3rd International Fluid Academy Days

Abstracts of the poster presentations

Preload independency as detected by passive leg raising is associated with weaning-induced pulmonary oedema

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Introduction Fluid overload has been reported as a frequent mechanism responsible for weaning-induced pulmonary oedema. In case of fluid overload, with respect to the shape of the Frank-Starling relationship, patients are likely preload-independent [1, 2]. ***Aim*** To predict the occurrence of weaning-induced pulmonary oedema by performing a passive leg raising (PLR), which is assumed to detect preload-independency when cardiac output does not increase. ***Material and methods*** In twenty-six patients who failed at a first 60-minutes T-tube spontaneous breathing trial (SBT), we performed a PLR before to start a second SBT. Before and at the end of the SBT, we recorded pulmonary arterial occlusion pressure (PAOP) and cardiac index measured by transpulmonary thermodilution (PiCCO device, Pulsion Medical Systems). During PLR, cardiac index was obtained by pulse contour analysis. Weaning-induced pulmonary oedema was diagnosed if patients exhibited signs of clinical intolerance associated with an increase in PAOP>18mmHg at the end of SBT. ***Results*** Because some patients performed several SBTs, fifty-three SBTs were finally analyzed, 30 cases with weaning-induced PE (WPE+) and 23 without (WPE-). During PLR, cardiac index did not change in WPE+ cases whereas it significantly increased in WPE- cases: 4(IQR: 0—5)% *vs* 13 (IQR: 11—15)%, respectively. The AUC of the ROC curve constructed for the PLR-induced increase in cardiac index as a predictor of weaning-induced PE was 0.90 (95%CI: 0.80—1.00). Considering a threshold of 10%, the sensitivity was 83 (95%CI: 61—95)% and the specificity of 97 (95%CI: 83—100)%. During PLR, PAOP increased significantly more in WPE+ cases than in WPE- cases: +30% (IQR: 12—58) *vs* 15% (95%CI: 7—28) respectively. The AUC of the ROC curve constructed for the change in PAOP during PLR as a predictor of weaning-induced PE was 0.67 (95%CI: 0.53—0.82). Considering a threshold of 19%, the sensitivity was 63 (95%CI: 51—85)% and the specificity of 65 (95%CI: 43—84)%. ***Discussion*** The present study reports that weaning-induced pulmonary oedema occurred in patients who exhibited preload independence before the weaning trial, as detected by a PLR test, although the values of pulmonary artery occlusion pressure before the weaning trial were similar in cases with weaning-induced pulmonary oedema and in cases without. This interesting association could suggest to further with a prospective study of fluid management leaded by detection of cardiac dependence at time of weaning management. ***Conclusions*** Preload-independency as detected before to start a spontaneous breathing trial by a passive leg raising is associated with weaning-induced pulmonary oedema. The mechanisms and clinical perspectives of such results deserve further studies.

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Ciprofloxacine Nanoparticles decreased intestinal colonization with pathological enterobacteria during severe acute pancreatitis

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Introduction Selective digestive decontamination (SDD) is proven to prevent septic complication in patients with severe acute pancreatitis (SAP) [1] but may be followed by colonization of intestine with antibiotic resi-

stant microorganisms. Diminishing a number of antibacterial drugs in its protocol together with their local sustained delivery to intestinal mucosa could prevent such complication. ***Aim*** To investigate the ability of muco-adhesive chitosan nanoparticles (CNp) loaded with ciprofloxacin (CIPR) to decrease colonization of intestine by foreign Gram negative pathological Enterobacteriacea (GNPE) and subsequent bacterial translocation (BT) during SAP. ***Material and methods*** In 200 Wistar rats SAP was induced by intraperitoneal injection of 250 mg/100 g of 20% L-arginine solution twice during 1 hour. Enteral administration of 1.5 mg/kg of CIPR included in CNp every 12 hours has been started just after SAP initiation in SDD group (n=10) and normal saline – in control (C) group (n=10). 5 ml of suspension of 9 log CFU/g of GNPE (K. pneumoniae, P. mirabilis and E. coli HLY+) was introduced to all animals by gavage 3 hours after SAP modulation. Concentration of microorganisms in small intestine, colon, pancreas, liver, spleen, lungs, portal and system blood, and peritoneal cavity were investigated during 12—120 hours by bacteriological methods. ***Results*** In C group colonization of ileum and colon by GNPE occurred in 50% after 12 hours and in all animals after 24 hours in concentration 4.5—6.5 log CFU/g. In SDD group it was observed in 20%—40% during 12—48 hours but amount of GNPE were less than 3.1 log CFU/g during all periods. BT to pancreas and internal organs started after 12 hours in 20% and appeared in 100% of animals of C group during 48—96 hours with E. coli, K. pneumoniae, P.mirabilis, S. aureus, B. fragilis and C. albicans in concentration 4.2—7.5 log CFU/g. In SDD group BT to pancreas and other internal organs was found in 10—20% cases during 24—48 h by normal E. coli and S. epidermidis in amount 2.7—3.5 log CFU/g without development of serious dysbiotic changes in small intestine and colon. ***Discussion*** Sepsis resulting from infected pancreatic necrosis is the most serious complication of SAP and contributes to high mortality. Pancreatic infection is thought to be a result of bacterial translocation from the gastrointestinal tract [2]. Breakdown of gut barrier integrity, systemic and local immunosuppression from the early phase, and bacterial overgrowth due to the decrease of gut motility are postulated as important factors in the mechanism of its occurrence. Several clinical studies [1, 3] have demonstrated that SDD effectively eliminates aerobic Gram-negative bacteria from the intestinal tract and reduces gram-negative septic complications in critically ill patients, but there is a risk of colonization of the gut with antibiotic resistant microorganisms. We supposed that diminishing of number of antibacterial drugs in SDD protocol together with their local sustained delivery to intestinal mucosa could effectively prevent such complication. We have chosen CIPR as it is an antibiotics of choice for systematic prophylaxis of GNPE pancreatic infection during SAP and it has low activity against normal intestinal microbiota [4]. To reach its constant concentration on mucosal surface of intestine we decided to incorporate it into CNp, which have muco-adhesive properties and ability for sustained liberation of loaded drugs [5]. Our results show that even in low doses CIPR incorporated into CNp diminished number of GNPE in all parts of the intestine without development of serious dysbacteriosis and has favourable effect on bacterial translocation to pancreas. ***Conclusions*** SDD by CNp loaded with CIPR effectively decreased intestinal colonization by GNPE and subsequent BT to internal organs during SAP in rats.

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Ability of single transpulmonary thermodilution to detect time course variation of extravascular water after broncho-alveolar lavage

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Introduction Measuring extravascular lung water (EVLW) is of great interest in critically ill patients with lung injury. Nevertheless, the accuracy of single transpulmonary thermodilution to detect small short-term changes has not been fully investigated [1]. ***Aim*** To test the ability of single transpulmonary thermodilution to detect variations of EVLW induced by a broncho-alveolar lavage (BAL). ***Material and methods*** Single transpulmonary thermodilution (PiCCO device, Pulsion Medical Systems) were repeated to estimate the

time-course variation of EVLW before and after BAL in mechanically ventilated patients. The values of three thermodilution measurements were averaged at the following steps: before BAL, after BAL, one hour after BAL, two hours after BAL, four hours after BAL and six hours after BAL. ***Results*** Twenty-two patients suspected of ventilator-associated pneumonia were included. For performing the BAL, the airway inspiratory flow was decreased from 60 to 40 L/min but the others ventilator settings were not modified during all the study period: mean tidal volume 420±44 mL and mean positive end expiratory pressure 8±4 cmH20 (ANOVA). An average of 194±25 mL of saline solution was injected for the BAL and the averaged amount of fluid left in the lung was estimated to be 136±37 ml. The pulmonary vascular permeability index was 2.31±1.14 before performing the BAL. EVLW increased significantly from 11.9±3.9 mL/kg to 14.8±5.1 mL/kg between before and after the BAL. After the BAL, the time-course of EVLW was as followed: 13.9±4.8, 13.5±4.4, 13.3±5.2, 12.6±3.8 mL/kg for one hour after BAL, two hours after BAL, four hours after BAL and six hours after BAL respectively. The differences between before and after BAL values of EVLW were significant until the second hour included. ***Discussion*** This study showed that transpulmonary thermodilution enables to detect small and short-term changes in extravascular lung water after a broncho-alveolar lavage. These results justify to pay attention on small changes in clinical practice, for instance during the weaning period. ***Conclusions*** Single transpulmonary thermodilution is able to detect small short-term variation of extra-vascular lung water in patients with ventilator-associated pneumonia.

