats (218±11.8 vs. 41.7±36.2. p=.4). The number of PCNA positive nuclei was marginally significantly higher in the gentamicin-treated rats than in gentamicin+3AB treated rats (3585±2215.3 vs. to 626.7±236.9, p=.7). **Conclusions:** The effect of PARP inhibitor on the bactericidal activity of gentamicin was assessed, no effect was observed. This study illustrates that PARP inhibitor significantly attenuates gentamicin-induced nephrotoxicity in rats with no effect on its bactericidal activity.

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33. Plasma NGAL Is An Early Biomarker Of Graft Function, Calcineurin Inhibitor Nephrotoxicity And Tubular Regeneration In Kidney Transplantation From Extended Criteria Donors

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University of Turin, San Giovanni Battista Molinette Hospital

Background: Delayed graft function (DGF), defined as the need for dialysis in the first week after kidney transplantation (KT), has been increasing for the use of kidneys from extended criteria donors (ECD). Plasma Neutrophil Gelatinase-Associated Lipocalin-2 (NGAL) has been proposed as early biomarker of DGF. **Aims:** The aims of this study were to evaluate: 1) NGAL in 5 patients in the first 24h after

KT from ECD; 2) the relationship between NGAL and DGF, slow graft function (SGF) and immediate graft function (IGF); 3) the trend of serum creatinine (sCr) and plasma NGAL in the first 5 days after KT; 4) NGAL before and after the introduction of calcineurin inhibitors (CNI); 5) the in vitro role of NGAL in tubular regeneration. **Methods:** Fifty patients were enrolled in the study (immunosuppression with basiliximab, MMF and steroids: CNI introduced when sCr <2.5 mg%). Patients were divided in 3 groups: DGF, SGF (sCr >3 mg% at day 6 after KT) and IGF (sCr <3 mg% at day 6 after KT). Plasma NGAL levels were measured by a fluorimetric method (Alere, San Diego, CA). Protein and mRNA NGAL levels, proliferation and apoptosis were evaluated in isolated human tubular cells cultured under hypoxia or with tacrolimus/cyclosporine. **Results:** Patients demographics and characteristics were: male 67%, recipient age 57.65 yr, donor age 65 yr, cold ischemia time 16.8 h, HLA mismatches 3.46, recipient BMI 24.2, donor hypertension 64.4%, donor eGFR 88.66 ml/min. The incidence of DGF was 28%: in the 72% of patients without DGF, SGF occurred in 55%, IGF in 45%. NGAL (24h after KT) were significantly higher in DGF than in SGF and IGF groups (DGF 654.94 ng/ml; SGF 439.75 ng/ml; IGF 357.37 ng/ml). A decline of plasma NGAL but not of sCr was detectable at day 2 after KT with a further decrease at day 3, 4 and 5. By contrast, NGAL increased after 24 hr from CNI introduction (before CNI: 12.12 ng/ml; after CNI: 188.25 ng/ml). Human tubular cells cultured under hypoxia or in presence of tacrolimus/cyclosporine showed enhanced mRNA/protein levels of NGAL. NGAL induced a dose-dependent decrease of tubular cell apoptosis via caspase inactivation and triggering of P-Akt/Akt pathway. **Conclusions:** NGAL is an early predictor of graft function and CNI nephrotoxicity after KT from ECD. Moreover, our data sustain the role of NGAL as growth factor involved in tubular regeneration.

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34. Microvesicles Derived From Endothelial Progenitor Cells Protect Kidney From Cisplatin-Induced Acute Toxic Injury By MicroRNA-Dependent Reprogramming And Inhibition Of Apoptosis Of Tubular Cells

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Background: Several studies suggested a role for bone marrow-derived stem cells in the regenerative mechanisms after acute kidney injury (AKI) by paracrine mechanisms. We previously demonstrated that microvesicles (MVs) released from Endothelial Progenitor Cells (EPCs) activate an angiogenic program in endothelial cells. MVs are small particles of about 6-16 nm of size which play a key role in cell-to-cell communication through the transfer of different RNA subsets including microRNAs, small non coding RNAs able to induce the epigenetic reprogramming of target cells through the modulation of protein transduction. Aims: The aim of the present study was to evaluate whether MVs derived from EPCs prevent mortality and renal damage in an experimental toxic model of cisplatin-induced AKI. Methods:

We isolated MVs from EPC supernatants by uktracentrifugation and we characterized their RNA content showing the enrichment in microRNAs that modulate proliferation and apoptosis. Results: After i.v. injection in cisplatin-treated mice, MVs localized in peritubular capillaries and tubular epithelial cells, significantly decreased mortality 7 days after administration and conferred functional and morphologic protection from AKI by enhancing tubular proliferation and reducing apoptosis. In surviving animals, a preserved renal function and histology was observed also 28 days after injection. Evidence for a role of MV-mediated transfer of RNAs in the renoprotective effect of MVs was derived from the loss of MV activity after 1) their treatment with RNase, 2) unspecific microRNA-depletion of MVs by EPC transfection with siRNA for Dicer, the intracellular enzyme essential for microRNA synthesus and 3) MV depletion of the anti-apoptotic microRNA miR-27a by EPC transfection with a specific antagomiR. In vitro, we confirmed the role of miR-27a in the anti-apoptotic effect of MVs in cisplatin-treated human tubular epithelial cells. Indeed, MVs derived from EPCs significantly reduced apoptosis through the down-regulation of the death receptor Fas (CD95), of the mitochondrial molecules Bcl-XL/Bcl-2 and of caspase-3, -8 and -9 activation. These effects were not observed after miR-27a depletion. Conclusions: MVs derived from EPCs protected from cisplatin-induced AKI by delivering their RNA content. The miRNA cargo of MVs and in particular miR-27a contributed to reprogramming cisplatin-injured tubular epithelial cells toward a regenerative program, inhibiting the death receptor/mitochondrial apopototic pathways.

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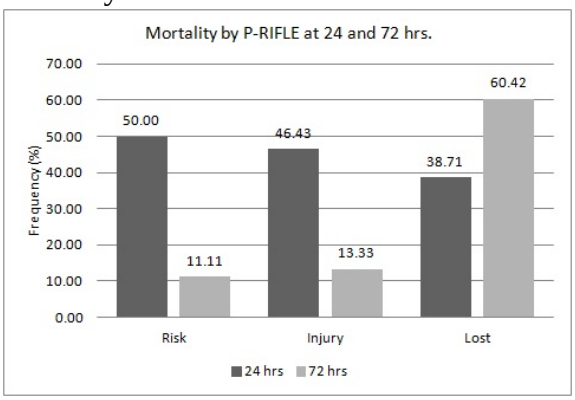
35. Classification Of AKI Using P-Rifle Score In A Picu In Fundación Valle Del Lili, Cali, Colombia

Gastón Castillo, Angie Cañas, María del Pilar Duque, Fernando Bermúdez, Eliana Manzi, Teresa Agudelo, Jaime Restrepo, Magda Cepeda
Fundación Valle del Lili

Introduction and Aim: Acute Kidney Injury (AKI)\'s incidence in PICU patient worsen mortality. We used the p-RIFLE score to estimate the incidence of AKI in children of PICU in an institute in of fourth level in Cali. **Methods:** Prospective study of patients hospitalized in PICU between september/29 and august/211, with AKI, in whom the p-RIFLE score was applied. **Results:** Among 1891 patients registered in PICU, 3.86% presented AKI. Half were under 24 month age (p25-p75: 6-18), and 58% were male. At 24 and 72 hours of admission, 43% and 66% of patients presented Failure, respectively. The principal admission diagnosis were cardiovascular (34%) and infectious (18%). 32 (44%) dead. Mortality by p-RIFLE in 24hrs is similar across strata, while at 72hrs Failure was higher. The relation in mortality was invested for patients classified as Failure among 24 and 72 hrs, vs. observed in Risk and Injury (Graphic). The association of mortality with p-RIFLE at 72hrs was significant (p=.), while at 24hrs did not (p=.712). 4% of patients were classified as very high of mortality by PRISM, but was not associated with mortality (p=.455). 39 (53%) of patients required RRT, but was not associated neither mortality (p=.368) nor worsening of RIFLe (p=.99). **Conclusions:** The use of

p-RIFLE at 72hrs allow to predict mortality at PICU.



36. Creatinine Production and Creatinine Degradation are Reduce in Patients with Acute Kidney Injury and Sepsis

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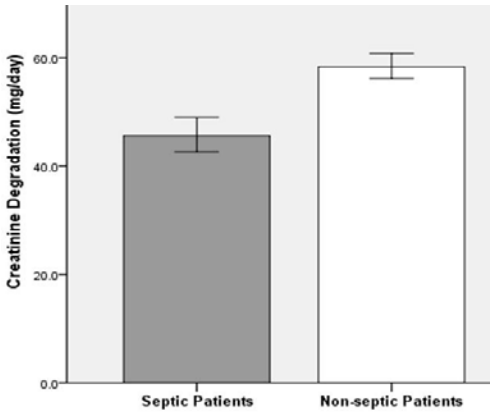
University of California San Diego, University of Montreal, Stanford University, University of Washington, Vanderbilt University, Cleveland Clinic

Background: Diagnosis and staging of acute kidney injury (AKI) uses serum creatinine (sCr). In a previous animal model of AKI, Doi et al have shown that sepsis dramatically decreases sCr levels and creatinine production. This phenomenon would limit early detection of acute kidney injury. We evaluated the effect of sepsis on sCr levels, creatinine production (Pc'), and creatinine degradation (Dc') in patients with AKI. We hypothesized that sepsis will reduce creatinine production and sCr levels in AKI patients with sepsis.

Methods: We analyzed data from 234 critically ill non-dialyzed patients with AKI from 5 centers included in the PICARD study. Creatinine production was calculated using Cockcroft-Gault formula and using Moran et al formula which adjusts sCr for fluid balance. Creatinine degradation was computed using Mitch et al equation and adjusted for fluid balance. **Results:** Of the 234 patients 139 were septic (59%). Non-adjusted and adjusted sCr levels were lower in AKI patients with sepsis than in non-septic patients (non-adjusted sCr median 2. IQR [1.5 – 2.8] vs. 2.5 IQR [1.8 – 3.5] and adjusted sCr 2. IQR [1.4 – 2.7] vs 2.4 IQR [1.8 – 3.6]; $p < .1$). Pc' was lower in septic patients than in non-septic (1,211 IQR [934 – 1,472] vs. 1,278 IQR [1.17 – 1,538] mg/day; $p < .1$); the same was observed after adjusting Pc' for fluid balance (1,92 IQR [828 – 1,295] vs. 1,124 IQR [892 – 1,344]; $p < .1$). Dc' was also significantly lower in septic than in non-septic patients [Figure 1]. **Conclusions:** Sepsis reduces creatinine production and reduces sCr levels in critically-ill patients with AKI. These observations could limit the early diagnosis of AKI. Sepsis also affects creatinine degradation.



37. AKI Superimposed On CKD After Cardiac Surgery Needs Different Cutoff Value Of Plasma NGAL

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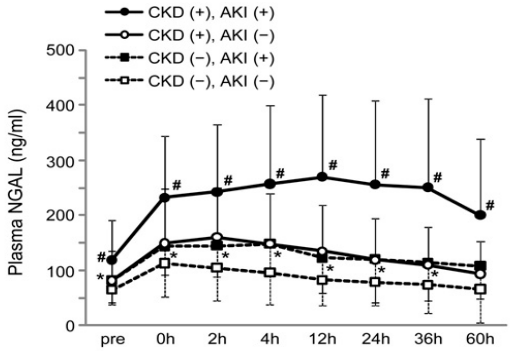
Background: Plasma neutrophil gelatinase-associated lipocalin (NGAL) is reportedly useful for pediatric and adult post-cardiac surgery acute kidney injury (AKI). However, although chronic kidney disease (CKD) is a strong risk factor for AKI development, previous clinical evaluations did not specifically examined AKI occurring in patients with CKD. Moreover, CKD significantly increases plasma NGAL levels in a stable condition. **Methods:** This study prospectively evaluated 143 adult patients who had cardiac surgery at two general hospitals. Plasma NGAL was measured before surgery, at ICU arrival after the surgery (hr), and 2, 4, 12, 24, 36, 6 hr after ICU arrival. **Results:** Based on patients' estimated glomerular filtration rate (GFR) before surgery, 67 (46.9%) were diagnosed as having CKD. Of 143 patients, 54 (37.8%) developed AKI after surgery. Multiple logistic regression analysis revealed that preoperative estimated GFR and operation time were significantly associated with AKI occurrence after surgery. Plasma NGAL measured before surgery and at , 2, 4, 12, 24, and 36 hr after ICU arrival in AKI was significantly higher than in non-AKI regardless of CKD complication. However, plasma NGAL alone was not sufficient to discriminate de novo AKI or AKI superimposed on CKD (Figure). Receiver operating characteristics analysis revealed different cutoff values of AKI for CKD and non-CKD patients. Conclusions: Plasma NGAL in post-cardiac surgery will predict AKI not only in non-CKD patients but also in CKD patients when cutoff values are determined properly.



38. The ICNARC model is predictive of hospital mortality in critically ill patients supported by acute dialysis

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Aims: To compare prediction power between ICNARC model and RIFLE classification in postoperative patients receiving acute dialysis. **Methods:** Between January 22 and December 28, 529 patients received acute dialysis during their ICU stay were enrolled. Patients' demographic, clinical and laboratory variables were analyzed as predictors of mortality. The RIFLE

logistic regression and the ICNARC model on ICU admission were evaluated to predict the patient's hospital mortality. **Results:** Hospital mortality for the study group was 29.3%. Between two score systems, the ICNARC model showed better mortality prediction in this patient group by using the area under the receiver operating characteristic curve (ICNARC .836, RIFLE .72, p<.5). Multiple logistic regression analysis indicated that age, surgery category, metastatic carcinoma, ventilator use, and previous history of hypertension were also affecting factors for hospital mortality. **Conclusions:** The RIFLE classification and the ICNARC model were both correlated with mortality in critically ill patient with acute dialysis. However, the ICNARC model was a better mortality predictor comparing with the RIFLE

39. TITLE:

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Objective: Acute kidney injury (AKI) is a common symptom in critically ill patients, and has a close association with the outcomes of patients .while there is still no uniform criteria for AKI . This study is to identify the value of the new proposed KDIGO criteria in diagnosing and predicting prognosis in the critically ill patients. **Methods:** Patients admitted to the Department of Intensive Medicine of Guangdong General Hospital between October 29 and July 21 were retrospectively evaluated. AKI was defined and classified by the RIFLE criteria , AKIN criteria and KDIGO criteria. Meanwhile, the diagnosis sensitivity and the value for prediction of prognosis were compared among the three criteria. **Results:** In total,524 patients were evaluated, and 95 patients had AKI identified by RIFLE criteria, 135 patients developed AKI according to AKIN criteria, while the number increased to 14 with KDIGO criteria. KDIGO criteria was superior to RIFLE criteria in diagnosing (18.1% vs26.7 %, p < .5); but KDIGO didn't overweight to AKIN criteria (p > .5).meanwhile there was also significant difference between RIFLE and AKIN criteria (18.1% vs25.8 %, p < .5); We made a further study for the prognosis of AKI, and the results showed that AKI is an independent risk factor of the hospital mortality identified by any stage of the RIFLE criteria or AKIN criteria p< .1） The area under the receiver operator characteristic curve (ROC)for hospital mortality was .7293, (p<.1） for RIFLE criteria ,.782, (p<.1)for AKIN criteria and .7777 (p<.1） for KDIGO criteria in all patients. And KDIGO criteria hadn't advantages in predicting hospital mortality (p > .5). Meanwhile we got the similar results of the one year mortality, the predicted value of mortality is close, the area under the ROC were .648, .644, .611 respectively.

Conclusions: KDIGO criteria are not superior to RIFLE and AKIN criteria no matter in diagnosing and projecting prognosis of AKI in critically ill patients. AKIN criteria based on the RIFLE criteria., although it could improve the sensitivity of the acute kidney injury diagnosis, it doesn't seem to bring substantial advantage in improving on the ability of the RIFLE criteria in predicting prognosis of critically ill patients classification.

