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Leucocyte removal efficiency of cell-washed and unwashed whole blood

An in vitro study

ABSTRACT

Leukocyte filtration of the cardiopulmonary bypass perfusate after cardiac surgery has evolved as an important technique to prevent effector functions mediated by activated leukocytes, however little is known about the filtration efficiency. Therefore an in vitro study was conducted to define the leukocyte removal rate of a transfusion leukocyte depletion filter, using cell-washed and unwashed whole porcine blood. In addition, the influence of different cell-washing protocols on the elimination rate of blood cells (leukocytes and platelets) was investigated.

Fresh diluted pooled heparinized porcine blood was processed using either a high flow (HF, n=5) or quality wash (QW, n=5) protocol on a continuous auto-transfusion system, or was left unprocessed (control n=5). Thereafter all samples were filtered using a transfusion leukocyte depletion filter. Blood samples for measurement of hematocrit, white blood cell count, including leukocyte differentiation and platelet count, were taken before and after filtration. To compare the experimental groups, the removal rate was presented as the fraction of leukocytes or platelets removed per plasma volume.

RESULTS

Cell washing significantly altered the fraction of leukocytes removed per plasma volume when compared to unprocessed blood (2.07 and 2.36 in the HF and QW group, respectively, versus 1.34 in the control group, $p=0.008$ for both). No statistically significant difference in leukocyte removal rate was observed between the different cell washing protocols. The leukocyte differential count showed that during all experiments, the neutrophils were removed most efficiently (99.7%).

Overall, significantly more platelets were depleted after cell washing compared to the control group (1.47 and 1.60 in the HF and QW group, respectively, versus 1.12 in the control group, $p=0.008$ and $p=0.032$, respectively). Furthermore, the amount of blood that could be filtered using a single pass technique, did not significantly differ between the experimental groups. However, a larger variation in the total amount of filtered blood was observed in the unprocessed group (570 ± 398 ml) compared to the cell washed groups (360 ± 42 ml and 430 ± 97 ml in the HF and QW group, respectively).

CONCLUSION

Blood processing with an auto-transfusion system significantly enhances the leukocyte and platelet removal efficiency of the transfusion leukocyte depletion filter that was studied. Especially neutrophils were efficiently removed.