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Antibiotic prophylaxis in patients treated with therapeutic hypothermia after out-of-hospital cardiac arrest is more beneficial than selective antibiotic therapy

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Introduction Therapeutic hypothermia (TH) has become standard of care in the post resuscitation management of out-of-hospital cardiac arrest (OHCA) (Guidelines ERC and AHA) [1, 2]. Pneumonia is a very common complication after OHCA possibly related to aspiration prior to hospital admission. TH reduces the innate immunity by neutrophilic dysfunction and increases the risk for infection and suppresses the classical signs of infection delaying the start of effective antibiotic therapy. ***Aim*** The aim of our pilot-study was to determine a possible benefit of antibiotic prophylaxis in OHCA-patients versus awaiting presumptive clinical diagnosis of pneumonia before initiating empirical antibiotic treatment. ***Material and methods*** A small prospective interventional study in a 36-bed ICU of a tertiary hospital. 27 out of 36 patients admitted after OHCA during a 4-month period were randomized in a prophylactic (PA; n=10) and a therapeutic antibiotic group (TA; n=17). Exclusion criteria were related to early death, insufficient data available in files, proven infection on entry ICU or no TH. The PA group received amoxycillin-clavulanic acid or cefuroxime upon admission in the ICU (started within 6h after admission ICU). In the TA group empiric antibiotic therapy was started after the presumptive clinical diagnosis of pneumonia (fever/purulent endotracheal aspirate (ETA)/radiographic infiltrate of the lung/elevated inflammatory parameters). The following variables were recorded: length of stay (LOS) ICU, LOS hospital, mortality hospital/ICU, duration of ventilation (DV), C-reactive protein (CRP), procalcitonine (PCT) serum levels and ETA cultures. ***Results*** In-ICU mortality in the PA group was 40% *vs* 29.4 in the TA group (p=NS). In the PA group DV and LOS hospital were significantly shorter (8.3±6.9 *vs* 14.7±25.5 days; p<0.05; 16.2±10.5 *vs* 29.6±9.3 days; p<0.05 respectively) and a trend towards shorter LOS ICU was observed (12.5±11.4 *vs* 20.4±11.6 days; p=0.123). In the survivors DV and LOS hospital were significantly shorter in the PA group (3.6±2.1 *vs* 25.5±9 days.; p<0.05; 15±4.5 *vs* 36.5±16.3; p<0.05 respectively.) and a trend towards shorter LOS ICU was observed (12.5±11.4 *vs* 20.4±11.6 days; p=0.19). In the TA group antibiotics were started after a mean of 3.4±0.6 days. There was significantly less positive ETA cultures after 24h in the PA group (10% *vs* 70%; p<0.05) and after >72 hours (40% *vs* 88%; p=0.06). Modification of antibiotic treatment was more frequently needed in the TA group (40% *vs* 76.5%; p=0.058). ***Conclusions*** There was a reduction in duration of ventilation and LOS hospital in OHCA-patients receiving antibiotics prophylactically. This may be caused by earlier effective antibiotic therapy. Pathogenic microorganisms were isolated less frequently in ETA from PA patients in the first 24hrs. Antibiotic regimens had to be adapted less frequently than in the TA patients possibly due to a shorter duration of ventilation and less secondary infections in this group. Because of the small size of the study a larger randomized study seems indicated.

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PiCCO guided fluid management in early phase in patients with severe sepsis and septic shock at the ED: a study protocol for a prospective randomized trial

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Introduction Hemodynamic monitoring and the associated fluid management are of critical importance in the therapy of patients with severe sepsis and septic shock. Both under- and overresuscitation are associated with increased morbidity and mortality [1, 2]. The PiCCO system (Pulsion Medical Systems) is a minimally invasive technique that provides accurate information on volume status. The extravascular lung water index (EVLWI) has been studied as an indicator for potential fluid overload. Only a few studies have prospectively investigated the relationship of EVLWI to clinical outcome. All these studies included patients in the ICU, and not in the early phase on admission at the ED [3—5]. ***Aim*** We start this study FIRST to detect the hemodynamic data in severe sepsis and septic shock patients at the time of admission on the emergency department (ED). Our SECOND goal is to determine if a fluid management algorithm based on the global enddiastolic volume index (GEDVI) and EVLWI in early phase of severe sepsis and septic shock will have a positive effect on the clinical outcome. ***Material and methods*** The study is a prospective randomized controlled single-center trial. A total of 100 patients with severe sepsis or septic shock will be included from December 2013 to December 2015. Subjects will be randomized (by computer sequence) to receive PiCCO monitoring or not within 2 hours after ED admission. The study ends after 72 hours of treatment. The control group will undergo fluid resuscitation based on the early goal directed therapy (EGDT). Fluid management of the subjects in the intervention group will be guided by GEDVI and EVLWI. The fluids will be stopped if the EVLWI is equal to or more than 10. The hemodynamic goals (MAP>65 mmHg; lactate <4 mmol/L and $S_{cv}O_2$>70%) will be accomplished by using cathecholamines (based on the SSC guidelines 2012). ***Results*** Our primary endpoint is the fluid balance (daily and cumulative). The secondary outcome measures include length of stay at the ICU and in hospital, days on mechanical ventilation and duration of weaning and number of organ dysfunction. A significant amount of demographic, clinical (shock index, weight, diuresis etc), biochemical (troponin, BNP, capillary leak index, etc) and PiCCO data will be gathered to make some interesting correlations. Risk stratification scores will be taken into account. Every 8 hours (during the trial period of 72 hours) there will be a PiCCO measurement and at the same time also measurements of lactate, $S_{cv}O_2$ and biochemical data. ***Discussion*** (cfr results; because the trial will be started in December 2013 we don't have results yet – it is a description of our protocol in early phase). ***Conclusions*** Our hypothesis is that early resuscitation guided by GEDVI and EVLWI is safe and avoids - even in early phase - unnecessary fluid input. This will prevent fluid overload and potential shorten the duration of mechanical ventilation. This will improve the clinical outcome of these patients. We also presume that this way of fluid resuscitation is superior to fluid management based on vital signs.

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Changes in intraabdominal pressure and body water content correlate with plasma vascular endothelial growth factor and proinflammatory cytokines concentrations in critically ill patients

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Introduction Massive fluid resuscitation, particularly crystalloids, may increases intraabdominal pressure (IAP) and affects content of total body water (TBW), extracellular body water (ECW) and intra-cellular body water (ICW). ***Aim*** The aim of the present study was to compare the relation between changes in IAP, TBW, ECW and ICW, and fluid therapy, vascular endothelial growth factor (VEGF), tumour necrosis factor alpha (TNFα), histamine and interleukin 1, 6, 10, 17 and 23 and capillary leak index (CLI). ***Material and methods*** Adult critically ill patients with acute renal insufficiency (AKI) were studied. Patients were divided into: treated with continuous furosemide infusion (furosemide group) and treated with continuous veno-venous haemofiltration (CVVH group). VE, TBW, ECW and ICW were measured using whole body bioimpedance. IAP was measured in the urinary bladder (Kron technique). CLI was calculated as CRP/plasma albumin. All parameters were measured at three consecutive days: the day of admission into Intensive Care Unit (ICU), 24 and 48 hours after the admission into ICU. ***Results*** Forty patients were studied. 23 were treated with furosemide infusion and 17 with CVVH. In furosemide group: IAP correlated with VEGF ($p<0.001$, r=0.81), histamine ($p<0.001$, r=0.41), IL-6 ($p<0.001$, r=0.44) and IL-17 ($p<0.001$, r=0.46). Moreover, TBW, ECW and ICW correlated with VEGF ($p<0.001$, r=0.54, $p<0.001$, r=0.47 and $p<0.001$, r=0.57, respectively). IAP strongly correlated with CLI ($p<0.001$, r=0.58). VE and ECW correlated with CLI ($p<0.001$, r=0.5 and $p<0.001$, r=0.46, respectively). In CVVH group: IAP correlated with VEGF ($p<0.001$, r=0.81), TNFα ($p<0.001$, r=0.46), E-selectine ($p<0.001$, r=0.47) and histamine ($p<0.001$, r=0.57). Moreover, TBW correlated with VEGF ($p<0.001$, r=0.41) and ECW correlated with VEGF and TNFα ($p<0.001$, r=0.47 and $p<0.001$, r=0.43, respectively). In both groups, changes in IAP, TBW, ECW and ICW didn't correlate with fluid balance. ***Discussion*** Intraabdominal hypertension has a high incidence during the early course of septic shock and develops during the 72 hours after the admission into Intensive Care Unit [1, 2]. It may results from massive fluid resuscitation, which raises fluid shift, leads to bowel oedema and subsequently intraabdominal hypertension [3, 4]. In the present study we documented that an increase in IAP and changes in body water content depended on plasma VEGF concentration and severity of septic shock measured by plasma cytokines. Additionally, changes in IAP and body water content didn't depend on daily fluid balance and volume of fluids resuscitation, however this findings should be confirmed in the further studies. ***Conclusions*** Changes in IAP and body water content correspond with plasma VEGF and pro-inflammatory cytokines concentration in critically ill patients.