40. The SAFE-T Consortium: A Collaborative Approach for the Qualification of Novel Kidney Biomarkers with the Regulatory Authorities

Joe F Keenan, Patrick Murray, Frank Dieterle, Ralf Schindler, Stefan Sultana, Scott Adler
SAFE-T Consortium, European Collaboration

Background: Drug-induced kidney injury (DIKI) is not an uncommon adverse event in drug development. The greatest issue is the late identification of Acute Kidney Injury due to the current standards (i.e. serum creatinine (sCr) and blood urea nitrogen (BUN)) which are delayed indicators of injury and may not be significantly changed until 2/3 of the kidneys function has already been lost. Over the last three years there has been progress with preclinical qualification processes for kidney biomarkers (PSTC and ILSI HESI qualification with EMA and FDA). These landmark qualifications mean that drug companies may now use certain novel preclinical markers for real decision making within their qualification context. **Methods:** The principal objective of this new project is to collect and generate sufficient clinical data from a number or candidate kidney biomarkers, that will provide convincing evidence for the health authorities to endorse these biomarkers for the detection and monitoring of drug induced kidney injuries in specific clinical situations. 22 kidney biomarker have been selected and are being analytically validated by a number of technologies (bead-based, electrochemiluminescence, LC/MS, and standard microtitre ELISA) by the participants of the consortium. A number of patient clinical studies have been started in key areas (Cisplatin toxicity, Contrast induced nephropathy and acute GN) and these samples will provide the basis for the exploratory phase of the project. **Results:** SAFE-T have gained regulatory feedback on this project and are actively recruiting patients and collecting samples. More than half of the 22 kidney markers have been analytically validated through a series of internal bar meetings. Studies have been designed and initiated to collect samples for analysis of kidney injury biomarkers in clinical settings of acute kidney injury (cisplatin exposure, radiocontrast exposure and acute glomerulonephritis). **Conclusions:** A SAFE-T DIKI status update including regulatory strategy, assay validation and study designs will be provided. Understanding the profiles of renal injury biomarkers in the context of various clinical scenarios of kidney injury will contribute to the development of acute kidney injury biomarkers.

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41. SAPS3 Score as Mortality Rate Predictors in Patients Treated with Continuous Renal Replacement Therapy

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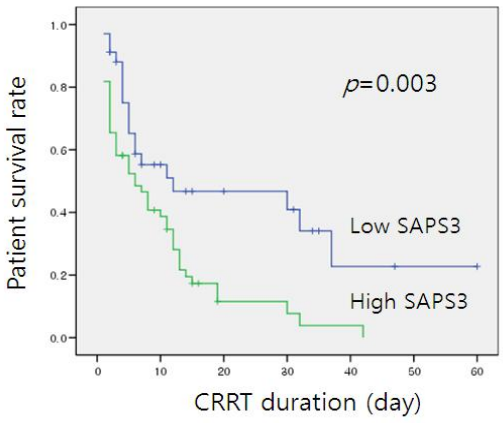
Purpose: Acute kidney injury (AKI) is a frequent condition that requires continuous renal replacement therapy (CRRT), which has a high mortality rate in intensive care unit (ICU) patients. We evaluated the Simplified Acute Physiology Score 3 (SAPS 3) and Acute Physiology and Chronic Health Evaluation II (APACHE II) score, determined at the start of CRRT, for predicting mortality in AKI patients treated with CRRT. **Methods:** We retrospectively analyzed the demographic, clinical, and laboratory

data of 89 ICU patients with AKI or acute-on-chronic kidney disease who received CRRT. We calculated the SAPS 3 and APACHE II score at the start of CRRT. **Results:** The average age of the 89 patients was 64.4±13.9 years. Fifty-nine (66.3%) patients were male. Eighteen (2.2%) patients had chronic kidney disease and thirty (33.7%) patients had diabetes. Sixty-two (69.8%) patients treated with mechanical ventilation. The average systolic blood pressure was 85.9±27.4 mmHg, and sixty-four (71.9%) patients treated with vasopressor. The overall mortality was 75.3%. The average SAPS 3 was 89.4±14.9 and the average APACHE II score was 28.4±5.2. The SAPS 3 was higher in non-survivors than survivors (p=.38). Sepsis was more common in non-survivors than survivors (p=.36). There were no significant differences between the two groups for other conditions. The variables influencing mortality on univariate analysis were SAPS 3 and presence of sepsis. The area under the receiver-operating characteristic curve for SAPS 3 was .69 (95% CI. .54–.83). At a SAPS 3 of 84, the sensitivity for predicting mortality was 71.6% and the specificity was 69.2%. Patient survival estimated by Kaplan-Meier method, patients with low SAPS3 score (<84) superior than patients with high SAPS3 score (>84) significantly (p=.3). **Conclusion**: The SAPS 3 determined before starting CRRT could be a predictor of hospital mortality in ICU patients with AKI.



42. Initiation of Acute Renal Replacement Therapy in ICU patients based on AKIN criteria in the absence of conventional indications fails to improve survival

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Introduction: Acute kidney injury (AKI) in intensive care unit (ICU) patients is associated with high mortality. Yet optimal timing of acute renal replacement therapy (ARRT) initiation is uncertain. We report preliminary results of outcomes of critically ill patients with AKI initiated on ARRT based on conventional "absolute" indications (Group 2) versus modified AKIN criteria (Group 1). Method: This was a single-center; prospective, observational study of patients with AKI from Medical (MICU) and Surgical ICU (SICU) referred

consecutively over 8 months to the Renal Service. Conventional "absolute" indications for dialysis were: serum K ≥6. µmol/L, serum urea ≥3 mmol/L, arterial pH ≤7.15, serum HCO3 ≤1 mmol, acute pulmonary edema, acute uremic encephalopathy and/or pericarditis (Group 2). In their absence, ARRT was initiated at (i) AKIN Stage 3 and (ii) AKIN Stage 1 or 2 with additional hypercatabolic indications (Group 1). Results: Thirty-four critically ill patients were studied (mean age 61±3 years, M:F=22:12, MICU: SICU 21:13, mean APACHE II score 25±1, mean SOFA score 12±1) with mean premorbid serum creatinine 16±11 µmol/L. Main AKI causes were sepsis (n=35) and ischemia (n=14). Baseline demographic and clinical characteristics were comparable in Group 1 (n=14) vs. Group 2 (n= 2), including peak serum creatinine (µmol/L) (at referral) 296±41 vs. 394±51, p=.26. Overall ICU mortality was 47%. Comparing Group 1 vs. 2, mean CRRT effluent flow (ml/kg/h) 33.3±3.6 vs. 31.9±2.1, p=.95; ICU mortality 43% vs. 5%, p = .68; in-hospital mortality 57% vs 65%, p=.64; and, renal recovery at 28 days 43% vs. 25%, p = .32. Conclusion: Use of modified AKIN criteria to effect earlier ARRT initiation did not improve clinical outcomes in ICU patients with high APACHE II scores. Further large scale studies are needed to clarify the role of earlier ARRT initiation.

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43. Formation of the Kidney Intervention During Extracorporeal Membrane Oxygenation (KIDMO) pediatric study group

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Background: Extracorporeal membrane oxygenation (ECMO) is a life-saving therapy for pediatric and adult patients with severe cardiac and/ or respiratory failure. ECMO patients are at increased risk of acute kidney injury (AKI) and development of fluid overload (FO), which are associated with increased mortality. Many of these patients receive renal support therapy (RST). However, the RST-ECMO literature consists only of single center experiences with often insufficient patient enrollment. A need exists for a multi-center group to evaluate AKI and RST on ECMO in a comprehensive, prospective manner. **Objective:** To form a multi-center study group to allow for the efficient study of AKI, FO, and RST in pediatric ECMO patients. **Methods:** A multi-disciplinary team of pediatric critical care, cardiology, nephrology, and ECMO experts was assembled from multiple large children's hospitals.

Results: The Kidney Intervention During Extracorporeal Membrane Oxygenation (KIDMO) study group has been formed with 6 participating institutions (Cincinnati Children's Hospital, Vanderbilt University, McGill University Health Centre, University of Alabama, University of Michigan, and Children's Healthcare of Atlanta). The KIDMO centers perform a combined 2-25 cases of ECMO per year, which will allow for adequate recruitment for future studies. Initial work includes a survey of participating ECMO centers to describe the use of CRRT in ECMO patients. Additionally, the KIDMO group has altered the data collection forms for the Extracorporeal Life Support Organization Registry, which captures data from the worldwide ECMO population. These alterations will enhance data collection regarding acute kidney injury and renal support therapies during ECMO. **Conclusions**: We describe the formation of the KIDMO study group that leverages an international, multi-disciplinary, multi-center organization to provide the patients and expertise necessary to study AKI, FO, and CRRT in pediatric ECMO patients. Initially, we aim to retrospectively describe these entities to provide the framework for development of prospective studies to investigate novel markers of AKI, fluid management strategies, and interventions to ameliorate the effects of AKI, and optimize RST for ECMO patients.

44. Acute Kidney Injury in Asphyxiated Newborns Treated with Therapeutic Hypothermia

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Background: Therapeutic hypothermia has become the standard of care for asphyxiated newborns. Previous reports have described the incidence of Acute Kidney Injury (AKI) in asphyxiated newborns to be as high as 6% prior to regular use of therapeutic hypothermia. To date there has not been an evaluation of AKI during therapeutic hypothermia in these patients utilizing the Acute Kidney Injury Network (AKIN) criteria and the association of AKI with outcome. We hypothesized AKI in asphyxiated newborns would be associated with increased mortality, prolonged intensive care unit stay, and prolonged requirement for mechanical ventilation despite hypothermia treatment.

Design/Methods: 96 consecutively cooled infants were retrospectively reviewed. All infants had renal function assessed before the start of cooling (baseline); at 24, 48, and 72h through cooling; and then on day 5, 7, and 1 of life as clinically indicated. The AKIN criteria were used to classify AKI.

Patient factors potentially associated with AKI were investigated including: Apgar scores, cord pH and base deficit, delivery room complications, severity of illness (need for pressors, transfusions), and exposure to nephrotoxic medications. **Results**: AKI was found in 36 (38%) of 96 infants with 16, 7, and 13 fulfilling criteria for stage I, II, and III, respectively. Overall mortality was 7% for the cohort and was higher for those who suffered AKI compared to those who did not, but did not reach statistical significance (14% vs. 3%, p= .99). Patients with AKI stayed longer in the Neonatal Intensive Care unit (15.4±9.3 vs. 11±5.9 days, p=.14), and required prolonged mechanical ventilation (9.7±5.9 vs. 4.8±3.7 days, p<.1) compared to those without AKI. On multivariate analysis AKI was associated with use of pressors, seizures within 6 hours of life, and elevated vancomycin levels. **Conclusions**: This is the first report using the AKIN definition for AKI in asphyxiated newborns undergoing therapeutic hypothermia. There is a high incidence of AKI in these patients, but this remains lower than reported publications prior to the institution of therapeutic hypothermia as the standard of care. AKI is associated with increased length of intensive care unit stay and prolonged mechanical ventilation. We highlight the importance of recognizing AKI in asphyxiated newborns undergoing therapeutic hypothermia and the potential reno-protective effects of this intervention.

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45. Serial Measurement of Urinary NGAL for Predicting AKI Worsening/Recovery in ICU

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Background: Urinary NGAL can detect AKI before serum creatinine elevation especially in post-cardiac surgery AKI, where the time of renal insult is clear. However, critically ill patients treated in ICU frequently suffer from multiple insults. Serial measurement of urinary NGAL may enable us to predict whether AKI will be developed or recovered in these patients. **Methods**: We prospectively studied 274 adult critically ill patients in mixed ICU of the University of Tokyo Hospital. Patients of end-stage renal disease and post-scheduled cardiac surgery were excluded. Urinary NGAL was measured at ICU admission (day 1) and 24 hr after (day 2). Diagnosis and severity of AKI was determined by the RIFLE criteria with one exception; the patients who needed RRT were categorized as Failure. **Results**: 126 (46%) patients were diagnosed as AKI at ICU admission and additional 33 patients reached the AKI criteria during one week observation period. Of 159 AKI patients, 44 (28%) patients showed worsening kidney function determined by increased severity of the RIFLE class. Urinary NGAL showed a good performance for detecting AKI [AUC-ROC .83, cut off value 54.7ng/ml (sensitivity 7%, specificity 84%)]. Based on the magnitude of urinary NGAL change for 24 hr (i.e. absolute delta), patients were divided into three groups as follows; the increasing group (the highest quartile, Δ>46 ng/ml), the decreasing group (the

lowest quartile, Δ< -22ng/ml), and the stable/persistent group (Δ was within IQR). In the stable/persistent group, urinary NGAL of day 1, day 2, their average, maximum and minimum values were all significantly associated with worsening kidney function (AUC-ROC > .9). On the other hand, only urinary NGAL at day 1, minimum values showed significant associations in the increasing group (AUC-ROC .75). In the decreasing group, urinary NGAL failed to show any significant association with worsening of AKI. However, relative reduction rate was able to predict recovery from AKI (AUC-ROC=.72). **Conclusion**: In the present study, absolute values of urinary NGAL can predict worsening AKI when increased or stable within 24 hr after ICU admission. Relative reduction rate can be used to predict recovery from AKI when urinary NGAL decreased after ICU admission. These data indicate serial measurement of urinary NGAL is useful for predicting AKI worsening and recovery

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46. Transfusion Related Acute Kidney Injury: Result of a Prospective Cohort Study

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Background: Acute kidney injury (AKI) occurs in up to two third of intensive care unit (ICU) patients. It has been shown that blood product transfusion increases risk of acute lung injury (TRALI). Considering strong association between ALI and AKI, we evaluated the association between transfusion and AKI in ICU patients. **Methods**: We performed a retrospective analysis of a prospectively collected cohort of consecutive adults (>18 years of age) who were admitted to the ICU and received blood product transfusion from March 24 to December 25. We excluded those who developed AKI prior to receiving transfusion or who were on chronic hemodialysis at time of admission. **Results:** A total of 127 patients met the inclusion criteria. The median age was 64 (IQR, 53-77), 65 were male (51%). A total of 49 (38%) patients developed AKI based on the AKIN criteria. In univariate analysis, there was no statistical significant difference in development of AKI based on the type of blood product that the patients received (cryoprecipitate, packed red blood cells, platelets or fresh frozen plasma). After adjustment for age, gender, baseline creatinine and presence of shock upon ICU admission, the transfusion of blood products was not independently associated with development of AKI (Odds ratio 1.6, 95% CI .95-1.18, p=.25). **Conclusion:** In a cohort of heterogenous group of ICU patient who received blood product transfusion, there was no increased risk of AKI.

EPIDEMIOLOGY AND PATIENT CHARACTERISTICS

47. Tubulointerstitial Nephritis and Uveitis Syndrome, with genetic fingerprint of SLE

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We report a case of acute kidney injury due to tubulointerstitial nephritis and uveitis (TINU syndrome) in a 38-year-old woman who was also found to have elevated titers of anti double stranded DNA antibody. Renal biopsy exhibited a mononuclear infiltrate without the characteristic morphologic features of lupus nephritis. Twelve genetic variants (single nucleotide polymorphisms) associated with SLE in eight different genes were analyzed; ten of them harbored at least one minor allele. Steroid therapy improved both uveitis and nephritis. The diagnosis of TINU is discussed, as well as its possible association with SLE.

