The effect of goal-directed crystalloid versus colloid administration on postoperative brain natriuretic peptide– A randomized controlled clinical trial

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Background: Brain natriuretic peptide (BNP), a marker of hemodynamic volume overload is released predominately from ventricular cardiac myocytes during increased ventricular wall stress.(1) Elevated postoperative BNP levels are associated with a higher risk of postoperative cardiac morbidity and mortality.(2) The aim of goal-directed fluid therapy is optimization of cardiac performance in order to improve postoperative outcome and reduce hospital length of stay.(3) It remains unclear if various perioperative fluid management strategies affect myocardial wall stress differently and thus modulate postoperative BNP release. Under the assumption of a fluid sparing effect we specifically tested the hypothesis that postoperative BNP release is significantly increased after goal-directed crystalloid administration compared to goal-directed colloid administration.

Methods: With IRB approval and informed consent we enrolled 56 patients undergoing open major abdominal surgery. All patients received standardized general anesthesia with a baseline infusion of lactated Ringer’s solution (LR). Patients were than randomly assigned to additional fluid boluses of 250 mL of LR or hydroxylethyl starch (HES) 6% 130/0.4 (Voluven®, Fresenius Kabi, Bad Homburg, Germany). Fluid administration was guided by esophageal Doppler monitoring (Cardio Q®, Deltex Medical Group PLC, Chichester, UK) using corrected aortic flow time and stroke volume according to a previous published algorithm. (3)

Baseline plasma BNP was assessed immediately after induction of anesthesia. Further measurements were performed at the end of surgery, on postoperative day 1 and 2.

Results: 29 patients were randomly assigned to the crystalloid group, while 27 patients received additional colloids. There was no significant difference in patient characteristics. As to be expected patients in the crystalloid group received significantly more LR than those in the colloid group (3250mL [2461, 4216] vs. 1737mL [1091, 2474], P < 0.01). Patients assigned to colloids obtained 1250mL [750, 1750] of HES solution. The overall amount of administered fluid within the first 3 postoperative days was nearly identical between both study groups. (8502 Â± 3306mL in the LR group vs. 8456 ± 2262mL in the colloid group, P = 0.95).

Except for stroke volume, which was higher in the colloid group (87mL Â± 18 vs.76mL Â±19; P = 0.04), no differences were observed in hemodynamic data including cardiac output (P = 0.13), heart rate (P = 0.86) and mean arterial pressure (P = 0.12)

A significant increase of maximum postoperative plasma BNP concentration compared to baseline measurement was assessed in the crystalloid group (P < 0.01) and the colloid group (P < 0.01).
There was no significant difference in baseline plasma BNP in both groups. The calculated Area Under the Curve (AUC) of postoperative plasma BNP concentration was 607pg/mL [213, 925,8] in the crystalloid group and 392pg/L [267, 771,4] in the colloid group and was not significant different between both groups (P = 0.52).

Conclusion: A colloid based intraoperative goal-directed fluid regimen does not affect postoperative plasma BNP concentration compared to the use of goal-directed crystalloid infusion in patients undergoing major abdominal surgery.

References: