Nr 1

No favorable impact of Retrograde Autologous Priming (RAP) on transfusion requirement: a pilot study

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**Background:** Hemodilution associated with cardiopulmonary bypass (CPB) exerts the risk for blood transfusion and volume overload. Priming of the CPB circuit with patients’ own blood – Retrograde Autologous Priming (RAP) limits hemodilution and has potential of reducing transfusion requirements.

**Aim:** The aim of the study was to investigate if RAP reduced the need for Red Blood Cell (RBC) transfusion and evaluate a possible impact on hemoglobin levels during and after cardiac surgery.

**Method:** Thirty patients undergoing coronary artery bypass grafting and/or aortic valve replacement were randomly allocated to standard priming (STP) or RAP. Priming volume removed in the RAP group amounted to 600 ml. A benchmark for RBC transfusion was a hemoglobin concentration < 8.0 g/dl. Allogeneic RBC transfusion and hemoglobin values were evaluated both per- and postoperative.

**Result:** No difference in transfusion requirement

**Conclusion:** RAP has potential of reducing hemodilution during CPB but revealed no favorable impact on transfusion rate or hemoglobin levels during the subsequent postoperative process.

Nr 2

Lower inflammatory activation of retransfused residual blood with the Ringer Wash-In technique

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**Background:** The residual blood in the cardiopulmonary bypass (CPB) circuit has been shown to contain high levels of cytokines and complement. Different techniques are used to retransfuse the blood after weaning. It is common to empty the blood into an infusion bag and give it to the patient as a direct infusion (DI). An alternative is to wash in the residual blood through the heart-lung machine with Ringer’s acetate (RWI)

**Aim:** Our aim was to assess differences in the blood in inflammatory activation and bacterial contamination between these two techniques.

**Methods:** 40 patients undergoing coronary artery bypass graft surgery with CPB were randomized to receive the residual blood either as a DI or through the RWI- procedure. The degree of inflammation was assessed by measuring interleukin-6 (IL-6), IL-8, the chemokine interferon gamma-induced protein 10 (IP-10) and complement activation. Cultures were taken from the CPB circle before weaning and from the retransfused blood. Results are mean ± SD, non-parametric tests were used.

**Results:** Higher levels of IL-6 and IL-8 was found in the DI blood compared to the RWI blood (IL-6; DI 363±116 vs RWI 72±65 µg/L; p=0,03), IL-8 DI 143±99 vs RWI 88±60 µg/L; p=0,056). IP-10 was higher in the RWI blood (DI; 2029±1673 vs RWI; 2537±1207 µg/L; p=0,03) although the complement levels were comparable between the groups.
Positive cultures were found in 11 patients before weaning (DI; 4, RWI; 7 p=0.29) and in 16 samples in the retransfused blood (DI; 11 RWI; 5 p=0.053). There were no differences in inflammatory mediators 4 hours postoperatively or in procalcitonin 5 days after surgery (DI; 0.86±5.5 vs RWI; 0.65±1.1 µg/L; p=0.43).

**Conclusions:** Residual blood retransfused through the CPB circuit with RWI technique has lower cytokine levels than with DI. The DI retransfused blood shows a high percentage of bacterial contamination.

**Nr 3**

**Predisposing factors of mid-term mortality following surgery with antegrade cerebral perfusion in acute type A aortic dissection**

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**Background:** Acute type A aortic dissections are associated with significant morbidity and mortality. Cerebral insults can occur secondary to the disease or the operative technique. This study aimed to identify whether verified cerebral infarctions are a predisposing factor of mid-term mortality in a single centre cohort of Norwegian patients.

**Material and methods:** In the period 2007-2014, 107 patients with acute type A dissection underwent surgery. Of these, 83 operations were performed with deep hypothermic circulatory arrest and antegrade cerebral perfusion (ACP). All but eight patients were perfused bilaterally through both carotid arteries during the systemic circulatory arrest. By applying uni- and multivariate statistics the cohort was retrospectively investigated. Survival was assessed by Kaplan-Meyer analysis.