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Intraabdominal pressure in term pregnancy and postpartum

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Introduction Data on intraabdominal pressure (IAP) measurement in pregnant women are scarce. It has been suggested recently that elevated IAP might play a role in some gestational complications, such as (pre) eclampsia [1, 2]. ***Aim*** To measure intra-bladder pressure, using the Foley Manometer Low Volume technique (FMLV, Holtech Medical, Charlottenlund, Denmark), as estimate for IAP in women with uncomplicated term pregnancies, before and after caesarean section (CS) and in relation to maternal and fetal characteristics. To evaluate the effect of different zero reference levels on IAP-values. To evaluate the reproducibility of FMLV during pregnancy. ***Material and methods*** IAP was measured 3 times per session according to a standard protocol in 24 term pregnant women before and after CS, as well as in 27 other women 15 minutes after and 1 day after a laparoscopic assisted vaginal hysterectomy (LAVH). Maternal weight and BMI and fetal position

were recorded. The midaxillary line was used as zero reference (IAPMAL) in all patients, and in a fraction of 26 patients the symphysis pubis (IAPSP) was used as an alternative zero reference. The intra-session intra-class correlation (ICC) and Pearson's correlation of IAP with maternal and fetal characteristics were calculated using SPSS 20.0. ***Results*** Mean IAPMAL was significantly higher before CS than after CS (13.7±2.7 mmHg *vs* 9.7±2.9 mmHg, p=0.012) and IAP after CS was not different from IAP in the LAVH-group (Fig. 1). The patient's weight and BMI before CS correlated with postoperative IAPMAL (r=0.50, p=0.01 and r=0.43, p=0.03 respectively), but not with IAPMAL before CS. A negative correlation between IAPSP and breech presentation was observed (r=-0.54, p=0.04). Overall mean IAPSP was significantly lower than IAPMAL (p<0.001), but IAPSP measurement was technically more difficult than IAPMAL. Overall ICC for IAPMAL and IAPSP was ≥0.73 and ≥0.83 respectively. ICC before CS was lower than after CS (0.73 *vs* 0.87 for IAP-MAL). ***Discussion*** There is a significant decrease in gestational IAP to non-pregnant values after delivery. The observed correlation between the fetal intra-uterine positioning and the maternal IAP suggests that there might be a direct pressure effect of the gravid uterus and/or the fetal position on the bladder, which subsequently might influence the measured IAP. According to our results of FMLV measurements using SP as zero reference level, higher ICC are obtained than with IAPMAL at the cost of a technically more difficult method. IAP measurement in pregnant women using the FMLV is highly reproducible as one single measurement is already reliable. ***Conclusions*** It can be stated that pregnancy is associated with high values of IAP, which depend on pre-gestational BMI and fetal position. Using alternative zero reference points in the FMLV technique is both beneficial and disadvantageous at the same time. One single IBP measurement is sufficient to reliably define IAP in term pregnant women. Further studies are needed to assess the relevance of increased IAP to normal and pathological course of pregnancy.

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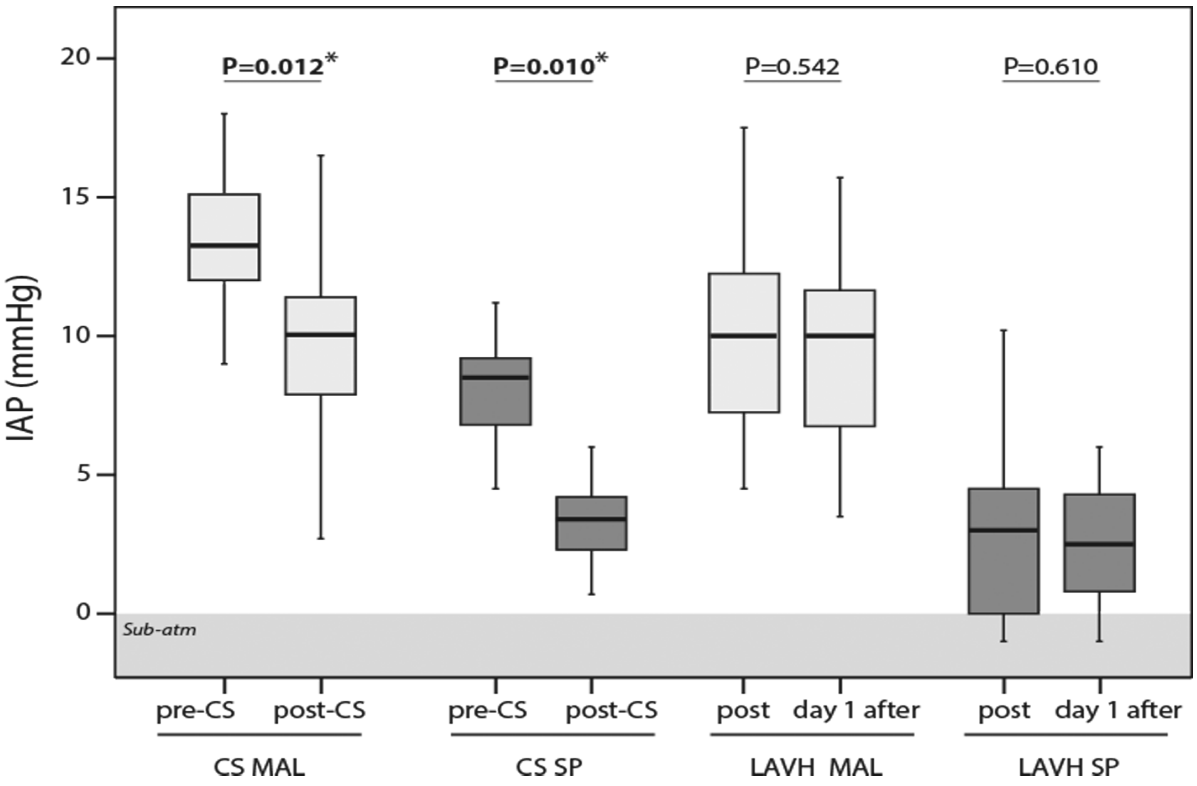

Fig. 1. Mean IAP values before and after cesaerian section (CS) and in the control group (LAVH) at different zero reference levels, midaxilalry line (MAL) and symphysis pubis (SP)

Minimising Prescribing Errors in the ICU

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Introduction Recent evidence suggests that prescribing errors are as common as 10% of UK admissions in the hospital setting, costing eight and a half extra bed days per admission, and costing the NHS an estimated 1 billion GBP per annum [1]. This was recently discussed by Smith in "Building a safer NHS for patients: Improving medication safety. DOH Guidance 2004". The majority of these mistakes are avoidable ("Safe Prescribing." Medical Protection Society – Factsheet for medical professionals practising in England 2012). ***Aim*** We aimed to audit the prescribing practice of infusions on a busy 14-bedded general ICU, and develop standardised practices and tools to improve prescribing accuracy and safety. In our establishment, drug infusions, including inotropes, sedatives, electrolytes, and crystalloid/colloid preparations are prescribed on a daily basis, in a non-standardised, freehand manner. We aimed to see if we could improve medicines safety with a small, but effective change in daily prescribing. ***Material and methods*** Two anaesthetists audited the daily infusion charts of all ICU patients in three separate spot checks over the course of a week. We assessed aspects of prescriptions that make them both legal and valid in accordance to current guidance ("Good Practice in Prescribing Medicines." General Medical Council 2008). This included collecting data on correct prescribing of the drug, dose, dosing range, diluents, and valid signatories/GMC identifier. New procedures were introduced to improve prescribing, which included a new standardised prescription sticker, with common, pre-printed infusion prescriptions on, and extensive education on the process of implementing and using the new standardised prescriptions. A month later, the same two anaesthetists audited the infusion charts in the same manner as previously. ***Results*** Overall, we assessed 129 individual prescriptions in the first round, and 111 after intervention, demonstrating a 70% improvement in prescribing safety (Tab. 1). Prior to introducing our standardised prescription stickers, only 24% of prescriptions fulfilled criteria for best practice of legal and valid prescriptions, increasing to 94% afterwards. As well as improving the clarity and timing of delivered prescriptions, we also showed a reduction in the number of infusions running without prescription (7 (6%) *vs* 24 (19%)). ***Discussion*** From the data collected and analysis of results, our audit supports the need for standardised prescribing practices within critical care, especially when dealing with potentially harmful vasoactive/sedative drugs. ***Conclusions*** We believe that we were able to demonstrate that with a small, cost effective intervention (20 GBP for 6200 stickers), we improved prescribing accuracy, and thus patient safety, when dealing with drug infusions in an intensive care setting.

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Table 1. Assessment of 129 individual prescriptions.