48. Association of Commonly Used Medications with Prevalence and Renal Recovery after Postoperative Acute Kidney Injury

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Background: Acute kidney injury (AKI) is a common clinical condition in postoperative patients associated with a significantly increased risk of morbidity and mortality. Although certain drugs have been associated with the onset of AKI, it is not known to what extent drug intake after AKI may impact renal outcome. We studied the association between the use of common postoperative medications and the prevalence of AKI as well as the recovery of renal function after the AKI episodes in postoperative patients. Methods: We conducted a retrospective, single center study of 54,768 adult surgical patients admitted to a tertiary academic center from 2-21 for ≥2 days. AKI was defined using consensus RIFLE classification. Renal outcome was classified as complete, partial and no renal recovery according to consensus. **Results**: AKI occurred in 21,361 (39%) patients, with RIFLE classes R, I and F, accounting for 21.3%, 1.3% and 7.4% respectively. Multivariate logistic regression showed that beta-blockers (OR 1.38, 95% CI 1.33-1.44), vasopressors (OR 2.5,95% CI 1.93-2.12), inotropes (OR 2.35,95% CI 2.8-2.67), diuretics (OR 1.72,95% CI 1.65-1.8), nesiritide (OR 2.43,95% CI 1.85-3.19), aminoglycosides (OR 1.28,95% CI 1.2-1.36), vancomycin (OR 1.6, 95% CI 1.53-1.67), amphotericin B (OR 4.46, 95%CI 3.31-6.1), trimetoprim-sulfametoxazol (TMP-SMX) (OR 1.31, 95%CI 1.19-1.44) and

antivirals (OR 1.24,95% CI 1.11-1.39) were significantly associated with higher risk for AKI, while ACE-inhibitors (OR .88,95%CI .84-.92), aspirin (OR .74,95%CI .7-.77), non-steroidal anti-inflammatory drugs (NSAIDs) (OR .91, 95%CI .81-.96) and statins (OR .79, 95%CI .75-.84) were associated with lower risk. In addition, use of amphotericin B (OR 1.71, 95%CI 1.31-2.24), diuretics (OR 1.53, 95%CI 1.35-1.74), vasopressors (OR 1.75, 95%CI 1.54-1.98) and beta-blockers (OR 1.18, 95%CI 1.4-1.35) was associated with increased risk for partial or no renal recovery in patients who developed postoperative AKI.

Conclusion: Our findings demonstrate that several commonly used postoperative medications may be associated not only with increased risk for AKI but also decrease the likelihood of renal recovery after AKI episode.

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49. Retrospective Analysis Of Acute Kidney Injury In Non Renal Solid Organ Transplant Recipients: Incidence, Outcome And Impact On Residual Renal Function

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Acute kidney injury (AKI) is a frequent complication in critically ill patients that is often associated with high mortality rates. Despite the increased incidence of chronic kidney disease (CKD) in non renal solid organ transplant (NRSOT) recipients due to drug nephrotoxicity, only a few studies analyzed the clinical impact of AKI in this selected population.

The aim of the present study was a 10-year retrospective analysis of AKI incidence in NRSOT recipients to identify its impact on outcome and progression toward CKD.

We retrospectively analyzed (2001-2010) the %age of NRSOT in the whole AKI population treated by dialysis. For each NRSOT recipient, we evaluated RIFLE and SOFA scores and the severity index ATN_ISS at the start of dialysis. The %age of AKI requiring dialysis in the whole NRSOT population and for single transplanted organ (liver, heart or lung graft) was also studied. Renal function was evaluated at the end of observation (30 days). Hemer-Lemeshow statistical test was performed.

In the period 2001-2010, we treated by dialysis (sustained slow hemofiltration of 10-12 hr, pre-dilution fluid 30-50%, blood flow 200 ml/min, polysulphone membranes 1.4-1.8mq) 1833 critically ill patients with AKI for a total of 9061 sessions. Among this population, 233/1833 (12.7%) were NRSOT recipients. We treated by dialysis 151/1335 (11.3 %) patients with a liver graft, 60/229 (26.2 %) with a heart graft and 22/88 (25%) with a lung graft. NRSOT patients' characteristics were: mean age 58.4 yrs (SD 8.2), male 66.6%, mean serum creatinine 3.46 mg% (SD 1.34), mean number of organ failures 3.3 (SD 1.87) and mean ATN_ISS score 0.63 (SD 0.13). The prevalent cause of AKI in NRSOT patients was sepsis (43.6%), associated with high mortality and with a difficult management of the immunosuppressive therapy. The global mortality in NRSOT patients was 45.49% (106/233), 43.5% (66/151) for

liver, 51.6% (31/60) for heart and 40.9% (9/22) for lung graft recipients, respectively. Mean serum creatinine at the end of the study period (30 days) was 2.34 mg% (1,97 mg% in liver, 2,26 mg% in heart and 2,89 mg% in lung graft recipients, respectively).
Our 10-year retrospective analysis revealed an increased incidence of AKI in the NRSOT population. The main cause of AKI was sepsis which was associated with an increase of mortality and with an impairment of renal function that may be responsible for the progression toward CKD.

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50. Case Report of Renal Replacement Therapy in a 1-year old patient with AKI

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Renal replacement therapy in children is a rare event, but with important implications for morbidity and mortality in this age group. Although the incidence of children with kidney failure is relatively low and patients requiring renal replacement therapy are usually few in these, has been recognized the significant positive impact on early recognition of children who require and implement of adequate therapy. According to the annual report of the UK Renal Registry, during 2009 there were 751 children with established renal injury receiving renal replacement therapy. We report a case of a patient who required renal replacement therapy secondary to a procedure-related multi-organ failure.
The patient was referred from a peripheral center of care with a diagnosis of septic shock of abdominal origin, multiorgan failure, acute renal injury, post- laparotomy for correction of intestinal mal-rotation, intestinal obstruction and release of congenital constricting bands and syndrome post-resuscitation. The patient was hospitalized in the Pediatric Intensive Care Unit (PICU). The principal clinical of the patient consisted in 6 days of intestinal obstruction, secondary to constricting bands and intestinal mal-rotation. In the course of corrective surgery, the patient presented cardio-respiratory failure accompanied by renal failure, and was referred to institution. To acute renal injury management we used renal replacement therapy with continuous veno-venous hemofiltration (CVVHF) for five days, then started continuous infusion of furosemide in which there was no improvement, which required restarting CVVHF for 18 days and hemodiafiltration with pump flow to 100ml/min with fluid loss of 150 ml/h. Renal function recovery was obtained after 30-days of management. As a related complication, blow up of catheter and filter plugging occurred.
After a 30-days hospitalization, the patient was discharged with additional diagnosis of postoperative of severe pneumonia and acute respiratory distress syndrome, septic shock refractory to inotropic fungemia resolved, myocardial dysfunction, renal dysfunction and acute renal injury.
Acute renal injury is a condition that quickly complicated pediatric patient, sepsis remains the leading cause of the complication reported in multiple series. Previous reports have shown the advantage of starting early RRT patients with a significant favorable impact in patients with sepsis and multi-organic failure.

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51. Survival and Mortality Risk Factors in Mexican Patients with Acute Kidney Injury

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Background: Acute Kidney Injury (AKI) information is scarce in Latin American ICU and non ICU patients. **Aim:** To determine patient survival, mortality risk factors and treatment in AKI patients from a hospital of the West of Mexico. **Methods:** Prospective cohort (Jan-May2011) of 79 patients with AKI (AKIN classification), diagnosed and treated by Nephrologists, were recorded at admission, at AKI diagnosis and daily for 1 month: age, gender, time between AKI onset and Nephrology diagnosis, fluid balance, SOFA, APACHE II, ISI, treatment (IHD, CCRT, conservative),date of death or patient discharge and other clinical and biochemical variables. **Results:** Mean age was 52±18 years, 61% were male, 48% were from ICU, 50% had surgery, 25% had sepsis; 59% had AKIN 3, mean time between AKI onset and Nephrology consultation was 59±48 hours, 56% received conservative treatment, 28% IHD and 16% CCRT; mean hospitalization was 15±9 days; Mortality was 51% (according to treatment was 46% conservative, 41% IHD and 92% CCRT) Results are shown in Table 1 (Comparisons according to hospitalization site and mortality). Mortality predictors at day of diagnosis were: Δ SCr, Uresis volume and diuretic use ($\chi 2=11.4$; $p=0.01$); and predictors 24-Hrs after were: Diuretic use and SOFA score ($\chi 2=7.1$; $p=0.03$) Conclusions: Mortality was similar to other studies, was high in general ward (42%)and was significantly predicted at diagnosis by small changes in serum creatinine. At 24 hours evaluation, SOFA and conservative treatment significantly also predict mortality.

	ICU (n=30)	General ward (n=49) p< 0.05
Fluid balance(Lt)	6.7 (3.3-11.3)	3.1 (0.8-6.4)
SCr Δ	1.8±1.5	3.6±3.1
Mortality n(%)	20(67)	20(42)
	Alive (n=39)	Dead (n=40) p< 0.05
Fluid balance(Lt)	2.08 (-0.38-5.4)	6.8 (3.3-11.4)
SCr Δ	3.7±3.2	2±1.8
SOFA (pts)	10±3	13±3
Diuretic use N (%)	21 (70)	19 (40)
ISI (pts)	0.37±0.2	0.57±0.3

52. The Impact Of The Daily Presence Of The Nephrology Resident In The Postoperative Cardiac Intensive Care Unit

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Background: Acute kidney injury (AKI) is a significant cause of morbidity and mortality following cardiac surgery.

Early nephrology consultation could result in better outcomes, but daily presence of the nephrology resident in the postoperative cardiac intensive care unit (PC-ICU) and its relationship with hard outcomes has not been explored. Purpose: We assessed the incidence of AKI, renal recovery, ICU length of stay, and in-hospital mortality following cardiac surgery before and after the daily presence of the nephrology resident as part of the PC-ICU team. **Methods:** We conducted a retrospective cohort study of 2 consecutive periods of time in adults taken to cardiac surgery in a single-center: from March 2009 to February 2010 (nephrology consultation by call) and from March 2010 to February 2011 (daily presence). We excluded patients with chronic kidney disease stage V, AKI or renal replacement therapy (RRT) before surgery. AKI was defined according to AKIN and RIFLE classifications within 7 days since cardiac surgery. We used multivariable linear and logistic regression to adjust for confounding variables. **Results**: We included 1096 patients who were taken to cardiac surgery in the Instituto Nacional de Cardiología Ignacio Chávez in Mexico City, 558 in the consultation period and 538 in the daily-nephrology-presence period. AKI occurred in 31.9% of patients in the consultation group and 28.7% in the daily group (p=0.019); in-hospital mortality was 8.25% and 5.6% (p=0.082). Adjusting for age, baseline renal function, risk scores (Euroscore and Thakar score), infections, and length of mechanical ventilation, the daily presence of the nephrology resident was associated with a lower risk of AKI (OR 0.714 [95% CI 0.520-0.982], p=0.039), shorter ICU length of stay (Beta -0.095 [95% CI 0.000 to -0.146], p=0.044) and lower in-hospital mortality (OR 0.469 [95% CI 0.256-0.858], p=0.014). In those patients who required RRT the daily nephrology presence was associated with a lower risk of failure to recover renal function (OR 0.023 [95% CI 0.001-0.384], p=0.009). Conclusion: Daily presence of the nephrology resident in PC-ICU was associated with lower risk of AKI, in-hospital mortality and seems to promote renal recovery in patients requiring RRT. The present model of attention is a proposal with potential benefits in teaching hospitals.

	B	S.E	Wald	df	Sig	Exp (B)	95% IC
Daily nephrology presence	-0.757	0.308	6.029	1	0.014	0.469	0.256-0.858
Re-intervention	0.266	0.337	0.622	1	0.430	1.305	0.674-2.527
Bleeding (mL)	0.000	0.00	0.113	1	0.736	1.000	1.000-1.000
Heart failure	0.436	0.369	1.394	1	0.238	1.546	0.750-3.188
Length of mechanical(days) ventilation	0.029	0.019	2.225	1	0.136	1.029	0.991-1.069
CPB (min)	0.009	0.003	9.768	1	0.002	1.009	1.003-1.015
CKD-EPI (mL/min/m2)	-0.016	0.006	8.444	1	0.004	0.984	0.973-0.995
Severe infection	1.379	0.360	14.637	1	0.000	3.969	1.959-8.043
Euroscore	0.202	0.047	18.641	1	0.000	1.223	1.116-1.340
AKIN 1	0.429	0.345	1.549	1	0.213	1.536	0.781-3.019
AKIN 2	1.590	0.519	9.387	1	0.002	4.905	1.774-13.567
AKIN 3	1.450	0.665	4.760	1	0.029	4.265	1.159-15.694

53. A New Clinical Score to Predict Acute Kidney Injury After Cardiac Surgery in Chinese Elderly Patients

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Objective: To develop and validate a risk score to predict acute kidney injury (AKI) after cardiac surgery in Chinese elderly patients. **Methods:** A consecutive sample of 848 elderly patients(age≥60 years old) who underwent cardiac surgery with cardiopulmonary bypass in the Guangdong general hospital between January 1, 2005 and July 31, 2010 was evaluated. The clinical outcome was AKI according to the serum creatinine criteria of the RIFLE classification during the first 7 days postoperatively. Patients were excluded if they had an end stage renal disease, or experienced renal replacement therapy. Those who had missing data were also excluded. In randomly selected 682 patients of the total cohorts, multivariate logistic regression analysis was used to develop a new prediction score based on clinical characteristics and perioperative variables of patients. The new score was validated on the remaining patients. Result: The incidence of AKI in the derivation cohort which consisted of 682 patients was 62.3% (n=425), while in the test cohort which consisted of 166 patients was 59.6% (n=99). Eight variables were included in the predictive index. Those variables in the new score that an estimated glomerular filtration rate less than 60 ml/min, male , hypertension, chronic heart failure New York Heart Association above stage 2, perioperative red blood cell transfusions above 625 ml were assigned 2 points, respectively. Cardiopulmonary bypass time above 113 minutes and duration of ventilator-assisted respiration during postoperative above 24 hours were assigned 3 points, respectively; other component was assigned 1 point: previous cardiac surgery. The patients with risk score≤4 in derivation, the risk of AKI was 26.0%; comparatively, the risk was 92.6% among patients with risk score≥13. The area under the receiver operating characteristic curve, judging the discrimination of the score, was 0.798 (95%CI 0.764 to 0.832) in the derivation, which in the validation set was 0.804 (95%CI 0.739 to 0.870). The calibration of the score assessed using the Hosmer-Lemeshow statistic in the derivation and validation were 0.478, 0.224, respectively.

Conclusion: A new score based on Chinese information was valid and accurate in predicting AKI after cardiac surgery in elderly patients. This score may allow prevention of post-operative AKI and early institution of therapeutic interventions to attenuate the impact of AKI on the prognosis of cardiac surgery patients.

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54. The Impact of Acute Kidney Injury on In-Hospital Morbidity and Mortality Among Patients With and Without Baseline Chronic Kidney Disease

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Background: Acute kidney injury (AKI) is a well-recognized risk for chronic kidney disease (CKD) and in-hospital mortality. The effect of AKI on in-hospital morbidity and mortality among

patients with and without CKD has not been previously well defined. The objective of this study was to evaluate the prevalence of AKI over a 5 year period and assess AKI associated morbidity and mortality in a cohort of hospitalized patients with and without CKD using the National Hospital Discharge Survey (NHDS) database. Methods: We analyzed NHDS database from 2005 to 2009 for primary diagnosis of AKI and CKD using ICD-9 diagnoses and procedure codes. Clinical information of all patients with AKI with and without CKD was abstracted and analyzed using SAS version 9.2 and JMP version 9.0.1. **Results:** 1,185,477 adult patients were hospitalized from 2005-2009, 61984 (5.23%) had a diagnosis of AKI. The rate of AKI over the 5 year period progressively increased: 3.97% in 2005, 4.52% in 2006, 5.58% in 2007, 6.42% in 2008, and 7.64% in 2009, $p<0.0001$. Among patients with AKI, 18.8% had a CKD diagnosis and 5.4% required renal replacement therapy (RRT). Non-CKD patients with AKI were less likely to require RRT compared to CKD patients with AKI (4.37% vs. 10.0%, $p<0.0001$). Moreover, non-CKD patients with AKI were more likely to be younger (69.4 ± 16.2 vs 71.9 ± 14.7 years, $p<0.0001$), female (48.7% vs. 46.9%, $p=0.0002$), require longer hospitalization (9.20 ± 10.3 vs 7.9 ± 7.76 days, $p<0.0001$) and be dismissed to care facility instead of home (36.1 % vs. 30.4%, $p<0.0001$). In-hospital mortality was more than 2 times higher among AKI patients without CKD compared to those with CKD (12.9% vs. 6.02%, OR 2.30 [95% CI 2.12, 2.50]). After adjusting for common comorbid conditions, the association of worse outcomes in AKI patients without baseline CKD remained significant. Conclusions: AKI is associated with prolonged hospitalization, higher likelihood for dismissal to care facility and significantly higher mortality among patients without baseline CKD compared to patients with CKD.

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55. Clinical study of 72 pediatric patients who were performed extracorporeal membrane oxygenation with CRRT

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Background: Patients with congenital heart disease(CHDis) are sometimes performed extracorporeal membrane oxygenation (ECMO). CRRT are necessary to control fluid balance and electrolyte balance for these patients. We studied efficacy of CRRT for the patients. **Methods:** There were 19 patients who were performed ECMO with CRRT (CHF) from 1997 to 22.(CHF period) From 23 to 25(initial CHDF period), there were 5 patients who were performed ECMO with CRRT (CHDF). From 25 to 211(high flow CHDF period), there were 48 patients performed ECMO with CRRT (high flow CHDF). All of them are 72 patients performed ECMO with CRRT at Shizuoka children's hospital. We checked age, diagnosis, CRRT, survival rate, prognosis of kidney function and so on. **Results:** In CHF period, average age was 4 years old. Diagnosis were CHDis(14 cases), acute myocarditis(2 cases), congenital diaphragm hernia(CDH)(2 cases), persistent pulmonary hypertension of the newborn(PPHN)(1 case) and Sepsis(4 cases). Modality of CRRT were mainly CHF(2 cases), CHDF(1 case) and PEX(1

case).survival rate was 28.6% (survivor; 6cases). Their CKD stage was 1(eGFR>9) as prognosis of kidney function. In initial CHDF period, average age was 1 months old. Diagnosis were CHD is(4 cases), persistent pulmonary hypertension of the newborn(PPHN)(1 case) and Sepsis(3 cases). Modality of CRRT were mainly CHDF(5 cases) and PMX-DHP(3 case).survival rate was 4% (2 cases).The one's CKD stage was 1(eGFR>9), the others was Cs2(eGFR6~9). In high flow CHDF period, average age was 3 years and 2 months old. Diagnosis were CHDis(41 cases), acute myocarditis(4 cases),CDH(1 cases), Croup(1 case), the other(1 case) and Sepsis(5 cases). Modality of CRRT were mainly high flow CHDF(48 cases), PMX-DHP(1 case) and PEX(1 case). Survival rate was 73.5% (survivor; 36 cases).Cs (eGFR>9) was 21 patients. Cs 2(eGFR6~9) was 3 patients. Cs 3(eGFR3~6) was one patient. Survival rate in high flow CHDF period significantly improved.(p<.5) **Conclusion**: From CHF to high flow CHDF period, we could achieve better survival rate. But, the better the survival rate improved, the worse the prognosis of kidney function became. We should improve both survival rate and prognosis of kidney function.

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56. Acute kidney injury does not contribute towards mortality in intensive care unit patients

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This prospective study was done in patients admitted in intensive care unit (ICU) over 1 year period to know whether acute kidney injury (AKI) per se contributes towards mortality or not. Patients with ICU stay of less than 24 hrs and readmission during the same hospital stay were excluded. All eligible patients were assessed within 24 hrs of admission to ICU, baseline APACHE II and SOFA scoring were done and subsequently followed up to look for new onset organ dysfunction/failure. Maximum total SOFA and non renal SOFA were the highest value of SOFA recorded during the course of stay in ICU. Delta SOFA was the measure of difference between maximum SOFA and baseline SOFA. AKI was defined. as per Acute Kidney Injury Network. A total of 197 subjects were enrolled, mean age was 52+17yrs. Mean baseline APACHE score was 10.55 + 8.2, baseline total SOFA 3.03 + 2.5, maximum SOFA 5.26 + 4.72, delta SOFA 2.23+3.34, delta non renal SOFA was 1.59 + 2.7. Duration of ICU stay was 7.2 + 7.6 days. Of 197, 49 patients (24.9%) developed AKI. Sepsis (79.6%), hypovolemia (41%) and nephrotoxic drugs (16%) contributed towards AKI. AKI patients had longer ICU stay (12.8+11.3 vs 5.3+ 4.6 days p<0.001), higher baseline APACHE score (15.2 + 7 vs 9 + 8.1 p<0.001), higher basal SOFA (4.6 + 2.5 vs 2.5 + 2.3 p< 0.01), higher maximum SOFA (10.04 + 4.6 vs 3.68 + 3.5 P<0.0001) and delta non renal SOFA (3.59 + 3.7 vs 1.12 + 2.2 P<0/001). On multivariate analysis delta non renal SOFA (OR 1.22) and ICU stay of > 7 days (OR 1.47) were the only significant predictors of development of AKI. Age and premorbid illness were not associated with AKI. Of 197 patients 55 (27.9%) died, in non survivors ICU stay (10.6+10.5 vs 5.8+5.6 p<0.01), baseline APACHE (15.1+7.2 vs 8.8 +7.9 p<0.01), baseline SOFA (4.7+2.7 vs 2.4+2.1 p<0.01), maximum SOFA (10.7 + 4.8 vs 3.2 + 2.9 P<0.01)delta SOFA (5.96 +

3.88 vs 0.8 + 1.5 p<0.01), delta non renal SOFA (4.9 + 3.2 vs 0.48 + 1.27 p<0.01) and maximum creatinine (4.8 + 2.9 vs 1.2 + 0.9 mg/dl p<0.01) were significantly higher than survivors. Baseline total SOFA (OR 1.44) and delta non renal SOFA (OR 2.31) were independent significant predictors of mortality while AKI was not an independent predictor. To conclude development of AKI does not contribute to the mortality in ICU patients. Baseline SOFA and the development of organ dysfunction other than kidney during the ICU stay contribute to the mortality.

57. The Usefulness of AKIN Criteria Predict Long Term Outcome of Hospital-Acquired Acute Kidney Injury

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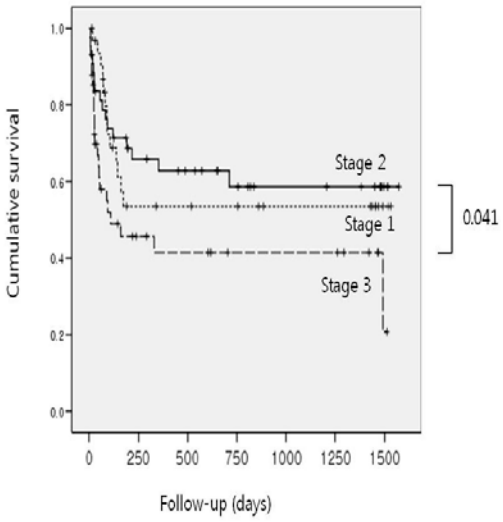
Background and Aims: Assessment of short-term outcome in hospital-acquired acute kidney injury (AKI) may underestimate the true burden of disease. It is important to focus to on long term survival. We investigate the long term outcome of hospital acquired AKI according to the Acute Kidney Injury Network Criteria stages.

Methods: This is a prospective, observational, single center study. All hospital acquired AKI patients were included. We monitored serum creatinine everyday for all patients using a hospital data survey system during the study period from Sep. 27 to Aug. 28.

Results: Among patients with AKI, 29.2 % were stage 1, 36.5% were in stage 2 and 34.4% were in stage 3. Median follow up days is 161 days (34-811). The long term mortality including hospital mortality was 45%. Cumulative mortality for patients with stage 3 was significantly higher than stage 2 (p<.41) (figure 1).

Conclusion: AKIN criteria is useful to predict long term outcome of hospital acquired AKI.



58. The Impact of Mitochondrial DNA Haplogroups on the Mechanical Ventilation Weaning of Critically Ill Patients

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Objective: To determine whether the main mitochondrial DNA (mtDNA) haplogroups of the Han people are associated with the weaning from mechanical ventilation of critically ill patients. Material and method: We prospectively studied 128 individuals

who were sequentially admitted to the intensive care unit. We used weaning of mechanical ventilation during the 28-day period as the endpoints. The follow-up of patients were performed until when the patient weaned from mechanical ventilation for the first time or the patient died during the 28-day period. After clinical data were obtained, the patients were underwent mtDNA haplotyping. We determined the mtDNA haplpgroups by comprehensive analyzing to the sequences of mtDNA hypervariable segment Ⅰ(HVS Ⅰ) and haplotyping specific polymorphisms in the mtDNA coding region. Results: Auunivariate analysis indicated that weaning individuals were significantly different from non-weaning ones from some demographic and clinical characteristics, including younger age, lower APACHE Ⅱ and SOFA score, less likely to have chronic ill health. On admission to intensive care unit, the frequency of the main subhaplogroups of Han population in the study cohort did not differ significantly from the control group. Kaplan-Meier analysis showed significantly higher mechanical ventilation weaning rate over 28 days in patients with mtDNA haplogroup R than those without the haplogroup (p=0.042). Binary logistic regression analysis indicated mtDNA haplogroup R was an independent predictor of mechanical ventilation weaning, cofferring 4.038-fold (p=0.007) increased chance of mechanical ventilation weaning at 28 days compared with those without the haplogroup. Conclusion: In Han population, mtDNA haplogroup R was an independent predictor for the weaning from mechanical ventilation of critically ill patients, conferring increased chance of weaning rate compared with individuals without the haplogroup.

TECHNIQUE CHARACTERISTICS

59. A Comparison of Filter Patency in CVVHD vs pre–dilutional CVVH in High Blood Flow CRRT Systems

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Background: It is unknown if pre-filter replacement fluids decrease clotting versus diffusive therapies due to hemodilution effect in high blood flow continuous renal replacement (CRRT) era. National shortages of calcium injectables forced us to abandon regional citrate anticoagulation for CRRT. We wanted to determine if predilution continuous venovenous hemofiltration (CVVH) offered an advantage over continuous venovenous hemodialysis (CVVHD) for filter patency.
Methods- We gathered data pertaining to all patients who received CRRT without any anticoagulation in the last 8 months. We compared filter life in the 2 groups – CVVH with pre dilution replacement fluid (group 1) vs CVVHD (group 2). All patients were run on the NxStage system one with a blood flow of 25 ml/min. 2 ml saline flushes were administered hourly to evaluate for filter patency. In group one, replacement fluids were started at 3 liters/hr and adjusted clinically. In group 2, dialysate was run at 25 ml/kg/hr and adjusted

clinically.
Results- We studied 255 CRRT systems in 69 patients. There were 43 males, 26 females and average age was 57 ± 12 yrs. Average filter life for group 1 was 18.7 ± 13.7 hrs and for group 2 it was 25. ± 15.4hrs (p-value adjusted for clustering = .4). We then analyzed those with reported clotting as reason for system discontinuation (n=15) and noted a significant difference in filter patency. Average filter life for group 1 was14.3± 9.5 hrs and for group 2 it was 18.7 ± 1.5 hrs. (p-value adjusted for clustering = .1). **Conclusion**: Contrary to conventional teaching, our results show that average filter life was longer in those patients on CVVHD as compared to pre-dilution CVVH. We conclude that Pre filter CVVH may be associated with more clotting as compared to CVVHD and while choosing a system for a patient with a contraindication for anticoagulation this factor should be taken into consideration.

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60. Saturation Coefficient Estimate of Peramivir in a Patient Receiving Continuous Veno-Venous Hemodiafiltration

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Purpose: To estimate the saturation coefficient of peramivir in a patient receiving continuous veno-venous hemodiafiltration (CVVHDF) during the Fall of 29. Peramivir is a potent neuraminidase inhibitor having activity against various influenza A and B subtypes. The main route of elimination is the kidney and a dose reduction is justified when the creatinine clearance is < 5 ml/min. Information from the manufacturer regarding dosing during continuous renal replacement therapy (CRRT) did not exist at the time of this analysis. A 29-year-old female with a history of flu like symptoms presented to a local emergency department. To manage volume and provide extracorporeal renal support CVVHDF was initiated. An infectious disease consult was obtained to evaluate the patient for emergency use peramivir and assist in the management of Streptococcus pneumoniae pneumonia and bacteremia. An initial peramivir dose of 6 mg followed by 48 mg every 24-hours was administered intravenously. This dose was derived based on current CRRT settings and an estimated saturation coefficient (SA) of **Methods**: CVVHDF was performed using a Prisma pump and an AN69 filter. During peramivir sampling, blood flow was maintained at 1 ml/minute with a dialysate flow rate of 16.7 ml/minute and a convective rate, using pre-filter solution, of 8.3 ml/minute, respectively. The mean total ultrafiltrate produced during sampling was 14.2 ml/minute. To calculate a saturation coefficient (SA), sampling of blood and effluent were conducted. Pre- and post-filter as well as an effluent sample were obtained 4- and 8-hours following the third dose of 48 mg. **Results:** Using an estimated SA of 1, a dose of 48 mg (following a 6 mg load) was given every 24-hours. Serum levels were obtained as described and analyzed. A linear decrease was observed over a 24-hour period (graph)

suggesting significant extracorporeal clearance. The calculated SA was .98, similar to the estimated SA of 1.
Conclusion: A calculated SA of .98 suggests peramivir was effectively removed by CVVHDF. Based on measured serum concentrations, a peramivir loading dose of 6 mg followed by 48 mg daily should provide therapeutic levels.

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61. A Retrospctive Review of Transfusion Reduction and Cost Savings Using the Circuit to Circuit Exchange Technique in Blood Primed CRRT Circuits.

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Background: The circuit-to-circuit exchange technique for Continuous Renal Replacement Therapy (CRRT) was developed at Helen Devos Children's Hospital as a means to minimize blood transfusions associated with circuit priming in children less than 15 kg. This procedure involves blood priming of the initial hemofiltration circuit using donor red blood cells (RBC). Subsequent circuits are then primed with a transfer of the patient's own blood from the old circuit to a new saline primed circuit thus avoiding additional transfusion exposure. Limiting blood exposure may benefit the patient by reducing the risk of adverse effects associated with transfusions. In addition, the cost savings associated with decreased blood utilization could impact total health care delivery costs.
Methods: A three-year, retrospective chart review of ten children less than 15 Kg requiring circuit blood priming while receiving CRRT was conducted. Patient age, weight, patient survival, days on CRRT, number of circuits used (blood prime and circuit exchange), circuit priming volume, and volume of RBC transfused during the CRRT course was collected. The cost savings associated with transfusion reduction was calculated. Total per unit cost of RBC transfusion (direct and indirect costs) is estimated to be $761 US dollars as determined by the activity-based cost (ABC) model by Shander.
Results: Ten children were identified during the study period. The mean transfusion reduction associated with the circuit exchange technique was 9.3ml/kg/day (± 9.6) of CRRT; with a corresponding savings of $254 US dollars (± 196) per CRRT day. No statistically significant differences in transfusion volume, days on CRRT, or number of circuits used could be shown between survivors and non-survivors, possibly due to the small sample size.
Conclusions: The cost of blood and concern's over transfusion related complications have generated increased interest in ways to decrease blood usage. The circuit exchange technique saved on average two units of RBC transfusion per CRRT course in these patients. This is an effective way to reduce blood transfusions thus potentially improving patient outcomes and health care costs.

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62. Treatment of hyperlipidemia in resistant nephrotic syndrome: the effect of combined therapy using double filtration plasmapheresis and oral statins

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Objective: by a case-controlled design, to compare the effects of treatment on hyperlipidemia in resistant nephrotic syndrome by combined therapy using double filtration plasmapheresis(DFPP) and oral statins or oral statins only. Methods: Eight inpatients were enrolled and received 1 session of DFPP for severe hyperlipidemia due to resistant nephrotic syndrome(NS). Oral Atorvastatin(2mg/d) were continuously given to these patients 1 week prior to start of DFPP until the end of followup(Combination group). In the same period 12 outpatients with severe hyperlididemia due to resistant NS were enrolled to take oral Atorvastatin (2mg/d)(statins group). In addition to treatment of hyperlipidemia, standard cares for primary renal disease were also given to all patients. For 1-month follow-up period, the changes of plasma concentration of lipids and albumin as well as urinary proteins were monitored. **Results:** There were no significant changes of serum albumin concentration and urinary proteins after 1 month in both groups. In the combination group, baseline values for serum albumin, total cholesterol, triglycerides, LDL-C and fibrogen were 18.7±5.g/L, 15.2±7.4 mmol/L, 5.5±5.21mmol/L, 9.±4.2mmol/L and 426±5mg/L, respectively. The reduction rate after single session of DFPP for these parameters were -11.3±13.4, 85.8±7.2, 8.1±6.2, 86.9±11.4, and 54.7±14.3%, respectively. At 2 weeks and 4 weeks after DFPP, the concentrations of plasma total cholesterol were as 41.8±13.4% and 7.2±21.% of baseline, while the concentration of triglycerides were as 68.6±45.5% and 125.8±48.8% of baseline. In the statins group, the baseline value of plasma albumin, total cholesterol and triglycerides were 23.6±3.9g/L, 15.4±5.mmol/L and 5.2±3.3mmol/L, respectively. At 2 weeks and 4 weeks follow-up, the concentrations of plasma total cholesterol were as 81.2±21.1% and 81.±16.7% of baseline, while the concentration of triglycerides were as 85.3±43.1% and 18.4±55.6% of baseline. The difference of plasma total cholesterol levels between two groups at the 2 weeks follow-up was significant (P<.1). **Conclusion**: Oral statins solely had slight effect on the hyperlipidemia of patients with resistant nephrotic syndrome, while combination therapy using DFPP and oral statins may more effective in treatment the hyperlipidemia in these patients.

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63. BUN/Cr Change Ratio (BUN/Cr CR) As A New Delta Check Strategy For Dialysis Sample

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Background: To detect mislabeled sample, clinical laboratory use delta check which compares current and previous test results. But in general, dialysis samples show much difference between pre- and post-dialysis. So delta check doesn't have much clinical value considering its required effort. In this

study, we suggest BUN/Cr change ratio (BUN/Cr CR) as a new delta check strategy for dialysis cases and tried to investigate its usefulness. **Methods:** BUN/Cr CR is defined as (BUN/Cr ratio before dialysis)/(BUN/Cr ratio after dialysis). From May to Jun 211, We collected 174 test results (BUN, Creatinine, Na, K, Cl, Total CO2, P, Total Ca) from dialysis patients, which are routinely acquired for before and after dialysis. Using collected data, we simulated sample change and calculated detection rate. **Results:** In unchanged sample set, all sample showed positive results in current delta check system. And for BUN/Cr CR, minimum was 1.3, maximum was 2.27, mean 1.28 and SD .14. In changed sample set, minimum was .41, maximum was 4.37, mean was 1.35 and SD was .55. When define normal BUN/Cr CR as between 1.1 and 1.6, only seven sample (4.%) showed abnormal in unchanged samples, while 91 (52.3%) showed abnormal in changed samples. **Conclusions**: BUN/Cr RR could detect sample change in high probability and could reduce clinically irrelevent result compared with current delta check system. But to implement this method, aid of sophisticated laboratory information system would be required.

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64. Sustained Low Efficiency Dialysis (SLED) in India: A More Practical Alternative to CRRT

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Background: Sustained Low Efficiency Dialysis (SLED) has in recent years emerged as a viable alternative to Continuous Renal Replacement Therapy (CRRT) in renal failure associated with septic shock and/or cardiac failure. The aim of our study was to compare SLED with CRRT in terms of solute removal, complications, and cost. **Methods:** Ours was a retrospective study comparing 52 patients who received CRRT for 27 days with 4 patients who received SLED (282 treatment sessions) between Jan 29 and November 211. All 92 patients had clinical shock and ARF. SLED was delivered as 6 hours of HD 6 days a week with blood flow of 15 ml/hour, dialysate flow of 35 ml/min, hemofiltration with 1 L saline/hour, with heparin or saline flushes. CRRT patients received heparin as anticoagulation. **Results:** Compared with CRRT, SLED proved to be cheaper, safer and a more efficacious modality of renal replacement therapy for patients with shock and /or cardiac failure. The cost of SLED per session was approximately 1/4th (Rs.1, /- vs Rs 4,/-) that of a day of CRRT. 75 % of SLED patients received heparin-free dialysis; filter clotting occurred in 1 % of heparin treatments and 36 % of heparin-free treatments. The time averaged serum creatinine was lower in SLED. Weekly Kt/V was significantly higher in SLED (8 ± 2), although equivalent renal clearance was similar to that of CRRT. 2 % of patients on CRRT had bleeding compared with 4 % of patients on SLED.
In summary, SLED is a viable, efficacious, resource-sparing alternative to CRRT in the Indian ICU setting.

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65. A comparison of estimated Creatinine clearance and measured glomerular filtration rate (Tc99mDTPA clearance) in Indians

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Background: The aim of this study was to compare measured glomerular filtration rate (GFR) with estimates of GFR derived from various estimated creatinine clearance methods of Jelliffe, Cockcroft and Gault, and 4MDRD equations in Indian population.
Methods: We enrolled 8 patients in the study. GFR was determined by technetium-99m diethyl triamine penta-acetic acid (Tc99mDTPA) clearance . Height, body weight and serum creatinine were measured, and GFR and creatinine clearance (CrCl) estimates calculated by various equations. Spearemans correlation was used to assess relationships between measured GFR (Tc99mDTPA clearance) and estimated clearances using the three formulae. Difference between the measured GFR and estimated clearances compared with measured GFR were examined to determine whether prediction error was independent from measurement magnitude. Analyses of differences were used to determine bias and precision. Bias was assessed by mean %age error (MPE), calculated as the %age difference between the estimated clearances for each formula and measured GFR. A positive bias indicates overestimation of GFR, and a negative bias indicates underestimation. Relationships were also assessed by gender and varying levels of renal function: GFR <6 ml / min, and GFR >6 ml/ min.
Results : The mean measured GFR was 77.2 ml / min (range 17 to 152 ml / min). The mean bias (mean %age error) was -4.9, -1.3 and -1.57% respectively for the, Jelliffe , Cockcroft and Gault, and 4MDRD formulas, respectively. The 4 MDRD formula overestimates the GFR in patients having GFR less than 6ml/ min, where as underestimates for GFR more than 6ml / min. **Conclusions**: 4 MDRD equation seems to be best for estimating GFR in Indian population.

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66. First Intention Continuous Veno-venous Hemodiafiltration in Young Children With Hemolytic and Uremic Syndrome.

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Background and objectives: Hemolytic and uremic syndrome (HUS) can lead to acute kidney injury requiring renal replacement therapy. Usual recommendations favour peritoneal dialysis (PD) in first intention for young children (without contra indication). We report a series of young patients with HUS treated with continuous veno-venous hemodiafiltration (CVVHDF) in first intention despite the lack of contra indications for PD.
Methods: Prospective study of consecutive cases of young children with typical HUS treated with CVVHDF in first intention in a single paediatric intensive care unit (PICU) in 211.
Results: Five children aged 66, 24, 18, 17 and 13 months and weighing 23., 9.7, 11.9, 11.8 and 9.2 kg, respectively, were included. Vascular access was in the right internal jugular vein in 4 and in the right sub-clavian vein in 1 patient. Catheters used were double- lumen 8.5

Fr diameter. Anticoagulation was achieved with heparin. CVVHDF durations were 8, 3, 6, 2 and 5 days. No hemodynamic or technical issue occurred during the CVVHDF courses. Normalization of electrolyte balance was reached within the first 24 hours of CVVHDF. Four children received red cells transfusion and 1 received platelets transfusion. Patients were discharged after 1, 4, 7, 5, 7 days in PICU. One patient was readmitted for plasma exchange therapy. One patient had 4 courses of intermittent hemodialysis after PICU discharge. **Conclusion:** Recent technological progress has made CVVHDF safer and more reliable in young children. It allows a tighter control of fluid and electrolyte balances in the first hours of treatment without hemodynamic impairment. Vascular access can be used for intermittent dialysis and/or plasma exchange therapy. Even in the absence of contra indication for PD, first intention CVVHDF for young children with HUS is feasible and showed no major safety issue in this small case series.

67. Post Filter Ionized Calcium Levels With Dilute Regional Citrate Anticoagulation: Do We Need To Follow Them?

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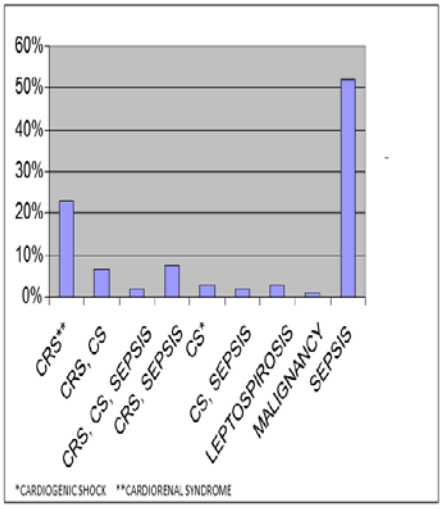
Background: Although regional citrate anticoagulation (RCA) with continuous venovenous hemodiafiltration (CVVHDF) has been shown to be safe and effective, it requires intensive monitoring of ionized calcium (iCa) levels every 6 hours from the patient as well as the circuit. At the University of Alabama at Birmingham (UAB), CVVHDF is performed with a .5% dilute citrate solution that serves as both an anticoagulant and replacement fluid (RF). Post filter iCa levels are checked every 6 hours and citrate adjusted to maintain a post filter iCa level of < .5 mmol/L. The purpose of this study was to determine if measuring post filter iCa levels every 6 hours are necessary with the typical citrate RF and blood flow rate ranges used at UAB. **Methods**: This is a prospective analysis of post filter iCa levels in 1 critically ill patients using pre-dilution CVVHDF. Post filter iCa levels were checked at varying combinations of citrate RF ranges of 15 to 25 ml/hr, dialysate ranges of 15 to 25 ml/hr, and blood flow rate ranges of 15 to 2 ml/min. Patient demographics, electrolytes, as well as dialysate parameters were reviewed. **Results**: Post filter iCa levels remained <.5 mmol/L for all 1 patients with the various combinations of blood citrate RF, dialysate, and blood flow rates. See Tables 1 and 2.



Conclusions: There appears to be limited clinical benefit to follow post

filter iCa every 6 hours when using the UAB .5% dilute RCA protocol for CVVHDF. Unless a patient has clotting problems on CVVHDF, we recommend post filter iCa can perhaps be changed from every 6 hours to once a day reducing not only complexity of citrate use with CRRT but also decreasing labor and cost.

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68. Heparin Anticoagulation in Powdered Sorbent Pheresis in Septic ICU patients

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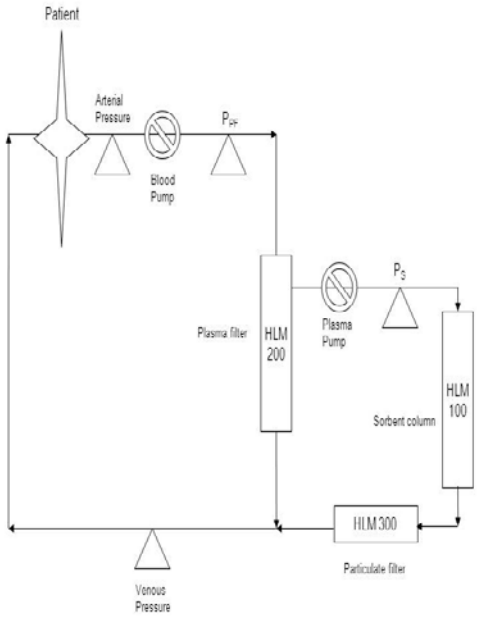
Introduction: Severe sepsis is associated with very high mortality. The Intermittent Modular Plasma Adsorption of Cytokines and Toxins (IMPACT) (Hemolife Medical Inc) system was used in these patients. We hypothesized that an attenuated anticoagulation protocol does not increase bleeding yet achieves prescribed treatment time. Method: IMPACT is based on coupled plasma-filtration adsorption methodology with three chemically distinct non-ionic, powered sorbents. Intermittent 4 h treatment sessions were instituted. Systemic anticoagulation was with unfractionated heparin following heparin-saline prime. Results: A total of 5 patients (M:F=4:1; age 67±7; and, APACHE II score 25±4) were prospectively treated with 17 sessions of IMPACT. Duration of ICU stay was 16±7 days. Circuit pressures pre- versus post-IMPACT (mmHg): arterial pressure (AP)-52±7 vs. -53±11, p=.778; venous pressure (VP) 44±9 vs. 48±16, p=.342; pre-sorbent column plasma pressure (PS) 92±8 vs. 133±78, p=.37; and pre-plasma filter circuit pressure (PPF) 45±11 vs. 63±25, p=.12. Operating conditions were: pumped blood flow rate QB 125±7 ml/min; plasma flow rate QP 2±9 ml/min; and, total heparin administered was 2515±1481 IU per treatment. One circuit spontaneously clotted during treatment. IMPACT treatment time was 237±25 minutes per session. Anticoagulation intensity pre- vs. post-IMPACT was: ACT (s) 189±2 vs. 238±98 (target 25 s), p=.61, activated partial thromboplastin time (aPTT) 65±57 vs. 12±63 s, p=.44, and platelet count (x19/µL) 25±92 vs. 139±71, p=.18. Overall, serum creatinine was 255±132 µmol/L. There were no major bleeding episodes requiring invasive hemostasis. Conclusion: Reduced systemic heparin anticoagulation during IMPACT did not increase bleeding but was associated with a significant rise in plasma filter and sorbent column plasma pressures. Prescribed treatment time was nevertheless still achieved.



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69. Plasma and Tissue Pharmacokinetics of Meropenem in Critically Ill patients on Continuous Renal Replacement Therapy

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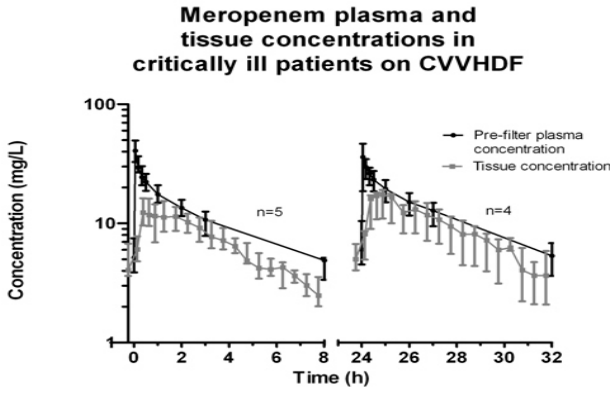
Background: For carbapenems, a minimum time above MIC (T>MIC) of 4% or preferably 1% of the dosing interval is required to ensure maximal antibiotic efficacy. This study examined the plasma and tissue pharmacokinetics of meropenem in critically ill patients undergoing continuous veno-venous haemodiafiltration (CVVHDF).
Methods: This was a prospective pharmacokinetic study in 5 critically ill patients on CVVHDF. CVVHDF was performed as a 2-3 L/h exchange using a polyacrylonitrile filter with a surface area of 1.5 m2 and a blood flow rate of 2 mL/min. Meropenem 5 mg was administered 8-hourly as an IV bolus infusion over 3 minutes. Serial blood samples (pre- and post-filter) and filtrate/dialysate samples were collected for analysis. Tissue concentrations were also measured using microdialysis. Meropenem concentrations were measured using a validated assay method. Pharmacokinetic analysis was conducted using a non-compartmental approach. **Results**: Three males and two females were enrolled with a median age of 63 (inter-quartile range 48-63) years and weight 1 (68-12) kg. Four of the five patients were sampled on two occasions (Profile A and B). The pharmacokinetic parameters for meropenem are reported in the Table. The concentration-time profile of meropenem in plasma and tissues is presented in the Figure below. %age T>MIC during the dosing interval was calculated to be 1% for MICs of 2 and 4 mg/L and 64% for MIC of 8 mg/L.
Conclusion: Based on our plasma and tissue pharmacokinetic data, meropenem 5 mg 8-hourly dosing appears appropriate using our dialysis settings.

