

RENAL PERFUSION, FUNCTION AND OXYGENATION AFTER MAJOR SURGERY AND IN SEPTIC SHOCK

Akademisk avhandling

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av

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Avhandlingen baseras på följande delarbeten

- I. Skytte Larsson J, Bragadottir G, Krumbholz V, Redfors B, Sellgren J, Ricksten SE.
Effects of acute plasma volume expansion on renal perfusion, filtration, and oxygenation after cardiac surgery: a randomized study on crystalloid vs colloid.
British Journal of Anaesthesia, 115 (5): 736–42 (2015)
- II. Skytte Larsson J, Bragadottir G, Redfors B, Ricksten SE.
Renal function and oxygenation are impaired early after liver transplantation despite hyperdynamic systemic circulation.
Critical Care (2017) 21:87
- III. Skytte Larsson J, Bragadottir G, Redfors B, Ricksten SE.
Renal effects of norepinephrine-induced variations in mean arterial pressure after liver transplantation: a randomised cross-over trial.
Submitted
- IV. Skytte Larsson J, Bragadottir G, Krumbholz V, Redfors B, Sellgren J, Ricksten SE.
Renal blood flow, glomerular filtration rate and renal oxygenation in early clinical septic shock.
Submitted



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Abstract

Background:

Acute kidney injury (AKI) is a common and deleterious complication to severe illness and major surgery, resulting in increased morbidity and mortality. The pathophysiology of, and hence the possibilities to prevent, AKI is not well understood. The aim of this thesis was to increase the knowledge on renal pathophysiology and preventions of AKI after major surgery and in early clinical septic shock.

Patients and methods:

Patients were studied in the intensive care unit (ICU) immediately after surgery and 24 hours from admission to ICU with septic shock. We studied the renal effects of crystalloid vs colloid fluid as plasma volume expander after cardiac surgery (paper I, n=30), renal physiology and the effects of target mean arterial pressure (tMAP) on renal variables after liver transplantation (paper II n=12, and II n=10), and renal physiology in early clinical septic shock (paper IV, n=8). Control groups from previous studies were used in papers II (n=73) and IV (n=58). A renal vein thermodilution catheter and PAH were used to measure renal blood flow (RBF), glomerular filtration rate (GFR) and renal oxygenation.

Results:

Neither crystalloid nor colloid fluid as plasma volume expander after cardiac surgery increases renal oxygen delivery (RDO₂). The use of crystalloid, but not colloid, fluid results in an increased GFR but impairs renal oxygenation. There is a reduction in GFR, compared to the preoperative value, immediately after liver transplantation. Compared to the control group, GFR and RBF/CI are lower but RBF and RVO₂ are higher after liver transplantation compared to after cardiac surgery. A norepinephrine-controlled tMAP of 75 mmHg in liver recipients results in increased RBF, RDO₂, GFR, and RVO₂ compared to at tMAP 60 mmHg. RO₂Ex is equal between tMAP 60 and 75 mmHg. In early septic shock, GFR, RDO₂, RBF and RBF/CI are lower, but RVO₂ unchanged, when compared to the control group, resulting in a higher RO₂Ex.

Conclusions:

Treatment of hypovolemia with a bolus dose of crystalloid fluid impairs renal oxygenation after uncomplicated cardiac surgery. GFR is reduced directly after liver transplantation, most likely caused by renal efferent vasodilation. RVO₂ for basal metabolism is increased in liver recipients. RBF and GFR are pressure-dependent at a tMAP <75 mmHg, due to the loss of renal auto regulation, after liver transplantation. In septic shock, blood is directed away from the kidneys due to an increased renal vasoconstriction. This results in impaired renal oxygenation and a tubular injury.

Keywords: Acute kidney injury, glomerular filtration rate, renal oxygenation, liver transplantation, septic shock