Problem	Pre-sticker	Post-sticker
All correct	31	104
Missing drug	4	0
Missing diluent (vol/type)	37	0
Missing dose range	20	0
Missing signature	2	7
>1 problem	35	0
TOTAL	129	111
(GMC missing)	73	10
IVI running w/o Px	24	7

How effective is the use of non calibrated arterial pressure based cardiac output measurement versus control in early goal-directed therapy in septic shock: a randomized controlled trial

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Introduction In septic shock patients, mortality remains high despite the introduction of the early goal-directed therapy (EGDT). This questions the role for extra targets to be implemented. The potential role for using the cardiac index (CI) and the stroke volume variation (SVV) as extra targets for the EGDT is investigated. ***Aim*** This small, single center Randomized Controlled Trial is a pilot study to evaluate the research protocol. Trial registration University Hospitals Gasthuisberg of Leuven Clinical Trial Center, Trial number S53778. ***Material and methods*** Patients presenting in the ED in septic shock were randomly assigned to a FloTrac/Vigileo group (n=3) or a Control group (n=4). Early goal-directed therapy was applied during the first 6 hours after admission. In the FloTrac/Vigileo group, goals for the CI (CI>2.5 L/min/m^2) and for the SVV (SVV<10%, only used in intubated and mechanically ventilated patients) were set to manage the use of fluid boluses and the use of inotropes. Primary endpoints are the amounts of crystalloids and colloids transfused, the use of inotropes or vasopressors and the number of organs showing signs of dysfunction after the EGDT. Secondary endpoints are the ICU length of stay, time span with vasopressor need, dialysis, intubation and 30 days mortality rate. The local Medical Ethical Committee approved this study. ***Results*** This study shows a trend towards more fluids transfused (crystalloids 1507±689 mL *vs* 1100±271 mL; colloids 1667±1155 mL *vs* 1500±408 mL) in the FloTrac/Vigileo group. The FloTrac/Vigileo patients had less lactate (1.1±0.28 mmol/L *vs* 1.93±0.78) and less laboratory and clinical signs of organ failure at the end of the EGDT. ICU length of stay was shorter in this group. The Mortality rate was 1/3 in the FloTrac/Vigileo group and 2/4 in the Control group. ***Discussion*** This pilot study should be continued over a longer period of time to conclude if these trends are statically significant to determine if CI and SVV targets in EGDT in septic shock patients improve their outcomes. ***Conclusions*** EGDT may have beneficial effects guided by functional hemodynamic parameters may have a place in the emergency room setting. Further research is needed.

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Early goal-directed post-resuscitation care

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Introduction Outcomes after cardiac arrest remain disappointing. Last years, high-quality post-resuscitation care and the use of structured protocols in achieving this, have been stressed. Our purpose was to implement a standardized protocol for post-resuscitation care in our tertiary teaching hospital [1—5]. ***Aim*** Goal is to treat and correct the factors, which determine outcome in cardiac arrest as soon as possible. Final goal is to achieve a neurologically intact survival. ***Material and methods*** We introduced and implemented a standardized protocol for the patient with return of spontaneous circulation and programmed this protocol in our computer software that we use in our cardiac intensive care unit. We trained staff working in this unit in post-resuscitation care and the protocol. ***Results*** When a patient after cardiac arrest is admitted to the cardiac intensive care unit, an automated protocol will be activated which will guide the sometimes-inexperienced physician and nursing staff in the post-resuscitation care. The protocol is quite aggressive based on the fact that the first hours after cardiac arrest are crucial in conserving vital organ function and neurological integrity. It is funded on three important core points: early coronary angiography, early cooling and early goal-directed therapy and monitoring. Activation of the protocol will display a screen with five questions. The first question sensitizes to the consideration of coronary angiography. The second question concerns therapeutic hypothermia and the early initiation of this therapy. We use an intravascular cooling device but we also have stocked ice-cold crystalloids in our unit to reach target temperature as soon as possible. The third question concerns 'do not resuscitate orders'. In the two last questions early intensive monitoring and therapy is stressed. Because of the importance of haemodynamic optimization in post-resuscitation care, we routinely perform a more advanced haemodynamic monitoring by applying non-invasive cardiac

output assessment or a pulmonary artery catheter. We programmed in our computer software the targets for which there is scientific evidence that they improve outcome in cardiac arrest to guide our therapy (Fig. 1). ***Conclusions*** Education in post-resuscitation care and implementing a structured protocol in our tertiary teaching hospital will improve the care for the patient with cardiac arrest and neurologically intact survival. It effectuates fast, high-quality and evidence-based care. Our experience so far is good.

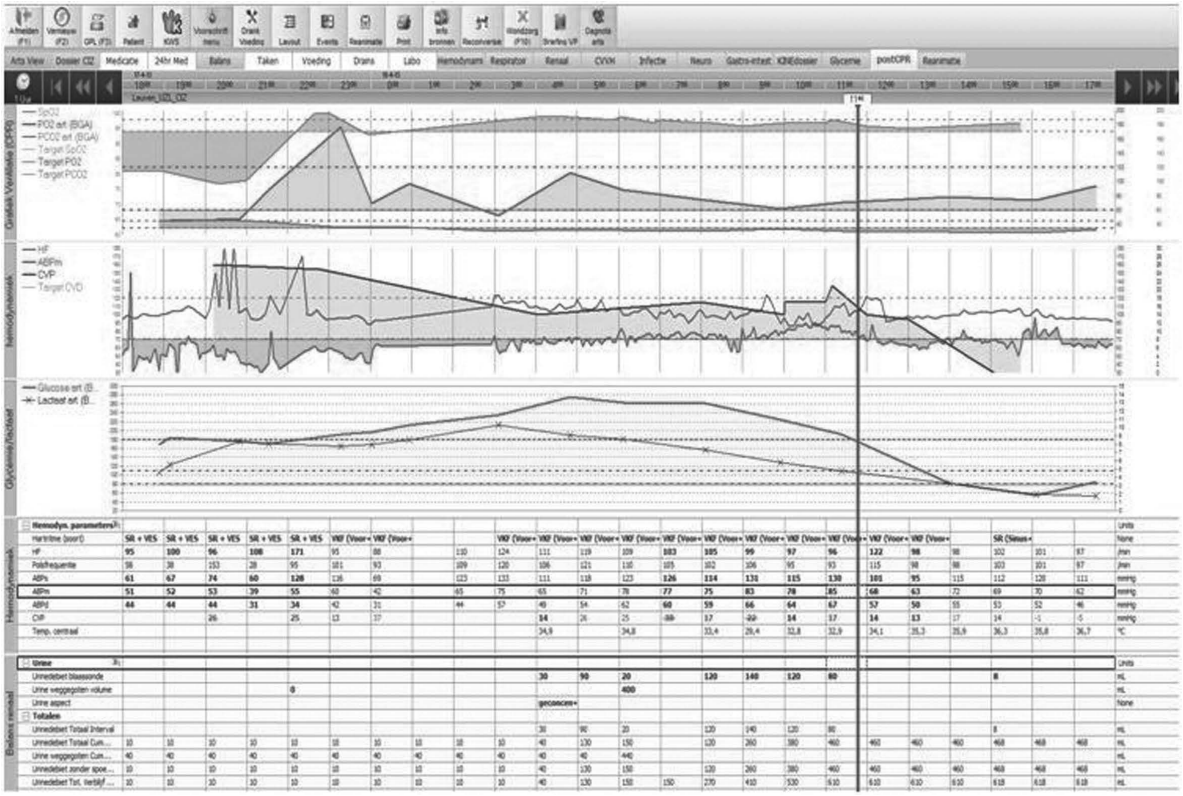

Fig. 1. Computer screen with pre-programmed targets for which there is scientific evidence that they improve outcome in cardiac arrest to guide our therapy

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A survey on "fluid management performance" and knowledge on hemodynamic monitoring among physicians working in acute care settings

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Introduction Adequate fluid administration and appropriate hemodynamic monitoring are essential elements for treating ICU patients. There is a lot of controversy and on-going debate about the exact fluid or the combination of fluids we have to administer to which patient. It is all about the dosing and the timing of the fluids, that should be seen as drugs [1, 2]. Over the last years, many hemodynamic monitoring systems have become readily available at the bedside and it is a challenge for every critical care physician to make the "right" choice of monitoring because it can contribute to a better outcome if used properly in conjunction with an early goal directed treatment protocol [3]. Until today there is no ideal strategy and the choice of

fluids and monitoring systems largely depends on regional and clinician's preferences. Some even believe it is a religious thing. ***Aim*** This survey was designed to analyse the current practice of fluid management and hemodynamic monitoring among critical care physicians attending the 2nd international fluid academy day (iFAD) meeting. Methods We conducted a survey consisting of a self-administered questionnaire that participants of the 2nd international fluid academy day (iFAD) held in Antwerp (Belgium) on November 17th in 2012 could voluntarily complete. The survey consisted of 16 multiple-choice questions, 8 on the choice of fluids and 8 on hemodynamic monitoring techniques, personal additions and comments were also possible. Besides answering the knowledge questions respondents also provided information on 4 general questions in relation to their country of residence, basic speciality and years of experience. ***Results*** A total of 89 participants, of which 47 were working in Belgium, 18 in The Netherlands and 24 in other countries, completed the questionnaire. The primary discipline of the respondents was anaesthesiology in 29%, internal medicine in 22%, intensive care medicine in 21% while 15% were not a doctor. A total of 61% came from intensive care units with>16 beds. Hyperchloremic metabolic acidosis, associated with the use of saline, was considered to be an independent risk factor of acute kidney injury and a cause of unnecessary interventions and costs. Balanced crystalloid solutions are preferred in patients with decreased kidney function. When asking whether the normal use (respecting dosing limits) of balanced tetrastarch (e.g. VoluLyte, Tetraspan, PlasmaVolume Redibag,…) could induce acute kidney injury, 54% answered probably or yes, whereas 45% answered no or probably no. About 43% of the respondents never used human albumin 20% as a resuscitation fluid. Little is know about the fluid strategy in patients with traumatic brain injury (TBI): 45% thought albumin is probably not a problem in patients with TBI, and only 19% answered that it should be avoided. In a hypotensive fluid responsive patient with severe sepsis (FiO_2 of 35%) fluid boluses with balanced crystalloids were the primary choice for correcting hypovolemia, albumin was preferred when ARDS was suspected (FiO_2 100%). In both cases 14% answered to use starches. 47% chose starches for an episode of hypotension during trauma surgery when blood is not available. For hemodynamic monitoring of different patient populations in the ICU (severe sepsis, septic shock, during high risk surgery and shock after major trauma) invasive blood pressure monitoring and lactate were most often used, followed by mixed venous saturation and clinical fluid responsiveness parameters. About 60% regarded lactate as the preferred method to measure tissue oxygenation. PiCCO hemodynamic monitoring systems were frequently used in the setting of septic shock. Conclusion Our survey showed a reduced use of normal saline in favour to an increased use of balanced crystalloid solutions in order to prevent the incidence of hyperchloremic metabolic acidosis, which is believed to be associated with morbidity and mortality. Starches are much less commonly used, but the results from this survey mirrors uncertainty about the "normal use " (respecting dosing limits) of starches and the risk of kidney damage. There is a lack of knowledge on fluid therapy in patients with traumatic brain injury, where hypo-osmolar solutions can have serious adverse effects. General agreement exists as to the ideal way to monitor different patient populations, where the majority of physicians chose more familiar techniques, presumably because lack of knowledge of the newer techniques. We can conclude that there is room for improvement to handle among latest evidence on modern volume replacement and monitoring strategies