Pharmacokinetic parameter	Profile A Median (IQR)	Profile B Median (IQR)
Peak plasma concentration (mg/L)	4.74 (36.56-45.56)	35.96 (27.49-44.93)
Trough plasma concentration (mg/L)	4.89 (3.48-4.99)	5.35 (4.16-6.46)
Plasma elimination half life (h)	3.71 (3.29-4.1)	3.75 (3.6-4.15)
Volume of distribution (L/kg)	.26 (.17-.35)	.25 (.23-.29)
Total clearance (L/h)	4.12 (4.11-4.79)	3.81 (3.16-4.75)
CVVHDF clearance (L/h)	2.91 (2.73-3.12)	2.8 (2.31-3.33)
Peak tissue concentration (mg/L)	13.6 (11.97-16.84)	18.3 (15.88-18.68)
Trough tissue concentration (mg/L)	2.59 (2.38-3.36)	3.66 (2.57-4.96)
AUC tissue: AUC plasma	.63 (.6-.69)	.69 (.64-.74)



70. Direct visualization of cortical peritubular capillary flow affected by Carbon Dioxide–induced pneumoperitoneum using intravital microscopy

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Aim: To examine the direct renal hemodynamics during carbon dioxide pneumo-peritoneum (CDP)in both human and porcine models using magnifying endoscopy (Hattori R, Yamamoto T, et al Transplantation 25). Laparoscopic living donor nephrectomy has become widespread because of its minimally invasive nature. However, it has been clear that the renal hemodynamics and function are affected during CDP. **Methods:** The erythrocyte velocity in the cortical peritubular capillary (CPC) was monitored and measured during laparoscopic nephrectomy on human donors and laparoscopic partial nephrectomy on humans with renal cell carcinoma during CDP(pressure of 8, 12, 15, 18, and 2 mm Hg). We used a direct imaging system of renal microcirculation by magnifying endoscopy, as previously described. We maintained the same pressure for 5 minutes. In the porcine model (6 pigs), we measured the erythrocyte velocity in the CPC using the same method during CDP (pressure of , 5, 1, 15, 2, and 25 mm Hg). The erythrocyte velocity in the renal artery did not change during increased CDP. When the pneumo-peritoneal pressure was 25 mm Hg, we found that >9% of the erythrocyte velocity in the CPC was non flowing. In the human model, the erythrocyte velocity in the CPC decreased when the CDP pressure was 12 mm Hg. We compared renal function(MAG-3) after Open surgry without CDP to Laparoscopic surgery with CPD in partial nephrectomy.
Results :The erythrocyte velocity in the CPC decreased during CDP in all kidneys in both the human and the porcine models. However, erythrocyte velocity in the renal artery did not change during carbon dioxide pneumo-peritoneum. After stopping the pneumo-peritoneum, the erythrocyte velocity in the CPC recovered immediately. Laparoscopically treated patients maintained significantly higher renal function. **Conclusion:**The findings of our study have shown that the suitable carbon dioxide pneumo-peritoneal pressure for renal micro-circulation is >8 mm Hg for laparoscopic surgery. CDP may protect renal function.

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71. Regonal Citrate Plus Low Dose Of Low Molecular Weight Heparins:A Safe And More Efficacy Anticoagulation Protocol For Continuous Veno - Venous Hemofiltration

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Objective: to compare the safety and efficacy of three different anticoagulation methods for continuous veno-venuous hemofiltration(CVVH). Methods: Between November 21 and September 211, 57 critically ill patients in Jinling Hospital requiring CVVH without anticoagulation contraindications were enrolled and randomized to 3 groups adopting different anticoagulation protocols as following: regional citrate anticoagulation in group A, systemic

LMWH in group B (loading dose of LMWH 4IU/kg, maintenance dose 4IU/kg/hr), and regional citrate plus low dose of LMWH in group C(loading dose 2IU/kg, maintenance dose 2IU/kg/hr). The filter survival time, the change of hemoglobin (Hb), platelet counts (PLT), and anticoagulation-related side effects were measured. **Results:** Fifty-three patients completed the study and entered into data analysis, 15 in group A, 19 in group B and C. The mean APACHEII scores in each group were 16.2 ± 3.65, 17.11 ± 3.5 and 17.1 ± 4.79, respectively (P>.5). There were no significant differences in age, gender, weight, baseline values of Hb, PLT, prothrombin time, activated partial thromboplastin time, blood pH, and bicarbonate concentration between 3 groups. The filter survival time were 21.22 ± 3.48h in group A, 25.1 ± 5.5 h in group B, and 4.35 ± 7.8h in group C (p <.1). There were 3 patients in each group of A (2%) and B (15.8%) switching to the anticoagulation protocol of group C due to filter life span less than 8 hours, 4 patients in group B(21%) switching to group C due to bleeding, 3 patients in group A(2%) and 4 patients in group C(21.1%) switching to group B due to citrate related complications. The %age of patients with reduction of Hb levels more than 3% were 2% in group A, 15.7% in group B and 15.7% in group C(P>.5). The %age of patients with reduction of platelet counts more than 3% were 2% in group A, 31.6% in group B, and 15.7% in group C(P>.5). The mortality rate was 4% in group A, 26.3% in group B and 36.8% in group C, respectively (P>.5). There were no differences in the CVVH duration, hospital days and ICU days between 3 groups. **Conclusion**: compared with anticoagulation using only regional citrate or LMWH, regional citrate plus low dose of LMWH protocol is more efficacy in prolonging filter life span, without significant increase of anticoagulation-related complications.

RRT RESEARCH

72. Continuous Venovenous Hemodialysis (CVVHD) Effluent Imipenem Levels Predict Plasma Free Imipenem Levels

Seth R Bauer, Milen Amde, Michael J Connor, Charbel A Salem, William H Fissell
Cleveland Clinic, Emory University

Background: Pharmacokinetic and pharmacodynamic studies typically require time-intensive sampling strategies that may exceed clinician and or Institutional Review Board comfort levels with blood loss due to phlebotomy. These concerns are heightened in the critical care environment. CVVHD effluent is typically well equilibrated with plasma, and most antibiotics in common use in the ICU are small molecules, suggesting that effluent drug levels might predict free plasma levels. We conducted an IRB-approved prospective observational study comparing antibiotic levels in CVVHD effluent with those in plasma. Here, we present data from 17 patients treated with concomitant CVVHD and imipenem. Methods: Inclusion: Adult patients with acute or chronic renal failure who were receiving CVVHD in the ICU. Exclusion: ESLD, pregnancy. Patient data: age, gender, current and admission weight, CVVHD doses were recorded on case report forms (CRFs). Sampling: After the fourth dose of antibiotic during uninterrupted CVVHD, trough, 3 minute post infusion peak, and

second trough blood and effluent samples were drawn and immediately stored on ice. Drug analysis: Free and effluent imipenem levels were measured by RP-HPLC in the lab of one of the investigators (WHF). Effluent and free plasma imipenem levels were compared using a multivariate linear regression. Results: Complete data was available from 17 subjects dialyzed with the NxStage Express (n=6) or Gambro Prismaflex (n=11). Plasma total imipenem levels were not measurable using our HPLC assay, but plasma free drug and effluent drug levels were measured in 51 paired samples. Effluent levels predicted plasma free drug levels in a CRRT-dose dependent manner. Effluent overestimated plasma in one sample. Discussion: Imipenem analysis in CRRT effluent may provide a blood-sparing technique for pharmacokinetic and pharmacodynamic studies. More study is needed to determine the best use of this technique.

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73. Perfluorocarbon Protects Kidney Tubular Epithelial Cells By Septic Plasma-Induced Apoptosis And Promotes CD133+ Renal Progenitor Cell Differentiation: Relevance For Bioartificial Renal Assist Devices

Vincenzo Cantaluppi, Davide Medica, Alessandro D Quercia, Federico Figliolini, Sergio Dellepiane, Gennaro Iavarone, Giovanni Abagnale, Giuseppe P Segoloni, Giovanni Camussi
University of Turin, San Giovanni Battista Molinette Hospital

Extracorporeal blood purification techniques including renal assist devices (RAD) with viable renal tubular epithelial cells (TEC) have been proposed for the treatment of sepsis-associated acute kidney injury (AKI). We previously demonstrated that plasma derived from septic patients induce a direct injury and pro-apoptotic effect on cultured human TEC. Perfluorocarbon (PFC) molecules are oxygen carriers used for organ preservation before transplantation. The aim of this study was to evaluate the effect of PFC on septic plasma-induced TEC injury and on renal CD133+ stem cell differentiation. TEC and CD133+ renal progenitors were isolated by cell sorting. Plasma was drawn by 1 patients with sepsis and AKI (RIFLE criteria). TEC were incubated with patients' plasma in presence or absence of PFC evaluating: cytotoxicity (XTT assay), apoptosis (TUNEL assay, ELISA for caspase-3, -8, -9), cell polarity (trans-epithelial electrical resistance, TER) and albumin uptake. Moreover, we studied the effect of PFC on proliferation (BrdU assay) and differentiation of CD133+ renal progenitor cells. Septic plasma induced: 1) a cytotoxic and pro-apoptotic effect on TEC through the activation of the death receptor as well as of the mitochondrial apoptotic pathways; 2) the alteration of cell polarity (TER) and albumin uptake; 3) the down-regulation of the tight junction protein ZO-1 and of the endocytic receptor megalin. All the detrimental effects induced by septic plasma on TEC were significantly reduced in presence of PFC. In addition, PFC induced CD133+ progenitor cell proliferation and differentiation toward an epithelial phenotype (increase of TER and expression of markers of fully differentiated TEC such as E-cadherin, ZO-1, megalin, alkaline phosphatase, aminopeptidase-A, aquaporin-1 and NGAL). C**onclusion:** PFC protects TEC from septic plasma-induced injury and provides an appropriated oxygen tension to promote CD133+ stem cell

differentiation toward a tubular epithelial cell phenotype. The results of the present study suggest a potential role of PFC in the improvement of RAD therapy and in the treatment of ischemic and sepsis-associated AKI.

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74. A Multiscale Model of Citrate Dynamics during Citrate Regional Anticoagulation for CRRT

Steven A Conrad
Louisiana State University Health Sciences Center in Shreveport, LA,

Regional anticoagulation with citrate provides effective anticoagulation during CRRT. Metabolic alkalosis and citrate accumulation are known but incompletely characterized complications. A mathematical model of citrate and bicarbonate transport during CRRT would permit investigation of the interaction of factors contributing to this problem. Multiscale models combine mathematical modeling approaches that are based on vastly different physical scales. A multiscale model was developed which incorporates a finite element model of solute handling in hollow fibers (microliter scale) with a dynamic compartment model of solute distribution in extracellular fluid (liter scale). This model can simultaneously simulate the transport of citrate and bicarbonate in a hollow fiber dialyzer during therapy as well as the accumulation, metabolism and elimination of citrate in body compartments. The finite element component is based on a partial differential equation model previously presented at this forum (CRRT, 22), by extending it from single solute transport (urea) to both citrate and bicarbonate. The model includes both momentum transport (blood and dialysate flows) and mass transport (solute). The influence of protein concentration, osmotic forces, hematocrit and the Fåhræus-Lindqvist effect on fluid flux have also been added to the previous model. The dynamic compartment model is a single-compartment lumped parameter mass transport model of both citrate and bicarbonate. Model parameters include volume of distribution, extracorporeal blood flow and outlet concentrations, and reaction rate for citrate to bicarbonate conversion. The compartment model is linked to the finite element model through integration of solute flux from the hemofilter as a compartment input, and mixed concentration in the compartment as a finite element input. This multiscale approach enables the evaluation of a number of parameters that affect citrate handling leading to citrate accumulation and metabolic alkalosis: mode of support (SCUF, hemofiltration, hemodialysis, hemodiafiltration), extracorporeal blood flow, hemofiltration rate, dialysate flow rate and composition (bicarbonate- vs. saline-based), citrate infusion rate and concentration, and citrate metabolic elimination rate (normal vs. prolonged). As a dynamic model, it can simulate these parameters over time scales ranging from minutes to days, thereby suitable for evaluating operating parameters during continuous therapies.

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75. Pharmacokinetics of Imipenem in Continuous Venovenous Hemodialysis (CVVHD) are related to severity of illness and dialyzer type.

William H Fissell, Milen Amde, Seth R Bauer, Charbel A Salem, Michael J Connor
Cleveland Clinic, Emory University

Background: Sepsis is the leading cause

of death in acute renal failure, and early appropriate antimicrobial therapy is associated with improved survival. Dosing depends on estimation of pharmacokinetic (PK) parameters (volume of distribution and clearance). In an IRB-approved study, we prospectively measured imipenem levels in patients receiving CVVHD in the ICU. PK were compared to anthropomorphic data and CVVHD prescription. Methods: Inclusion: Adult patients with acute or chronic renal failure who were receiving CVVHD in the ICU. Exclusion: ESLD, pregnancy. Patient data including age, gender, current and admission weight, and CVVHD dose were recorded on case report forms (CRFs). Sampling: After the fourth dose of antibiotic during uninterrupted CRRT, trough, 3 minute post infusion peak, and second trough blood and effluent samples were drawn and immediately stored on ice. Drug analysis: Free and effluent imipenem levels were measured by RP-HPLC in the lab of one of the investigators (WHF). Data analysis: Imipenem levels and data from CRFs were entered into a spreadsheet for PK calculations. Statistical testing was performed using JMP 9 for Windows. Parameters with a p value less than .3 in univariate analyses were included in multivariate linear regression analyses. Results: Complete data was available from 17 subjects dialyzed with the NxStage Express (n=6) or Gambro Prismaflex (n=11). Volume of distribution (39.9 +/- 9.6L; .35 +/- .11 L/kg) was greater than previously reported for healthy subjects. Clearance (total 14 +/- 26 ml/min; extracorporeal 38. +/- 85 ml/min) was similar to that previously reported for healthy subject. Univariate analyses suggested a relationship between filter type and volume of distribution, which was confirmed in a multivariate model (p=.22). Total clearance was predicted by CVVHD dose (p =.22), but not by age, gender or severity score. Discussion: Imipenem is a broad-spectrum beta-lactam that is bacteriocidal in a time-dependent fashion. The large volume of distribution noted in this critically ill population suggests that patients may be at risk for underdosing, and the potential role of drug binding to the dialyzer is intriguing. The relationship between CVVHD dose and total clearance is expected. The total clearance of unbound drug was similar to healthy subjects, suggesting that dose-adjustment may not be as necessary in this population as previously thought. More research is needed.

