

# Leukocyte Filtration Decreases the Number of Adherent Leukocytes in the Cerebral Microcirculation after a Period of Deep Hypothermic Circulatory Arrest

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## Background

The reperfusion injury following deep hypothermic circulatory arrest (HCA) is thought to play a major role in the development of cerebral injury. Cardiopulmonary bypass (CPB) and HCA induce a systemic inflammatory response, which in turn promotes a cascade of leukocyte and endothelial cell activity. It has been established that leukocyte filtration during CPB improves brain protection after HCA. The exact effect of leukocyte filtration in cerebral vessels has not, however, been verified. There has been abundant discussion about whether the leukocyte-depleting filter better the outcome exactly by reducing the amount of activated leukocytes in cerebral circulation, or merely by acting as a filter in general, filtering out other harmful products such as microemboli as well.

## Aim

Our aim was to investigate whether leukocyte filtration affects endothelial cell and leukocyte adhesion in the cerebral microcirculation via direct visualization with intravital microscopy.



Leukocytes in post-capillary venules stained by rhodamine

## Material and Methods

Twenty-two juvenile (6-7 weeks) piglets were randomly assigned to undergo CPB with (n=11) or without (n=11) a leukocyte-depleting filter 70 minutes before and 120 minutes after a 75-minute HCA at 18°C. Through a cranial window placed over the parietal cortex, recordings were made with the intravital microscope at 11 timepoints, documenting the diameter of the vessels visualized as well as the amount of leukocytes rolling along and attached to post-capillary venule walls. Plasma was labeled with fluorescein-isothiocyanate-dextran for assessment of microvascular diameter. Rhodamine staining was used to observe adherent and rolling leukocytes. The animals were electively sacrificed 2 hours post-operatively.

## Results

There were no differences between the study groups regarding hemodynamic data. Numbers of adherent activated leukocytes were lower in the cerebral post-capillary venules in the leukocyte filter group, reaching borderline statistical significance when assessed throughout the experiment (p=0.069), and statistical significance when assessed during the rewarming period (p=0.029).

## Conclusion

The leukocyte depleting filter succeeds to reduce the number of adherent leukocytes during the reperfusion period in an experimental operation with deep hypothermic circulatory arrest, and thus might mitigate the cerebral reperfusion injury following cardiac surgery.

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