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A survey on attitudes and preferences regarding fluid management and hemodynamic monitoring among nurses working in acute care settings

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Introduction Adequate fluid administration and hemodynamic monitoring are one of the cornerstones in treating ICU patients. Recent trials on this subject demonstrated that hydroxyethyl starches are associated with adverse effects on survival and kidney function and that balanced fluids are preferred over unbalanced fluids, since the latter lead to hyperchloremic metabolic acidosis [1, 2]. In the field of hemodynamic monitoring many new techniques have emerged in clinical practice [3]. Little is known about the knowledge of nurses regarding fluid management and hemodynamic monitoring; the respondents from last year's surveys

were mainly doctors and not nurses [4—6]. The question is to what extent nurses, working in acute care departments, are aware of these new trends. Not infrequently it is the nurse who starts fluid therapy and monitoring in acute medical situations. ***Aim*** This survey was designed to analyse the choice of fluids and hemodynamic monitoring among nurses working in acute care setting attending the 2nd international fluid academy day (iFAD) meeting. ***Methods*** We conducted a survey consisting of a self-administered questionnaire that nurses participating the 2nd international fluid academy day (iFAD) held in Antwerp (Belgium) on November 17th in 2012 could voluntarily complete. The survey consisted of 12 multiple-choice questions, 8 on the choice of fluids and 4 on hemodynamic monitoring techniques, personal additions were possible. Besides answering the knowledge questions respondents also provided information on their country of residence and working place. ***Results*** A total of 43 participants, of which 39 were active in Belgium and 4 in the Netherlands completed the questionnaire. A number of 51% of the respondents were working in an emergency department, 18% in an intensive care unit and 9% in a burn unit while 16% were not a nurse. The most commonly used colloid is albumin (86%), followed by Volulyte® (71%) and Voluven® (52%). In a hypotensive fluid responsive patient with severe sepsis (FiO2 of 35%) fluid boluses with plasmalyte (23%) and volulyte (21%) were the primary choice for correcting hypovolemia, albumin (37%) was preferred when ARDS was suspected (FiO_2=100%). In both cases approximately 20% answered not to make this decision on their own. A number of 28% answered not to decide which maintenance fluid to use in a neurotrauma patient, whereas 19% chose normal saline and another 19% plasmalyte. The majority of the nurses are convinced that balanced salt solutions are preferred over "classic" salt solutions. The formation of oedema is considered to be a cause of morbidity and mortality. For hemodynamic monitoring in different patient populations, invasive blood pressure monitoring (95%) and central venous pressure (CVP) (88%) are most often used, followed by lactate. Mixed venous oxygen saturation and passive leg raising test are much less used. PiCCO hemodynamic monitoring systems are mainly used in the setting of septic shock. Conclusion Our survey revealed that nurses in intensive care and emergency medicine are generally well aware of the infusion policy: balanced crystalloids replace more and more “normal” saline, among colloids albumin is preferred…but synthetic colloids are still frequently used for fluid resuscitation. Invasive blood pressure monitoring, central venous pressure and lactate are considered more important than $S_{cv}O_2$ and passive leg raising test for monitoring a patient. In intensive care, working as a team is very important. Nurses are often involved in the initial fluid therapy and the choice of hemodynamic monitoring, so appropriate attention should be paid to their teaching. Improving their knowledge could add to the achievement of the goal that every patient should be treated according to the latest evidence.

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Interim results of a prospective study on the validation of non-invasive hemodynamic monitoring with PulsioFlex in critically ill patients

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Introduction Thermodilution (TD) is considered a gold standard for the measurement of cardiac index (CI) in critically ill patients [1]. ***Aim*** The aim of this study is to compare intermittent bolus transpulmonary TD CI (TDCI) with intermittent automatic calibration CI (AutoCI) and 2 continuous CI (CCI) obtained by pulse contour analysis with $PiCCO_2$ (PiCCI) and PulsioFlex (PuCCI)(Pulsion Medical Systems, Munich, Germany). ***Methods*** Interim results of an ongoing prospective multicentre study in 53 patients. Age 58.7±15.4, SAPS II score 51.4±14.7 and SOFA score 10±3.2. All patients underwent PiCCO monitoring via a femoral line whilst a radial line was kept in place during four 8-hour time periods (in the first two periods, the Pulsioflex was connected to a radial line; in the last two it was connected to a femoral line). In the first and third periods,

the Pulsioflex was calibrated with TDCI, for the second and fourth periods Pulsioflex was calibrated with AutoCI. Simultaneous PiCCI and PuCCI measurements were obtained every 2 hours while simultaneous TDCI and AutoCI were obtained every 8 hours. We also looked at the effects of 40 interventions ***Results*** In total, 940 CCI and 382 TDCI values were obtained: 940 paired PiCCI and PuCCI; 358 paired AutoCI-TDCI measurements. TDCI values ranged from 1.5 to 6.9 L/minute/m2 (mean 3.6±1.1), AutoCI from 1.8 to 7.2 (3.6±0.9), PiCCI from 1.0 to 7.1 (3.5±1.1) and PuCCI from 1.3 to 7.6 (3.6±1). Pearson's correlation coefficient comparing mean PuCCI and PiCCI values per patient had an R2 of 0.79. Comparison between AutoCI and TDCI had an R2 of 0.51. Changes in AutoCI correlated well with changes in TDCI (R^2=0.44, concordance coefficient=95.7), as did changes in PuCCI versus changes in PiCCI (R^2=0.99, CC=93.4%). Changes in PiCCI and PuCCI induced by an intervention correlated well with each other (R^2=0.86, CC=100%). The percentage error (PE) obtained by Bland and Altman analysis and R^2 for the different comparisons are presented in Table 1. ***Conclusions*** The preliminary results indicate that in unstable critically ill patients, CI can be reliably monitored with Pulsioflex technology via a femoral line. Moreover the PulsioFlex was also able to keep track of changes in CI. Although TDCI remains a gold standard for the measurement of CI in ICU patients, PulsioFlex noncalibrated and less invasive monitoring (via a radial line) may provide useful information.

Table 1. Results of Bland and Altman analysis. PE: percentage error, CCI: continuous cardiac index, R^2: Pearson correlation coefficient, TD-Pi: thermodilution *vs* PiCCO, TP-Pu: thermodilution *vs* pulsioflex, n: numer of measurements

Pulsioflex	Auto Cal	PE (CCl) (%)	*n*	R^2	PE (TD-Pi) (%)	*n*	R^2	PE (TD-Pu) (%)	*n*	R^2
All	All	37.9	940	0.73	22.8	382	0.88	38.5	382	0.66
All	Yes	43.4	510	0.50	20.4	210	0.88	42.3	210	0.47
All	No	27.8	430	0.83	25.6	172	0.85	32.5	172	0.74
Fem	All	30.6	464	0.73	20.2	192	0.88	33.0	192	0.66
Rad	All	44.2	476	0.58	25.2	190	0.85	43.7	190	0.56

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Preliminary results of an ongoing prospective study on the use of noninvasive hemodynamic monitoring with Nexfin® for hemodynamic pattern recognition and outcome prediction in critically ill patients