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76. The Relationship Between Thyroid Hormone And Corrected QT Interval And QT Dispersion in Non-diabetic Hemodialysis Patients

Hyung-Jong Kim, Dong Ho Yabg, Keuyng Mi Park
Bundang CHA Medical Center, CHA University

Purpose: Cardiovascular disease and sudden cardiac death are common in hemodialysis patients. These cardiac complications are often associated with prolong QTc interval (QTc) and QTc dispersion (QTcd). Also, subclinical hypothyroidism is associated with the risk of heart failure, other cardiovascular events and death. It was reported that subclinical hypothyroidism can alter autonomic modulation of heart rate and cause increased inhomogeneity of ventricular recovery times. The purpose of this study was to evaluate the relationship between thyroid hormone

and QTc, QTcd in non-diabetic hemodialysis patients. Method: We studied 29 hemodialysis patients (13 male and 16 female; mean age 54.6±14.72 years) without thyroid disease. The patients had a 12-lead ECG performed immediately after hemodialysis. The QT interval was manually measured from the onset of the QRS complex to the end of the T-wave. The blood sampling was performed before hemodialysis for the measurement of biochemical parameters, TSH, fT4, T3. The patients was divided to two groups according to QTc (group 1; QTc < 43ms, group 2; QTc ≥ 43ms). We examined the relationship between QTc, QTcd and thyroid hormone of two groups, respectively and compared the two groups. Results: The underlying renal diseases included hypertension (HTN) 55.2%, glomerulonephritis (GN) 2.7%, ADPKD 1.3%, unknown 13.7%. The mean of hemodialysis duration, Kt/V, nPCR, BMI was 63.72±42.78 months, 1.48±.2, .88±.22g/kg/d, 23.3±3.93kg/m2, respectively. In group 1, the means of homocysteine, TSH, T3, fT4 were 14.79±4.26umol/L, 2.5±2.52uIU/mL, 1.6±.2ng/mL, .96±.16ng/dL and in group 2, 18.47±3.84umol/L, 4.66±1.85uIU/mL, 1.9±.16ng/mL, .99±.83ng/dL. In group 1, QTc and QTcd were not significant correlation with TSH, T3, fT4. In group 2, QTc was significant positive correlation with TSH (p<.5) and QTcd was not significant correlation with thyroid hormone. There was no significant difference between two groups, except for homocysteine. Conclusion: It have been reported that prolonged QTc, QTcd and subclinical hypothyroidism are associated with cardiovascular disease and sudden cardiac death. The result of this study showed that TSH is associated with prolong QTc interval in non-diabetic hemodialysis patients. We suggest that subclinical hypothyroidism may be associated with prolong QTc and QTcd in non-diabetic hemodialysis patients.

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77. The "U-shaped" Association Between Temporal Timing Of Renal Replacement Therapy Initiation And In-hospital Mortality In Postoperative Acute Kidney Injury

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National Taiwan University Hospital, Taipei, Taiwan-

Introduction: Postoperative acute kidney injury (AKI) is associated with worse outcomes in surgical patients, but whether the temporal timing of renal replacement therapy (RRT) initiation affect patients' outcomes in postoperative AKI are not yet well understood. **Methods:** This multicentered, non-concurrent prospective study enrolled patients who underwent RRT in intensive care units (ICUs) for postoperative AKI between January, 22 and April, 29. The demographic data, comorbid diseases, types of surgery and RRT, and the indications for RRT of patients were documented. Patients were categorized into early (ED, ≦1 day), intermediate (ID, 2-3 days), and late dialysis (LD, ≧4 days) groups according to the period between ICUs admission and RRT initiation. The 18-day in-hospital mortality was taken as outcome. **Results**: Six hundreds sixteen adult patients (393 men, age 62.9±15.4 years) were enrolled, and 362 patients (58.8%) died within 18-day hospitalization. Both the probability of death and in-hospital mortality rates of the three groups

represented U-shaped curves. ED [hazard ratio (HR), 1.534] and LD (HR, 1.654) as compared with ID, age (HR, 1.7), diabetes (HR, 1.329), liver cirrhosis (HR, 1.596), initial central nervous system dysfunction (HR 1.319), sepsis (HR, 1.994), as well as pre-RRT mean arterial pressure (HR, .986), inotropic equivalent (HR, 1.8), and APACHE II scores (HR, 1.61) were identified as independent predictors for in-hospital mortality. Further, some factors were identified as predictors for entering either ED or LD groups. **Conclusion:** Current study found the "U-shaped" association between timing of RRT initiation and prognoses, and reminded physicians of paying more attention to patients with certain risk factors.

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78. The Affect Prescription and Absorption on Anti-epileptic Concentrations in Ex Vivo CRRT Model

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Background

Neuroscience ICU's utilize CRRT for indications such as AKI, sepsis, drug intoxications, volume overload, electrolyte control and ICP control. Many patients on CRRT require anti-convulsive medications. How CRRT prescriptions affect drug concentrations due to filtration or filter absorption is unknown. We tested four anticonvulsants in an ex vivo CRRT model to see how mode affects clearance and filter absorption. The sieving coefficients and filter absorption of these drugs were measured in two modes. Although sieving coefficients of many drugs are reported, the filter behavior by mode of CRRT and filter interaction is not largely **Methods :** Machine Setup
A Prismaflex® System configured in CVVHDF or CVVH using a Prismaflex® M15 AN-69 filter was used. Samples were obtained from two runs; in the first run the blood flow rate was set at 1 ml/min with a replacement rate of 2 L/hour and no dialysate (CVVH). On the second run, the blood flow rate was 1 ml/min, fluid replacement at 2 L/hour and dialysate at 1L/hr, thus delivering CVVHDF. Saline was used as the replacement and dialysate. Filter absorption and sieving co-efficient were calculated.
Medication Preparation
A saline/Anti-epileptic mixture was connected to the access line of the machine. The return line was connected to an effluent bag.
Drug Sampling & Drug Concentration
After initiating flow samples were drawn from three sites within the circuit; Pre-filter, Post-filter and the Ultra-filtrate. Phenobarbital, phenytoin and valproate concentrations were determined using a particle enhanced turbidimetric inhibition immunoassay technique.
The sieving coefficient, filter absorption and drug clearance were calculated for each run. **Results:** Phenytoin, levetiracetam and phenobarbital had high sieving coefficients with near complete drug filtration. Valproate had significant filter absorption with absorption of 56% and 37% respectively in CVVH and CVVHDF modes.
Conclusions: Phenytoin, phenobarbital, and levetiracetam had low absorption and high sieving coefficients. Valproate filter absorption was 56 % in CVVH and 37% in CVVHDF. Anti-convulsive drug levels should be monitored inn patients on CRRT. Many of these drugs are

protein bound; the effects of "free" drug concentration need further investigation.

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79. Mode and Dose of Continuous Renal Replacement Therapy (CRRT) Affect Estimation of Plasma Piperacillin Levels From CRRT Effluent.

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Background: Pharmacokinetic and pharmacodynamic studies typically require time-intensive sampling strategies that may exceed clinician and or Institutional Review Board comfort levels with blood loss due to phlebotomy. These concerns are heightened in the critical care environment. CRRT effluent is typically well equilibrated with plasma, and most antibiotics in common use in the ICU are small molecules, suggesting that effluent drug levels might predict plasma levels. We conducted an IRB-approved multicenter prospective observational study comparing antibiotic levels in CRRT effluent with those in plasma. Here, we present an analysis of factors affecting the predictive model between effluent and plasma free piperacillin levels. Methods: Inclusion: Adult patients with acute or chronic renal failure who were receiving CRRT in the ICU. Exclusion: pregnancy, ESLD. Patient data: age, gender, current and admission weight, and CRRT dose and mode were recorded on case report forms (CRFs). Sampling: After the fourth dose of antibiotic during uninterrupted CRRT, trough, 3 minute post infusion peak, and second trough blood and effluent samples were drawn and immediately stored on ice. Drug analysis: Total, free, and effluent piperacillin levels were measured by RP-HPLC in the lab of one of the investigators (WHF). Data analysis: Statistical testing was performed using JMP 9 for Windows. Parameters with a p value less than .3 in univariate analyses were included in multivariate linear regression analyses. Results: Effluent piperacillin levels, predilution replacement fluid rate, and effluent rate were strongly associated with plasma piperacillin level. Significant associations between center, mode (CVVHDF vs CVVHD) and piperacillin dosing interval (6 vs 8 vs 12 hours) were observed. The data for mode and piperacillin dosing interval (6 vs. 8 vs. 12 hours) were clustered by center. Effluent levels averaged 61 +/- 19% of plasma free levels in predilution CVVHDF, versus 96 +/- 37 % in CVVHD ($p < .1$). Discussion: As expected, effluent from predilution CVVHDF under predicted plasma levels. Confounding by a higher average CRRT dose in the CVVHDF group versus the CVVHD group may play a role, as simple correction by the predilution fraction did not fully explain the difference. This suggests that at higher prescribed doses, the dialyzer cartridge may not be equilibrating completely with plasma. More research is needed to use this technique reliably.

NURSING ISSUES

80. CRRT Super Users To The Rescue

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Purpose: To increase the comfort level of nurses caring for patients receiving CRRT in the Intensive Care Unit. Nurses working at a national comprehensive cancer center were noticeably stressed and anxious when assigned to care for patients receiving CRRT. Nurses who did not have an opportunity to work on a regular basis with patients receiving CRRT were faced with a daunting task. They felt too much nursing time was devoted to caring for "the machine" which added the burden of managing multiple liters of fluid volumes each hour monitoring an extracorporeal circuit in addition to caring for a critically ill patient. They were frustrated that "the machine" was always alarming and were uncomfortable trying to troubleshoot. **Methods**: Volunteers were chosen to serve as leaders (Superusers) for the project 3 nurses were chosen from the day shift and 3 nurses from the night shift. There was a balance of both novice and experienced ICU nurses. The identified Superusers worked on the project with the CRRT machine for 2 months. With the dialysis nurse as part of the workgroup effort, they revised policies and created teaching materials that included a CRRT power point and reference flowchart. The group posted colorful visual aids in the unit including troubleshooting tips for CRRT and obtained other educational assistance from the CRRT provider. A CRRT binder was developed which hosted Evidence Based practice articles related to CRRT for reference as needed. Competency forms were developed for new nurses in addition to an ongoing competency assessment form. **Results/Conclusion**: The Superusers became proficient and knowledgeable with CRRT and shared their expertise with other ICU nurses. The training sessions were well received by all nurses in the Intensive Care Unit. The dialysis nurse and CRRT Superusers are readily available to assist with the set-up and troubleshooting of "the machine" as needed. There is a noticeable difference with the reduction in anxiety and discomfort of the ICU nurses assigned to patients receiving CRRT. Nurses are not as reluctant to care for these patients. Some nurses have frequently requested an assignment with a patient receiving CRRT as they become more comfortable and proficient. Since the start of Superusers there is a decrease with the complaint of problems with "the machine" and as a result it has a more welcome presence in the ICU for nurses caring for patients with acute renal failure who are receiving CRRT.

81. Electronic CRRT Flowsheet: Decreasing Errors and Increasing Nurse Recruitment

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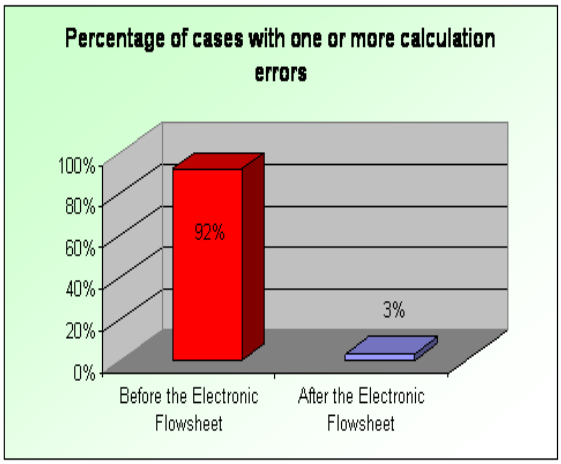
Purpose: The Critical Care nurse manages all aspects of renal therapy and nursing care in providing Continuous Renal Replacement Therapy (CRRT) in the Critical Care Unit (CCU). A flowsheet is the tool used to document and guide the management of these complex patients and can be in paper or

electronic format. Flowsheets are typically designed to keep a historical depiction of care but can also be structured to keep track of fluid volume calculations. The purpose of this project was to design and test an electronic flowsheet to improve patient care by making calculations more accurate while ensuring patient safety through consistent documentation. **Methods:** CRRT patient volumes have to be calculated multiple times to achieve the ordered fluid removal. The number of calculations can vary from 1 to 16 over a 24 hour time period. These calculations in and of themselves are fairly basic, but when you combine the multitude of calculations needed, the occurrence of utilizing negative numbers, and the high acuity level of care needed for these patients, the risk for error increases significantly. Chart reviews showed that 92% of audited records had at least one calculation error and 17% of these errors resulted in a patient volume variation error greater than 5 mL's in a 12 hour period. Surveys also showed that for non CRRT certified CCU nurses; the worry of making a calculation error was a primary reason for not wanting to get certified. In response to these issues, we created an electronic flowsheet that performed the **calculations**. At a later date when our computerized documentation system could accommodate the calculations, we incorporated the program into the system to prevent multiple forms of documentation.

Summary of Results- By creating this tool, the calculation error rate decreased to 3%, and errors resulting in a patient volume variation of greater than 5 mL's in a 12 hour period decreased to less than 1%. Our number of certified CRRT nurses increased by 15% since tool implementation and when surveyed, 7% of the nurses stated that the new tool positively affected their decision to become certified. **Conclusion:** CRRT flowsheets are more complex than normal patient care flowsheets because of their need to function as a worksheet, this complexity results in increased work for the nurse and high incidence for error. Significantly, this tool not only increased calculation accuracy but also was a positive recruitment tool for CRRT nurses.



82. How is it Possible to Mobilize Patients Treated with CRRT

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Introduction: It is a multidisciplinary unit with 22 beds. 8 beds for CRRT. Standard treatment is CVVH pre– and post-dilution: 35 ml/kg. Intensive care nurses provide all tasks in connection to CRRT. In 21 95 patients were treated with CRRT. The unit has a no sedation strategy and a nurse patient ratio 1:1. **Purpose:** Creating awareness of the possibility that critical ill patients can be mobilized from bed to chair. CRRT

patients should be mobilized to prevent complication caused by bedrest. Mobilizing the patients to a chair strengthens the patients integrity and experience of normality. **Method:** Before mobilization the patients have to be screened that the mobilization from bed to chair is safe. This includes: contraindications , haemodynamic, respiratory , level of consciousness, pain, BMI, location of the dialyses catheter Preparing the mobilization: secure invasive catheters , change the dilution fluid and drain the filtration bag to avoid these interventions during the mobilization, Information and accept from the patient: important to make a deal about the duration of the mobilization , appropriate location of the equipment ; organize help from colleagues ; delegate the responsibility of the invasive catheters, the ventilator etc. It may be necessary to make a reduction of the blood flow during the mobilization. The patient will be mobilized with a ceiling fitted lift from bed to chair. The monitoring is sequential during and after the mobilization . The patient has the opportunity to watch TV, listen to the radio and have visitors for an equal communication face to face. **Results:** In a period of 12 days we registered the patients who received CRRT compared to sedation, assist ventilation and mobilization. CRRT: The unit treated 44 patients. 6 patients received CRRT. Sedation: 2 of the 6 patients (33%) were sedated (respectively 12 and 5 days). Assist ventilation: 6 patients was intubated (1%). Mobilization: 5 of the 6 patients were mobilized during CRRT (83%) . C**onclusion:** Our experience and assessment is that patients treated with CRRT can be mobilized. Before mobilization the patient must be screened, too ensure the safety of the mobilization from bed to chair.

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83. RN Staffing in a Pediatric CRRT Program

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Introduction: Pediatric use of CRRT is limited in the United States, limiting the amount of available data and statistics available to set benchmarks or outcomes. Additionally, RN staffing needs during therapy has not been established, and many variances exist between providing centers. The purpose of this study was to collect data regarding Registered Nurse (RN) staffing of CRRT patients and determine if a relationship exists between RN staffing ratios and time off circuit for troubleshooting and/or circuit changes. Data was also collected to assess the time between physician order and initiation of therapy. **Objectives**: This study explored the following research questions: 1. What is the relationship between nurse-to-patient staffing and time off circuit for troubleshooting? 2. What is the relationship between nurse-to-patient staffing and time off circuit for circuit tubing changes? 3. What is the mean time between physician order for initiation of CRRT and time therapy has begun? **Methods:** A retrospective chart review was the design for this study. The population is patient's who have received CRRT over the past 5 years at All Children's Hospital in the pediatric intensive care unit and cardiovascular intensive care unit. Patients who have had CRRT running concurrently with Extracorporeal Membrane Oxygenation (ECMO) were not included in the study. **Results:** The sample size was 84

medical records of patient's who received CRRT between May 25 and August 211. Seven records were excluded due to CRRT and ECMO running concurrently, and 12 records were unavailable for review. Data was collected for analysis from 65 records. The patient's ages ranged from 3 days old to a 65 year old with a congenital heart defect. Therapy time ranged from one to 38 days with a mean of 6.1 days. RN Staffing options for this period were Gambro Clinical Specialist on-call, CRRT staff on-call, and CRRT staff prescheduled. Mean time from order to initiation of therapy was 269.5 hours. There is a significant difference in mean time for staffing options (p=.41). Additionally, there is significant difference between staffing and off circuit time for troubleshooting and circuit changes. Results and implications for practice are discussed including practice changes encountered since the program had begun.

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84. Nursing Knowledge of Pediatric CRRT Principles and Troubleshooting

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Education and training is an important aspect of preparing a nurse to care for a pediatric patient who requires CRRT. General concepts and pathophysiology of kidney injury and failure are imperative in order to fully understand the treatment and necessary hourly calculations. Additionally, the nurse must also have proper training to set up and manage the CRRT machine. When providing training it is expected that the learner complete and evaluation of the program as well as complete necessary skills in order to be competent. However, even with the classroom learning and clinical practice, very few education programs re-evaluate the ongoing retained knowledge and troubleshooting ability. Outcome measurement of training is done well at the end of the session, but frequently falls short for long term evaluation. CRRT is a complex treatment which is not just running a machine, but constantly evaluating the effects of the treatment and prevention of complications.
The goal of this project was to provide an opportunity for staff nurses who care for pediatric CRRT patients to re-evaluate their initial training and demonstrate ongoing critical knowledge regarding the bedside care of the patient. The setting is a 28 bed pediatric critical care unit which provides CRRT to 12-15 patients per year. All bedside nurses who have completed training were asked to complete an evaluation prior to an update class. Twenty evaluations were returned and elements included a Likert Scale of training objectives and seven multiple choice and true/false questions about bedside care and policy.
Results indicated that staff felt they still met the course objective (mean=4 on 1-5 scale). The lowest mean score of 3.89 was given to the statement "Original classroom time was enough to cover the material". However, the mean score for the seven other questions was only 72%. Questions which scored less than 8% were regarding safety and alarm conditions. Results of this data have provided the CRRT trainer to make changes to the course and training in order to improve nurses knowledge and preparation, and provide higher quality of care to the patient. Other

organizations can implement a similar tool to evaluate their training programs. The scores can also be used to drive quality initiatives and track/trend occurrences.

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85. Non-invasive Hemodynamic Monitoring Used to Determine Rate of Fluid Removal with Continuous Renal Replacement Therapy

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Introduction: Hemodynamically unstable patients in the intensive care unit (ICU) who develop acute kidney injury (AKI) have shown to have an increase in morbidity and mortality. These patients who develop AKI frequently require some type of renal support. Evaluation of volume status in these patients can be problematic as typical measures such as decreased urine output, hypotension, and cardiac dysfunction are not reliable indices. The use of non-invasive monitoring in these situations can assist with the determination and maintenance of volume status.

Case: 34 y/o white female presented to the emergency room with increasing shortness of breath and dizziness. Pt states that she has had cough and fever for 4 days. In emergency room she is found to be hypotensive and hypoxic. She was intubated for respiratory distress and transferred to the ICU for further care where she was started on vasopressors and mechanically ventilated. Over the following three days the patient developed AKI and was transferred to our facility for further management. On arrival to our facility the patient's creatinine was found to be elevated to 2.6 and blood urea nitrogen (BUN) of 3 and lactic acid of 4.2. She had been oliguric for past 24hrs and was 6 liters net positive since hospital admission. Femoral Arterial Catheter was placed and FloTrac sensor and a Vigileo monitor (Edwards Lifesciences Irvine California) attached. Femoral Venous Dialysis Catheter was placed and continuous renal replacement therapy (CRRT) was started. Stroke Volume Variation (SVV) was monitored and fluid removal rates were adjusted to keep SVV between 1-15%. Over the next 48hrs the vasopressors were discontinued and the patient's creatinine decreased to 1.4, BUN to 2, lactic acid to 1.1 and net fluid balance from hospital admission was decreased to a positive 2 liters. **Discussion**: Non-invasive hemodynamic monitoring has been used to continuously assess fluid status in hemodynamically unstable ICU patients. We instituted this technology in this unstable AKI patient who require CRRT, and were able to get optimal tissue perfusion without excessive fluid shifts. Monitoring SVV enabled us to remove excessive fluid and minimize episodes of poor tissue profusion which was demonstrated by few episodes of hypotension and improvement of patients lactic acid.

TARGETED INTERVENTION WITH CRRT

86. Therapy In Patients With Acute Kidney Injury Admitted To The Cardiac Surgery Intensive Care Unit Between January 26 And January 2011.

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Background: Acute kidney injury during cardiac surgery is a very common complication. 5% to 3% of patients develop some degree of kidney injury, with associated elevated mortality. The development of sepsis in this same group of patients is associated with an increase of acute kidney injury, as well as mortality, which varies from 17% to 65%. We conducted a transversal, descriptive, observational, retrospective study on post-operative cardiac surgery patients; study's objective was to analyze the results of using CRRT and its impact on mortality. **Methods**: During the period between January 26 and January 211, 3,12 post-operative cardiac surgery patients under extracorporeal circulation were admitted into post-operative therapy. Of these, 16% presented acute kidney injury under creatinine and urine output criteria. Average age was 58.9 years. Demographic variables, surgery type, cardiopulmonary derivation and aortic clamp time, functional class, number of failures, creatinine and urine output, and time at which continuous renal replacement therapy began were measured. **Results:** Three thousand one hundred twenty post-operative cardiac surgery patients were admitted, of which 59% were men and 41% were women, 6% had undergone revascularization, 35% had undergone valve replacement, and 3% had congenital anomalies. Average clamp time was 55 minutes, and average extracorporeal circulation time was 145 minutes. Sixty-seven % of patients were NYHA functional class III, and 61% had three organ failures. Of the total population 5 patients (16%) developed acute kidney injury (according to RIFLE criteria). Seventy-eight patients had complications with sepsis; of these, 16 patients (2.5%) (I = 4; F = 12) were administered continuous renal replacement therapy as of 43.5 hours following diagnosis, with an initial creatinine level of 3.8 mg/dL, and 1.3 mg/dL at the end of therapy. Initial urea was 65 +/- 6.3 mg/dL and decreased to 34.7 +/- 6.5 mg/dL. Urine volume increased from .3 mL/kg/hr +/- .9 to 1. mL/kg/hr +/- .3. Mortality rate was 2.5%. The remaining patients of this group did not receive renal support, and their mortality rate was 17.9%. **Conclusions**: The use of renal replacement therapies on post-operative cardiac surgery patients complicated with sepsis and acute kidney injury has a positive impact on morbidity and mortality. Therefore, developing algorithms oriented toward diagnosis and timely treatment becomes necessary.

87. Mars System for Acute Liver Failure due to Hepatitis A, Complicated y Acute Renal Failure. Case Presentation

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A 26-year-old man with weakness, adynamia, vomit, and abdominal pain was admitted in August 21. Patient was administered acetaminophen and quinolones for suspected infectious gastroenteritis. Five days later the patient showed at the emergency room and was admitted to the hospital for various tests and diagnosed with infection due to hepatitis A, IgM positive. His symptoms were treated, and he was discharged 24 hours later. He returned three days later, and due to elevated hepatic enzymes and oral intolerance, he was transferred to the ICU and administered hemodialysis due to overhydration, anuria, metabolic acidosis, and nitrogen retention. Due to lack of response, he was transferred to our unit, where the diagnosis was confirmed: hepatitis A seropositive and hepatitis B, C, CMV, and Epstein-Barr negative. Upon admission, he presented bleeding at the catheter insertion site and thrombosis of the right basilic vein. Anticoagulation was performed using LMWH, then orally. On September 17, once coagulation times had improved, the catheter was removed and relocated to left jugular level. The Molecular Adsorbents Recirculating System (MARS) was used. Patient received five eight-hour sessions with hemodialysis, bicarbonate buffer, UF 5 mL, QB 2 mL/min, QD 5 mL/min, 6 mL of human albumin 2% with no complications. Liver function tests showed improvement and a decrease in bilirubin levels after each session. The patient began urination after the first session (.5 mL/kg/hr) and entered into the polyuric phase eight days later, recovering full renal function three months later. The patient presented nosocomial pneumonia caused by Staphylococcus Epidermidis and was administered Meropenem with an adequate response. Albumin causes the amalgamation of a large amount of substances implied in the development of hepatorenal syndrome, hepatic encephalopathy, and hemodynamic instability, and the MARS system has been associated with improved bilirubin and ammonia levels and, therefore, improved encephalopathy and hepatic regeneration. Although there are no studies that absolutely support this type of procedure, it is evident that its use and multidisciplinary support make the pathology to present fewer complications and a better outcome.

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88. The Hemodynamic effects during Sustained low-efficiency dialysis versus Continuous veno-venous hemofiltration for patients with intracranial hypertension in a cross over study

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Background: Hemodynamic instability occurs frequently during dialysis treatment and still remains as significant cause of patient mobility and mortality, especially in patients with increased intra-cerebral pressure (ICP). This study was to compare the ICP and hemodynamic parameters between the sustained low-efficiency dialysis (SLED) and continuous veno-venous

hemofiltration (CVVH) in end- stage renal disease (ESRD) patients.
Methods: ESRD patients with increased ICP status post ICP monitor insertion were enrolled. Patients were randomized to receive CVVH or SLED first and then the other the next day. The ICP monitor was equipped and the indwelling radial artery catheter connected to the FloTrac/Vigileo hemodynamic monitoring system and for whom the ultrafiltration rate was set around 1. kg/8hr to 1.5 kg/8hr according to fluid status.
Results: Ten patients (6 female, mean age: 59.9 ± 11.9 years) were analyzed. The disease severity assessed by APACHE II was 28. ± 5.1 at the enrollment. There were no significant differences of blood pressure, heart rate, cardiac output, and cardiac index between the SLED and CVVH. The stroke volume was increased 7.5 ± 18.1 % in CVVH and -.1% ± 13.7% in SLED patients at 6 hours after dialysis. The stoke volume index also increased 8.8% ± 17.3% in CVVH and -2.9 ± 15.6% in SLED at 6 hours after dialysis. The stroke volume variation was significant different in CVVH from SLED (87.9 ± 27.% vs -13. ± 24.7%, p=.42) . The modality effect on stroke volume, stroke volume index and stroke volume variation were all significant (p<.5). The time effect on intra-cerebral pressure (ICP) level after dialysis was significant (p=.7). However, the ICP level was no significant difference between the treatment modality. The dialysis dose quantification showed higher in SLED than CVVH after 8 hrs dialysis. (EKRjc, 62.7± 19.5 vs 5.2 ± 17.5 ml/min, p=.2)
Conclusions: We provide conclusive evidence that under controlled cross-over conditions, SLED and CVVH displayed an identical acute hemodynamic profile. Both modality augmented intra-cerebral pressure after dialysis. SLED showed excellent de-toxification; however, the decrease in the venous return on SLED will greatly affect stoke volume during hypovolemia.

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89. MARS Benefits Patients with Liver Failure Complicated by AKI

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Purpose: Acute liver failure (ALF) and acute on chronic liver failure (AoCLF) are associated with high morbidity and mortality. In those requiring renal replacement therapy, mortality reaches 7% before undergoing liver transplantation. Current optimization utilizes continuous renal replacement therapies (CRRT) to ensure electrolyte balance. The primary objective of the study is to evaluate the efficacy of extra-corporal albumin dialysis (ECAD) in patients with acute liver failure (ALF/AoCLF) and acute kidney injury (AKI) in improving duration to liver transplantation. **Methods:** Patients with AKI and ALF/AoCLF prescribed to receive CRRT were recruited. Molecular Adsorbent Recirculating System (MARS®) was used daily for 8 hours and patients received CVVHDF for the remaining time. Patients received a maximum of 5 MARS treatments. Following 5 days, the patient continued to receive CRRT. **Results**: 5 patients with AKI and ALF/AoCLF received MARS. The MARS was used for an average of 2.6 days (1-5). Two patients underwent successful liver transplant, 2 died and 1 was discharged on intermittent hemodialysis. Bilirubin reduction ratios ranged from 12 to 49%. Total bilirubin improved in all 3 patients

with AoCLF; no improvement was witnessed in the 2 patients with ALF. HESA and GCS scores remained stable or improved in all 5 patients.
C**onclusion:** Despite the high mortality rate, patients with AKI and liver failure benefit from treatment with MARS and CVVHDF which increases the time until a liver transplant can be performed.

	Pt 1	Pt 2	Pt 3	Pt 4	Pt 5
Indication for MARS	Hep B cirrhosis	Hep C cirrhosis	Acetaminophen induced acute liver failure	Nonalcoholic steatohepatitis cirrhosis	Liver lymphoma
Days on MARS	4	5	1	2	1
Outcome	Discharged on Dialysis	Liver Transplant	Liver Transplant	Death	Death
Change in HESA	1 (3->2)	1 (3->2)	N/A	N/A	N/A
Change in GCS	7 to 15	15 to 15	5 to 5	3 to 3	7 to 7
Change in total bilirubin	↓49.2%	↓17.2%	↑165.6 %	↓12.8%	↑6.4%
Change in creatinine	↓58.3%	↓76.2%	↓34.2%	↓66%	↓32.1 %

90. Impact of Albumin Dialysis on Albumin Binding Function

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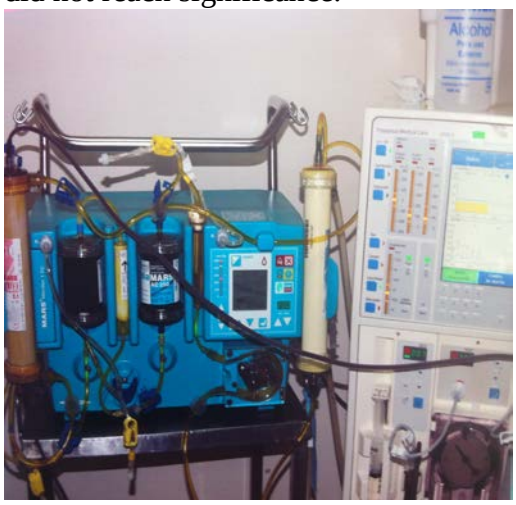
Background: Liver Failure is associated with an accumulation of endogenous toxins at the main albumin binding site for multiple vasoactive, neuro-, nephro- and hepatotoxic metabolites (Klammt et al. EJGH 27). The resulting binding dysfunction can be quantified using fluorescence markers competing for binding sites with said toxins The Albumin Binding Capacity (ABiC) correlates with mortality. Patients in who ABiC can be improved within 7 days have a mortality of only 6.25% while patients who maintain a low binding capacity below 4% over 7 days despite treatment have a mortality of 83% (Klammt et. al. Liver Transplantation 28). Therapeutic means to improve ABiC include extracorporeal detoxification removing albumin bound toxins and infusion of albumin. The effect of the latter is limited by the occupation of therapeutic albumin binding sites by commercial conservatives such as Caprylate and N-Acetyltryptophane (Stange et al. Liver Transplantation 211). Since Albumin Dialysis so far is based on commercial albumin as Dialysate the effect of stabilizers on capability to improve ABiC was investigated. **Methods:** Plasma samples were taken before and after Mars treatments in patients suffering from liver failure. Bilirubin, Bile Acids and ABiC was measured before and after treatments and

compared by paired tests. **Results:** MARS resulted into a significant reduction of bilirubin and bile acids, however, despite this effective removal, the effect of individual MARS treatments on albumin binding function did not reach significance.



Caprylate measurements in the albumin dialysate compartment of the MARS circuit revealed caprylate concentrations of 1.53 umol caprylate/umol albumin, despite pre-circulations of the albumin circuit of 3 minutes over adsorbents according to the manufacturer`s specifications may resolve this problem. **Conclusion**: Improvement of patients ABiC by albumin dialysis requires a higher ABiC of Dialysate Albumin than Patients Albumin. Although pre-treatment recirculation of the MARS Circuit for 3 minutes can reduce the caprylate/albumin ratio, a target of less than .3 umol caprylate/umol albumin cannot be achieved in the current set up, which would be required to achieve an albumin binding capacity of >95% in the MARS Circuit.