Low normal values of circulating immune cells and higher proportion of Vδ2 T-cells increase the risk for acute kidney injury after aortic surgery

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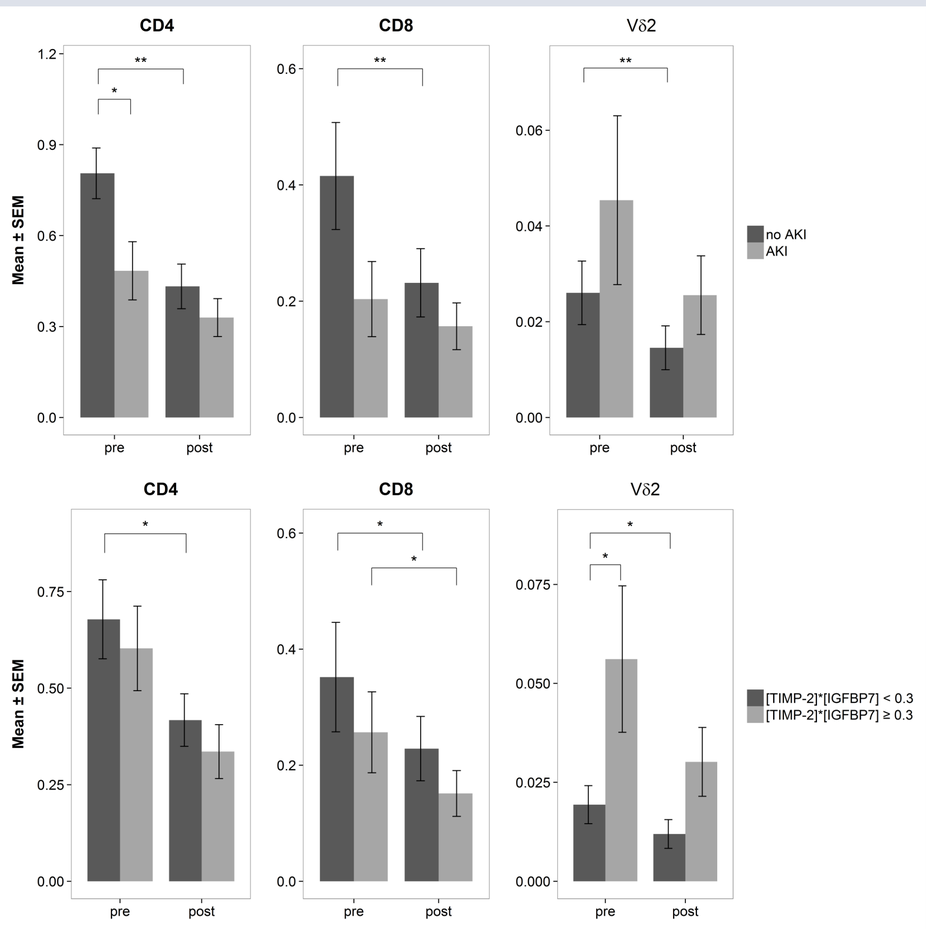
Purpose

To assess the postoperative course of tubular cell cycle arrest biomarker expression after mild ischemic-reperfusion injury and intravenous contrast during endovascular multi-branched aortic repair and to identify cellular immunological phenotype associated with tubular cellular stress and acute kidney injury (AKI).

Methods

Prospective single-center pilot study including 18 patients. Incidence of tubular cellular stress as measured by expression of cell cycle arrest biomarkers, incidence of AKI, clinical and laboratory parameters were evaluated. Robust immunological profile of 62 immune cell subsets based on flow cytometry was assessed before and 24 hours after surgery.

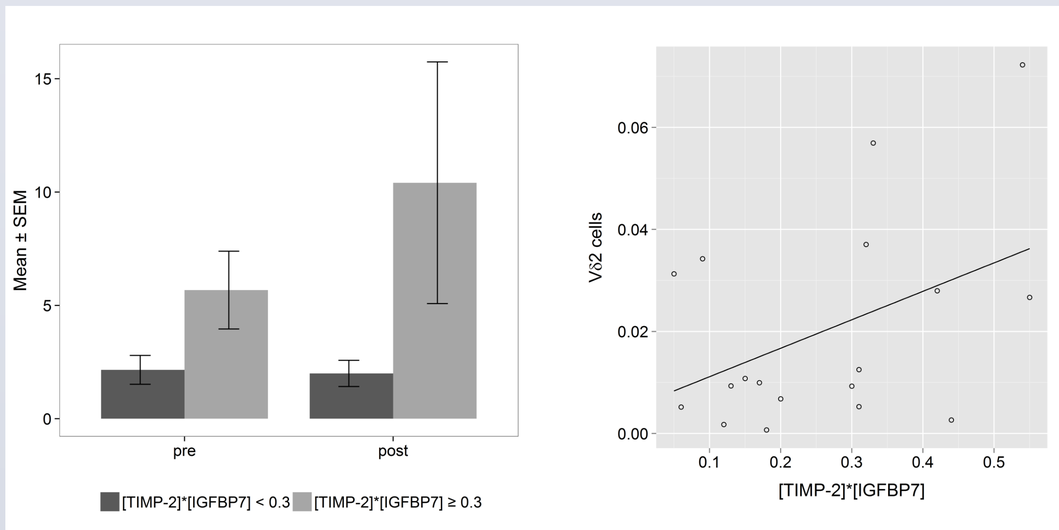
Fig 1. Comparison of T-cells subgroups showing increased absolute count of Vδ2 T-cells in patients with cellular stress and patients with AKI, while CD4 and CD 8 cells are decreased. * p<0.05, ** p<0.01



Results

Duration of surgery (p=0.03) and postoperative level of [TIMP-2]•[IGFBP7] (p=0.05) were associated with AKI. Significant early cellular immune response with decrease of absolute numbers of circulating T, B and natural killer (NK) cells within first 24 hours was detected in all patients (from 1.29 /nL (SD 0.60) to 0.81 /nL (SD 0.37), p<0.01). By contrast, only limited cellular reaction was detected in patients, who developed AKI (from 0.96 /nL (SD 0.49) to 0.73 /nL (SD 0.38), p=0.36). This was due to significantly lower cell number prior to surgery as compared to patients without AKI (1.61 /nL vs 0.96 /nL, p=0.02). Trend to increased proportion of Vδ2 T-cells was identified in patients at AKI- risk, while other T-cells decreased, showing moderate correlation between cell cycle arrest biomarker and number of Vδ2 T-cells (r=0.46, p=0.07) [Fig 1,2].

Fig 2. Increasing proportion of Vδ2 T-cells in patients with cellular stress within first 24 hours after surgery as compared to patients without cellular stress (10.4% vs 2%). There was a moderate correlation between cell cycle arrest marker and absolute count of Vδ2 T-cells (r=0.43, p=0.073).



Conclusion

Strong systemic immune response with migration of cells from peripheral blood compartment in to organs occurs within first 24 hours after surgery. Low normal pre-operative level of circulating T, B and NK cells and increased proportion of Vδ2 T-cells within first 24 hours represents the early immunological risk factors for AKI after aortic surgery.