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Introduction Non-invasive hemodynamic monitoring may become a new tool in the armamentarium of the intensive care unit. The few studies carried out so far have yielded conflicting results regarding the applicability and reliability of a continuous non-invasive analysis of finger blood pressure waveform using an inflatable finger cuff. There have been no studies investigating correlation of non-invasive finger arterial pressure monitoring with outcome in intensive care patients. We used the Nexfin® monitor (BMEYE, Amsterdam, The Netherlands), which is based on the volume-clamp principle of Penaz (1973) in combination with the physiocal criteria of Wesseling (1995). ***Aim*** The aim of the present study was to validate the Nexfin® in a mixed population of medical ICU patients and to look for a pattern recognition that may be linked with outcome. ***Methods*** Interim results of a prospective ongoing study in 77 patients admitted to the medical ICU (46 patients mechanically ventilated, M/F ratio 1/1). Age 65.6±15.9, BMI 25.6±4.8, APACHE II

score 22.9±10.9, SAPS II 48±20.1, SOFA score 7.5±4.5. A modified outreach score (SOS) was calculated on admission. For all patients, simultaneous recording of arterial pressure by radial line (n=78), PiCCO (n=44) or by NIBP with arm cuff (n=47) was compared with the Nexfin monitor. Statistical analysis was performed with Student's t test, Pearson correlation and Bland-Altman analysis. ***Results*** A total of 103 measurements in 77 patients were performed. In seven patients measurement with Nexfin was not possible. For CO (55 paired measurements), values were 6±2.1 L/minute (range 2.6—12). Pearson's correlation coefficient comparing Nexfin-CO with reference CO showed a good correlation (R^2=0.52). Bland-Altman analysis comparing both CO techniques revealed a mean bias±2SD (LA) of 0.3±3.6 L/min (58% error). The MAP was 84.2±15.6 mmHg (53—131.5) and values obtained with the Nexfin correlated well with the reference method with an R2 of 0.72. Bland-Altman analysis comparing both MAP techniques revealed a mean bias±2SD (LA) of -0.3±18 mmHg (20.9% error). However, Nexfin-MAP did not correlate well with NIBP (R^2=0.36). Hemoglobin values obtained with Nexfin Massimo technique did not correlate well with laboratory values (R^2=0.26, 33% error). The 26 patients that died in the ICU had higher APACHE II (p=0.017), SAPS II (p<0.0001), SOFA (p<0.0001) and SOS (p=0.004) scores and significantly lower MAP (p<0.0001), hemoglobin (p=0.01) and lower dp/dtmax (p=0.003), a marker for contractility. There were no outcome differences with regard to subgroup analysis in patients with either low or high CO or SVR. ***Conclusions*** In unstable critically ill patients, MAP (and CO) can be monitored with the Nexfin. The exact patient population for this technology has yet to be defined and more patients are probably needed for pattern recognition, although the results indicate that low MAP and dp/dtmax are associated with poor outcome. In the future, Nexfin data could theoretically be incorporated in a new outreach score.

Differences between room-temperature *vs* iced saline indicator injection for transpulmonary thermodilution

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Background Cardiac index (CI) is a cornerstone of goal-directed therapy. Ice-cold injectate is assumed to provide best accuracy of transpulmonary thermodilution (TPTD)-derived CI, global end-diastolic volume index (GEDVI) and extravascular lung-water index (EVLWI). Room-temperature injectate might facilitate TPTDs outside the ICU, e.g. in the operating room. However, this is substantiated by few data. Therefore, this study compares TPTD-results derived from iced injectate (TPDTIced) with room-temperature injectate TPTDs (TPTDRoom). ***Materials and methods*** 26 adult mixed ICU-patients with PiCCO-monitoring (Pulsion Medical Systems, Munich, Germany) were included in this observational study. There were 14 medical patients, 8 postoperative, and 4 other (1 with trauma, 1 with severe burns and 2 with intoxication). In total, 26 sets of TPTDs were recorded. Each set consisted of six 20 mL TPTDs (three times with room temperature 22°C and subsequently three times with ice-cold 4°C saline). Means of the three room-temperature TPTDs were compared with the means of the three cold TPTDs (primary endpoint; Bland-Altman analysis corrected for repeated measurements). To analyse a possible loss of indicator remaining in the venous catheter during 1st injection, means of 1st warm and 1st cold measurements were compared to means of the 2nd measurements. ***Results*** The mean age was 57±18 years, BMI 27.6±7.5, weight 79.1±21.8 kg, male to female ratio 1/1. Sixteen patients were mechanically ventilated, 3 were on noninvasive MV and 6 on CVVH. In total, 11 patients received norepinephrine at a dose of 0.2±0.3 ug/kg/min and 9 received dobutamine at a dose of 5.7±4.2 ug/kg/min. Mean injectate temperature was 23.4±1.6 *vs* 4.5±2.6°C (p=0.0003). Mean CI (4.0±1.0 *vs* 3.8±1.0 L/min×m^2; p=0.0003), GEDVI (804.7±190.6 *vs* 766.2±198.2 mL/m^2; p=0.002), and EVLWI (10.5±3.4 *vs* 9.5±3.6 mL/kg; p=0.0003) were significantly higher for TPTDRoom compared to TPTDIced. Mean bias and percentage errors for CI, GEDVI and EVLWI were 0.2±0.28 L/min×m^2 and 14.2%, -49.23±71.22 mL/m^2 and 18.1% and -0.51±0.68 mL/kg and 13.3%, respectively. Means of first warm and first cold measurement significantly exceeded means of second measurements for CI (3.9±1 *vs* 3.8±1 L/min×m^2; p=0.008) and GEDVI (799.1±194.5 *vs* 778.7±191.5 mL/m^2; p=0.005), but not for EVLWI (10.3±3.5 *vs* 10.2±3.4 mL/kg; p=NS). ***Conclusions*** TPTDRoom results in slight, but significant overestimation of CI, GEDVI and EVLWI. In routine, bias and PE values are acceptable for CI and EVLWI. Loss of indicator within the catheter may result in significant (albeit clinically irrelevant) overestimation of 1st measurements of CI and GEDVI.

Relation between body anthropomorphy and baseline intraabdominal pressure measurements in critically ill patients

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Introduction Previous studies showed a correlation between intraabdominal-pressure (IAP) and body anthropomorphic data like sagittal-abdominal-diameter and body-mass-index (BMI) [1, 2]. ***Aim*** The aim of this study is to examine possible relations between other body parameters and baseline IAP in critically ill patients. Furthermore, this study will also compare gastric versus bladder pressure measurements. ***Patients and methods*** Prospective study in 81 mechanically-ventilated patients equipped with a Foley bladder catheter connected to a FoleyManometer (Holtech Medical, Charlottenlund, Denmark) and a CiMON balloon-tipped nasogastric probe that records endexpiratory (IAPee), endinspiratory (IAPei) and mean IAP (IAP) (Pulsion Medical Systems, Munich, Germany). Intraabdominal-hypertension (IAH) is defined as an IAPee above 12mmHg and IAP is defined as IAPee-IAPei. Comparison of bladder (IBP) and gastric (IGP) pressure measurements was done with Pearson correlation and Bland and Altman analysis. The following body anthropomorphic parameters were measured: distances (ear-xiphoid, ear-nose, xiphoid-pubis, and ribcage-crista), diameters (rib cage, umbilical, waist, and hip), circumference (rib cage, abdominal, waist, and hip), height (patient, rib cage, hip, and sagittal abdominal diameter). ***Results*** SAPS-II was 56.1±13.3; APACHE-II 27.1±9.9, SOFA 11.3±5.4; age 57.6±14.4; height 174±9.4cm; weight 84.4±20.4; BMI 27.9±7.1. The M/F-ratio was 2/1. IAPei was 14.5±4.4 mmHg; IAPee 10.5±3.2; IAP 12.2±3.8, IBP 10.5±3.8 and IAP 4.0±1.6. In patients with IAH (n=48) SAPS-II score was higher (58.2±12.4 *vs* 53±14.3; p=NS), as was SOFA score (12.4±5.5 *vs* 9.9±4.9; p=0.07). The BMI was also higher in IAH (29.1±8.2 *vs* 26±4.1, p=0.05). The IAP was significantly higher in IAH: 4.7±1.5 *vs* 2.8±0.8 mmHg (p<0.0001). We found a positive correlation between IAP and ΔIAP, suggesting a lower abdominal wall compliance (Cab) the higher the IAP: ΔIAP=0.31×IAP+0.23 (p<0.001, R^2=0.536). The following body parameters were significantly higher in patients with IAH: IAPmean (14.6±2.6 *vs* 8.7±2.1 mmHg), rib cage diameter (39.3±5.1 *vs* 37.1±5 cm p=0.07), umbilical diameter (42.1±6.8 *vs* 39.6±5.7 cm, p=0.09), abdominal perimeter (119±16.9 *vs* 107.2±12.3 cm, p=0.0015), waist circumference (105.4±14.4 *vs* 99±10.7 cm, p=0.04), the convex xiphoid to pubis distance (39.8±6.9 *vs* 35.5±4.9 cm, p=0.004), rib cage height (23.2±3 *vs* 20.6±4.2, p=0.0018), sagittal abdominal diameter (27.8±3.7 *vs* 22.9±4.3 cm, p<0.0001), Patients with IAH had higher alveolar plateau pressures (28.8±5.3 *vs* 24.4±4.5 cmH_2O, p=0.0007) and higher PEEP (9.6±3.1 *vs* 8±2.7 cmH_2O, p=0.03). Patients with IAH had lower abdominal and respiratory compliance (respectively 143.5±58 *vs* 209.9±68.8, p=0.0001 and 32.9±9.6 *vs* 38.8±12.9, p=0.03). Significant differences were observed between men and women. There was a significant Pearson correlation between IBP and IGP (Fig. 1): IBP=1.1×IGP+0.96 (R^2=0.91, p<0.0001). Bland and Altman analysis comparing IGP and IBP at endexpiration showed a mean bias of 1.5±1.1 mmHg. The mean IAP was 11.1±3.4 mmHg (4.4—19.5 with coefficient of variation of 30%). The limits of agreement were small from -0.7 to 3.7 mmHg resulting in a percentage error of 19.5% (Fig. 2). ***Conclusion*** Patients with IAH have increased abdominal perimeter, convex