**Results:** Mean age was 61.8 (±12.8) years and 23 (27.7 %) were female. Mean operating time was 397 min, mean CPB time 257 min and mean ACP time 54 min. Arch surgery was performed in 27 (32.5 %), while only the ascending aorta was replaced in the remaining patients. Computer tomography (CT) was used to confirm recent peri- or postoperative cerebral infarctions in 27 (32.5 %). Thirty-day mortality was 16.9 %. Overall mortality was 24.1 % during follow-up of 2.8 (±2.4) years. Age and postoperative CT detection of recent cerebral events influenced on mortality (p= .025 and .009). Duration of extracorporeal circulation had a trend of predicting worse outcome, but this was non-significant.

**Conclusion:** This series of acute type A aortic dissection showed an acceptable overall mortality, with relatively frequent recent cerebral infarctions as diagnosed by CT. Age above 65 years and the presence of peri- and postoperative cerebral insults increased mortality, but no predisposing factors of the cerebral events per se were identified.

**Nr 4**

**Characterization of aortic root pressure during administration of blood- and crystalloid cardioplegia**

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**Background:** Cardioplegic solutions (blood and crystalloid) compositions are introduced into the coronary arteries to arrest the heart and protect the myocardium during cardiac
surgery. The optimal infusion pressure for cardioplegic delivery is unknown and may vary for crystalloid and blood based solution. Some studies suggest that the aortic root pressure (ARP) should be between 80-100 mmHg to achieve a good myocardial protection. The aim of the current study was to investigate and characterize the aortic root pressure during administration of blood and crystalloid cardioplegia in patients undergoing open heart surgery.

**Methods:** 14 adult patients with 3 vessel disease, undergoing elective coronary artery bypass grafting. All patients alternately received cold antegrade blood and crystalloid cardioplegia, in random order. The blood cardioplegia was given by a roller pump, and crystalloid by pressure bag. In the lines of both systems, we measured the proximal pressure, the distal pressure and the aortic root pressure during delivery of supplementary doses. All 3 pressures were measured after 20, 35 and 50 seconds. Also Hct, MAP, CVP, Tp and flow were recorded. Mean pressures were calculated, and compared.

**Results:** ARP was significantly higher during administration of blood cardioplegia. The mean ARP for blood cardioplegia was 53.3 mmHg while it was 35.8 mmHg during administration of crystalloid cardioplegia. p-value of (0.005). Pressure loss were higher in crystalloid than in blood delivery line.

**Conclusion:** Administration of cold blood cardioplegia is associated with higher, and maybe more appropriate aortic root pressure than crystalloid, in our hospital setup.

**Nr 5**

**Healthcare failure mode effect analysis of a miniaturized extracorporeal bypass circuit**

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**Objective:** The introduction of new and more advanced technology in healthcare occurs with an increasing speed. Therefore more attention is needed for safety evaluation of new devices or techniques from an end-user perspective, especially when (inter-) national perfusion safety standards are lacking. Objective was to perform a prospective risk analysis of a miniaturized bypass system to prevent or reduce the severity or likelihood of failures.

**Methods:** To evaluate the safety of the Extra Corporeal Circulation Optimized (ECCO, Sorin Group, Mirandola, Italy) bypass circuit, healthcare Failure Mode and Effect Analysis (hFMEA) was used. A multi-disciplinary team that consisted of two clinical perfusionists, a clinical physicist, a clinical physicist trainee and a technician has performed this analysis.

**Results:** The hFMEA demonstrated that failure of the bubble sensor for the electric remote clamping system on the arterial line, activated by air passing the venous bubble trap, had the highest risk score of all failure modes. This has led to the implementation of an extra level sensor in the system to prevent air passing through into the centrifugal pump.

**Conclusion:** Early identification of possible technology failures in any process or device can avoid adverse patient outcomes. The technique of hFMEA is a valuable tool to evaluate the use of high-risk apparatus, such as an extra-corporeal bypass system, in patient treatment in order to increase patient safety.