In-vitro comparison of the CytoSorb® 300mL hemoadsorber and the Oxiris® hemofilter on two major pro-inflammatory cytokines

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Introduction

We performed an analysis of two blood purification systems to determine their performance for removing the two most common pro-inflammatory cytokines from whole blood.

Methods

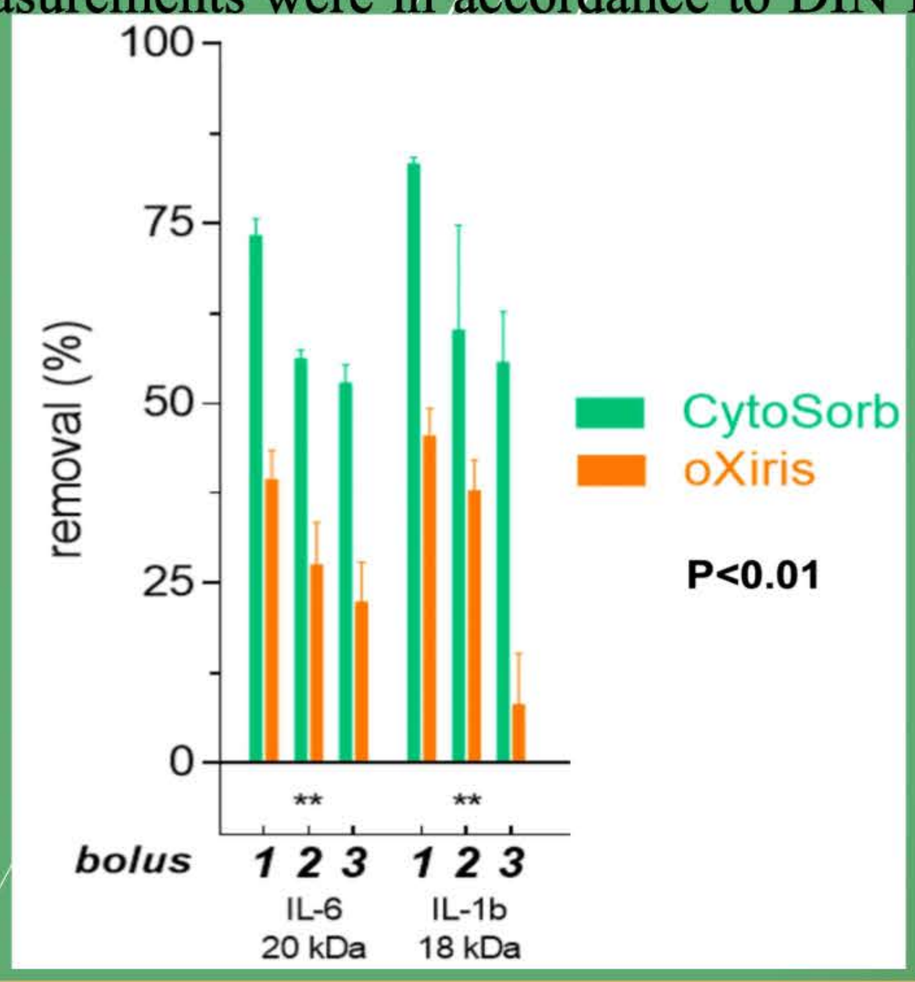
An in-vitro full-scale benchtop recirculation model was used to compare the CytoSorb® 300mL (CytoSorbents Inc., Princeton, USA) and oXiris® (Baxter, Deerfield, IL, USA) devices. Human target molecules were added at t=0min (bolus 1), 120min (bolus 2), and 240min (bolus 3). Overall removal was compared at various timepoints(t= 0, 5, 15, 30, 60, 120, 121, 125, 135, 150, 180, 240, 241, 245, 255, 270, 300 and 360 mins). A total of three runs were completed. Purified recombinant human interleukins (IL)-1 beta and IL-6 were used. The removal rate r was defined as follows:

$$r[\%] = \left(1 - \frac{c_{bolus_{iend}}}{c_{bolus_{istart}}}\right) * 100\%; (i = 1,2,3)$$

Equation: $c_{\mathrm{Bolusiend}}$ and $c_{\mathrm{Bolusistart}}$ is the target molecule concentration measured at the beginning and the end of each bolus time interval, respectively. All measurements were in accordance to DIN EN ISO 8637:2014-03 for testing of hemodialyzers.

Results

Both devices showed effective removal of the tested targets. IL-1b (-42.8%, 25/75%-CI: -52.6 — -18.9; p<0.01) and IL-6 (-33.3%, 25/75%-CI: -35.1 — -27.5; p<0.01) were removed more quickly and to a higher extent by the CytoSorb® device. Figure #1 exemplifies the overall removal of IL-1b and IL-6 at the three different timepoints. As expected, the overall removal decreased over time after adding another bolus suggesting a stepwise saturation of both devices. This trend was more pronounced in the Oxiris® filter group.



Conclusion

Both devices were capable of removing cytokines from blood in this benchtop model. The CytoSorb® device was significantly more efficient in removing both tested substances. These findings might have an impact on the decision making process in patients with pronounced cytokine storm. It is important to underline that the Oxiris filter tends to reduce its removal power at the sixth hour because it is becoming saturated, while the CytoSorb device continues to adsorb more than 50% of the cytokines. Moreover the 6h duration is one important limitation of the study: as the Cytosorb therapy is proved to be efficient up to 24h, the real CytoSorb efficacy, superior to Oxiris already in 6h, could be shown continuing the experiment up to 24h.