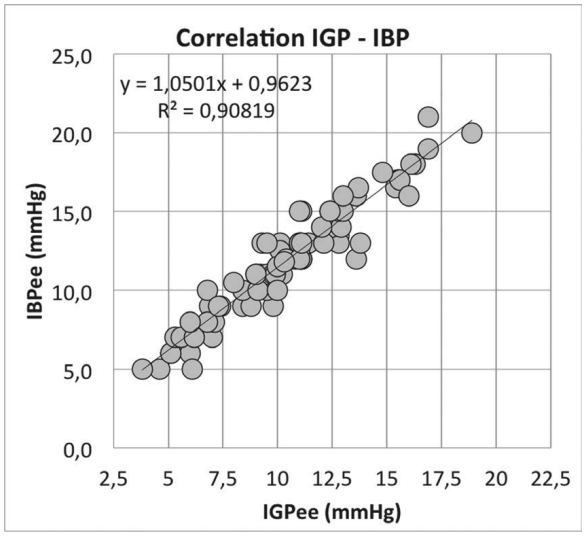

Fig. 1. Pearson regression plot comparing intragastric and intrabladder pressure

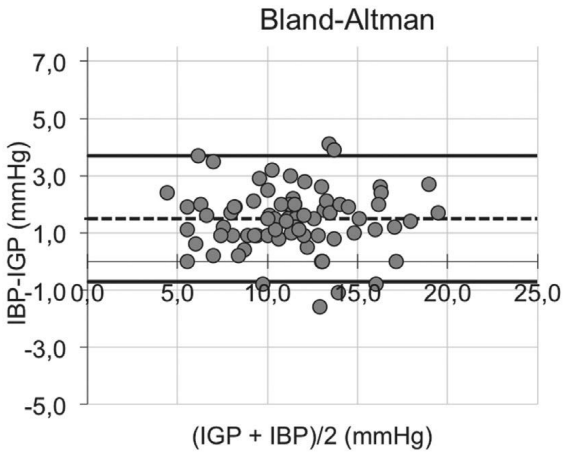

Fig. 2. Bland and Altman plot comparing intragastric and intrabladder pressure

xiphoid-to-pubis distance, rib cage height and diameter, hip height and diameter and sagittal abdominal diameter. Female patients have significantly different body measurements. High IAP is related to IAP. Body anthropomorphy plays a role in the abdominal wall compliance and the way the patient's IAP behaves in relation to increased intraabdominal-volume. In our patient sample we found a good correlation between IGP and IBP when measured at endexpiration in supine position.

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Comparison of bio-electrical impedance analysis in healthy volunteers and critically ill patients

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Introduction Little is known of the water content composition in critically ill patients. Recent studies advocate the use of crystalloids over colloids, but this may lead to extravascular fluid accumulation. Massive fluid resuscitation, which is recommended as the initial goal directed treatment for septic shock, may lead to an increase in extracellular water (ECW), intracellular water (ICW) and total body water (TBW) content, because of the presence of vascular endothelial hyperpermeability with capillary leak [1, 2]. Recent studies show that BIA may provide additional information to the fluid balance [3]. ***Aim*** The aim of this study is to compare the variables that can be obtained with bioelectrical impedance analysis (BIA) in healthy volunteers and critically ill patients. ***Methods*** Retrospective data-analysis of 21 BIA measurements that were obtained in 15 critically ill patients and compared with the data collected in 25 healthy individuals (nurses and doctors). Fluid volume excess (VE), TBW, ECW, ICW and the ECW/ICW ratio were measured by whole-body BIA using the BioScan 920-II multi-frequency analyser (Maltron International, Essex, United Kingdom). Prior to examinations, patients` weight and body mass index were measured. Two electrodes were placed on the wrist (proximally to the metacarpophalangeal joint and on the wrist) and 2 on the ankle (proximally to the transverse metatarsal arch on the superior side of the foot). Bioimpedance was measured at 4 frequencies of 5, 50, 100 to 200 kHz in supine body position. ***Results*** The patients were older (67.9±12 *vs* 34.8±11.2 years, $p<0.0001$) and heavier (83.6±11.8 *vs* 71±21 kg, $p=0.01$) with higher body mass index (29.2±5.1 *vs* 23.7±5.1, $p=0.0007$) than the healthy volunteers. Significant differences were observed in body water composition between patients and healthy individuals. Patients had higher values for TBW (45±7.7 *vs* 38±9.7 L, $p=0.01$), ECW (24.1±5.4 *vs* 16.9±5.3 lts, $p<0.0001$) and ECW/ICW ratio (1.2±0.2 *vs* 0.8±0.2, $p<0.0001$) while ICW was

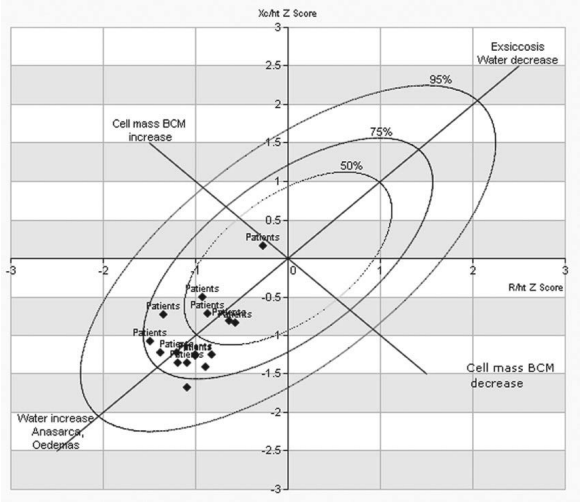

Fig. 1. Bioelectrical impedance vector analysis in patients

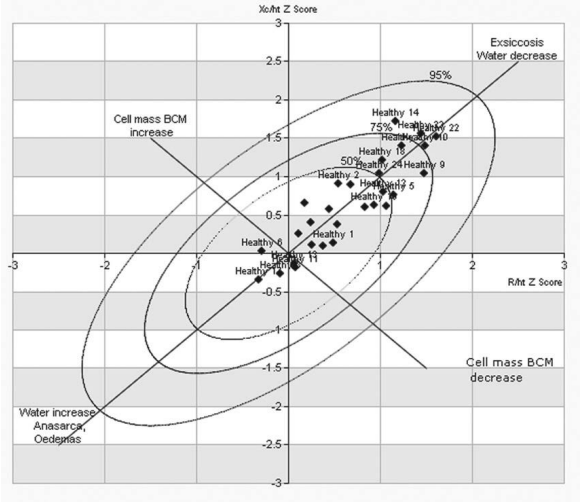

Fig. 2. Bioelectrical impedance vector analysis in healthy volunteers

lower 20.9±3.8 *vs* 21.2±5, *p*=NS). Patients had a VE of 7.8±5.7 *vs* -0.2±0.6 L in healthy volunteers ($p<0.0001$). There were no significant differences in protein, mineral, muscle, glycogen mass and dry weight. The distribution of individual impedance vectors in patients (Fig. 1) showed that 75% of cases were located outside the 50% percentile ellipse in the lower left quadrant (water excess, anasarc oedema) compared to 0% of the healthy volunteers (Fig. 2). ***Conclusions*** BIA analysis allows to obtain a good idea of body water composition in critically ill patients and this may help the clinician to guide fluid resuscitation and de-resuscitation.

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Comparison of indirect calorimetry with Quark RMR and M-COVX calorimeters in critically ill patients

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Introduction Indirect calorimetry has been suggested for calculation of caloric needs in critically ill patents. Little is known about direct comparison of different techniques. Different bedside monitors are available and the Quark RMR and the M-COVX are both based on indirect calorimetry. In the past the M-COVX has been compared with the Deltatrac [1] and the Deltatrac has been compared with the Quark RMR [2], but to the best of our knowledge, a direct comparison between the M-COVX and the Quark RMR has not been performed yet. The Quark RMR is considered the gold standard (the previous gold standard being the Deltatrac) [1] and it is a new generation metabolimeter designed to measure resting energy expenditure (REE) through indirect calorimetry provided in a compact bedside solution. It is designed to accurately and instantaneously measure energy requirements of either spontaneously breathing or mechanically-assisted patients. ***Aim*** Comparison of calculation of total caloric needs with 2 devices, the M-COVX (Datex Ohmeda, Helsinki, Finland) and the Quark RMR (Cosmed, Rome, Italy). ***Patients and methods*** Retrospective analysis of data on 11 measurements obtained in 8 mechanically ventilated patients. ***Results*** The APACHE-II score was 20.1±7.7, SOFA score 6.6±3.1. All patients were intubated and mechanically ventilated. Patient demographics were as follows: body weight 78.6±12.2 kg, height 171.4±7.5 cm, body mass index 26.8±4.2, body surface area 1.9±0.2 $m^{2,}$ ideal body weight 64.9±8.6 kg and lean body weight 55.6±7.4 kg. The average REE caloric needs were 1490±307 kcal with the Quark RMR and 1813±223 kcal with the M-COVX. The Pearson correlation comparing Quark with M-COVX was significant (R^2=0.4, $p<0.01$): M-COVX=0.46×Quark+1092 kcal. The average caloric needs were 1692±241 kcal (range 1215—1937) with a coefficient of variation of 14.2%. The Analysis according to Bland and Altman showed a systematic overestimation by M-COVX with a mean bias of 243±239 kcal with lower limit of agreement of -236 kcal and upper limit of agreement of 722 kcal and a percentage error of 28.3%. ***Conclusions*** Indirect calorimetry with M-COVX showed a systematic overestimation with 243 kcal of the REE daily caloric needs. Further studies are needed to validate these results

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Intraoperative crystalloids therapy increases intraabdominal pressure and extravascular water content, but not intracellular water content – pilot study

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Introduction Crystalloids are often used as the main intraoperative therapy in patients undergoing spinal anaesthesia. However, the uncontrolled infusion of crystalloids may lead to tissue oedema resulting in an increase in intraabdominal pressure (IAP). ***Aim*** The aim of the present study was to analyse the effect of crystalloid infusions on body water content and IAP. ***Methods*** Adult patients undergoing orthopaedic surgery under spinal anaesthesia were studied. The IAP was measured via the urinary bladder with the gold standard technique. The IAP, total body water content (TBW), extracellular water content (ECW) and intracellular water content (ICW) were measured at four time points: just before anaesthesia (baseline), just after surgery completion, three hours after surgery completion, and on the morning of the first postoperative day. The TBW, ECW and ICW were measured using whole body bioelectrical impedance analysis. In all patients, spinal anaesthesia related perioperative hypotension was treated with crystalloid infusion. In patients not responding adequately to crystalloid infusion, a single intravenous dose of 25 mg ephedrine hydrochloride (Ephedrini, Polfa, Poland) was used. Patients, who required colloids or blood infusion were excluded. ***Results*** Forty patients aged 19 to 81 years were studied. In all patients, the early postoperative period was uneventful and massive fluid resuscitation was not necessary. The mean intraoperative crystalloid volume was 3135±1650 mL and the mean postoperative fluid balance was 2823±3046 mL. The mean duration of anaesthesia was 172±103 min. Perioperative crystalloid infusion significantly increased IAP from 6±2 mmHg to 8±3 mmHg (p<0.01). Moreover, crystalloid infusion increased TBW (p<0.01) and ECW (p<0.001). Crystalloids infusion did not affect ICW. ***Discussion*** Perioperative inflammatory response increases perivascular fluid shift and may result in tissue oedema, particularly bowel oedema and subsequent increase in IAP [1, 2]. A significant increase in IAP was observed after infusion of 3500 ml/day [3]. Others suggested that the administration of 0.35 L/kg body weight per day of crystalloids increased IAP to grade III, whereas 0.475 L/kg body weight increased IAP to grade IV [4]. In the present study we documented, that 3000 mL of crystalloids (41 mL/kg body weight/3 hours) affected IAP, TBW and ECW. Conclusion Intraoperative crystalloid infusion increases IAP, TBW and ECW but did not affect ICW. The use of bio-electrical impedance analysis can guide the clinician during fluid resuscitation.

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Acute effects of different resuscitation fluids on renal hemodynamics, microcirculatory oxygenation, inflammation, oxidative stress, and renal function in a rat model of endotoxemia

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Introduction In the early stage of sepsis, impairment of the renal microcirculation is a key complication potentially leading to renal failure through hypoxia-induced tubular epithelial cell injury and acute tubular necrosis. Fluid resuscitation during sepsis is considered crucial for the preservation of adequate intravascular volume and blood pressure and thereby promotion of microvascular perfusion and renal oxygenation. As most solutions do not exactly plasma-matched, liberal fluid resuscitation regimes might lead to non-physiologically high ion concentrations and may be associated with the development of metabolic acidosis. This in turn could affect inflammatory and coagulation homeostasis and thereby deteriorated organ function. This insight has led to development of modern preparations based on balanced, plasma-adapted solutions and to the idea of developing a totally balanced fluid resuscitation concept. However, whether these new, balanced fluids are able to improve renal oxygenation, inflammation, oxidative stress, and ultimately, renal function under septic conditions remains to be elucidated where titration of an optimal dose is still an area of uncertainty. ***Aim*** The aim of this study was therefore to investigate the acute effects of two "balanced" resuscitation solutions, a crystalloid based one and a colloid based solution and saline as an unbalanced solution. We investigated their effects on renal physiology, immunology, and biochemistry in a rat model of LPS-induced endotoxemia. Hemodynamic and microvascular responses to the different fluids were assessed early and late. At the end of the experiment animals were sacrificed and immunohistochemistry and functional renal parameter evaluated. ***Material and methods*** Rats were randomized in 5 groups (n=6 per group) to receive intravenous administration of 10 mg/kg lipopolysaccharide (LPS; Escherichia coli A127:B8, Sigma, Paris, France) or vehicle (time control) in 30 min. An amount of 30 ml/kg/hr Volulyte® 6%, 30 ml/kg/hr, AQIX®RS or 30 ml/kg/hr of 0.9%NaCl was continuously given for a period of 180 min after shock (defined as a MAP of about 40 mmHg being reached after LPS) was reached. Time points were defined as T0 prior to LPS infusion, T1 at beginning of fluid resuscitation, T2 30 min after fluid resuscitation and T3 180 min after fluid resuscitation. The study also consisted of a time control and a LPS group without resuscitation. Besides the standard hemodynamic measurements and clinical chemistry, oxygen tension in the renal cortex (CμPO2), outer medulla (MμPO2), and renal vein were measured using oxygen-dependent quenched phosphorescent lifetimes of Oxyphor G2. Renal blood flow (RBF) was measured using ultrasound Doppler. Renal oxygen delivery (DO2ren) and renal oxygen consumption (VO2ren) were calculated. Oxidative stress (MDA) and nitrosative stress (NO) was assessed in renal tissue homogenates. Renal function and injury was assessed by immunohistochemistry labeling of iNOS, IL-6, NGAL and FABP. ***Results*** Of the fluids tested Volulyte® 6% was most effective in improving MAP especially at immediate resuscitation (T2: ++$p<0.01$) and RBF at early (T2: +++$p<0.001$) and late resuscitation (T3: ++$p<0.01$) time periods following shock in comparison to the other fluids. Crystalloid solutions showed a significant improvement in MAP value at T3 (+$p<0.05$) but not in RBF with respect to the LPS group. Of the solutions 0.9% NaCl and AQIX®RS caused the most renal vasoconstriction. In addition Volulyte® 6% also improved the DO2 and VO2 at T2 (++$p<0.01$) compared to the LPS group and was marginally improved at T3. However, despite these macrocirculatory benefits, they not result in improved cortical and medullar microvascular oxygen levels. Furthermore, while elevated value of the plasma lactate level was increased by colloid administration in comparison to the LPS group at T3 (+$p<0.05$), lactate levels decreased after crystalloids administration (NaCl: ++$p<0.01$ and AQIX®RS: +$p<0.05$) at T3. Interestingly, oxidative stress levels as measured by tissue MDA level of the LPS group (*$p<0.05$) was increased by resuscitation with Volulyte® 6% (+$p<0.05$) but nitrosative stress as measured by NO levels was not significantly changed in LPS and LPS group received Volulyte® 6% .with respect to Control On the other hand 0.9%NaCl caused a significant increase in NO levels in kidney (*$p<0.05$) of all resuscitation fluids tested in comparison to Control group. Crystalloids showed no significant differences in MDA levels compaired to the LPS group. None of the fluids tested improved the increased creatinine levels induced by LPS administration. In addition none of the fluids tested significantly improved the inflammatory and parameters related to renal injury as measured by immunohistochemistry. Our results suggest that administration of different doses of fluids would have made a difference in the results since no consensus exists for the administration of the optimal dose of fluid in sepsis. ***Discussion*** This study showed that the use of a colloid solution was effective in an initial resuscitation in an endotoxemia setting in comparison to crystalloid solution in relation to systemic and renal hemodynamic parameters including renal oxygen delivery and consumption. On the other hand, both 0.9%NaCl and AQIX®RS showed beneficial effect on the MAP but not on RBF and renal oxygenation parameters at the late resuscitation phase. Administration of fluids at the given dose did not significantly affect inflammatory or functional parameters related to kidney function. ***Conclusions*** Our results strongly suggest that, timing, dose and type of the fluid and severity of shock determine the success of resuscitation. That is why new resuscitation targets may be needed possibly targeting the microcirculation. Our results also suggest that in addition to fluids other supportive therapeutic approaches are needed to control oxidative, nitrosative and inflammatory activation associated with septic AKI.