SELECTIVE REMOVAL OF GLYCATED AND OXIDIZED ALBUMIN BY ADSOPTION: MISSION IMPOSSIBLE?

Jens Hartmann, Claudia Schildböck, Stephan Harm

University for Continuing Education Krems, Austria

Introduction

In addition to its function as a transport protein, albumin has other important tasks that are particularly important for patients undergoing therapeutic apheresis. Albumin not only contributes significantly to colloid osmotic pressure, but is also an important buffer in the event of oxidative stress.

Pathological modifications of albumin can occur in various clinical pictures. These include the reversible oxidation of the Cys-34 position from human mercaptalbumin (HMA) to human non-mercaptalbumin 1 (HNA-1), or non-reversible oxidation to HNA-2. Furthermore, glycation of albumin occurs, particularly in diabetic patients, due to the increased glucose level in the blood. These changes have an impact on the functions of albumin and thus contribute to a worsening of the patient's condition.

Procedures based on adsorption on polystyrene-divinylbenzene (PS-DVB) adsorbents remove a certain amount of albumin as a side effect.

The aim of this study was to investigate whether PS-DVB adsorbents selectively adsorb oxygenated albumin and/or glycated albumin.

Methods

Oxidized albumin was generated by incubation of fresh frozen plasma (FFP) and human serum albumin (HSA) with cystine for 2 days (HNA-1) or with H_2O_2 for 3 hours (HNA-2) at 37 °C with subsequent dialysis to remove excess cystine.

Glycated albumin was produced by incubation of FFP and HSA with glucose (4.5 g/dL) for 3 weeks and subsequent dialysis to remove excess glucose.

The adsorption tests in FFP and HSA were carried out with 10 % v/v PS-DVB adsorbent (Cytosorb, Jafron HA and Biosky MG) for 2 hours at 37 °C (n=3).

The HMA, HNA-1 and HMA-2 were quantified using HPLC according to Imai et al [1]. Glycated albumin was quantified by a photometric fructosamine test kit.

Results

None of the adsorbents tested can selectively remove oxidized or glycated HSA. Furthermore, the adsorbents have no oxidative or reducing effect on HSA.

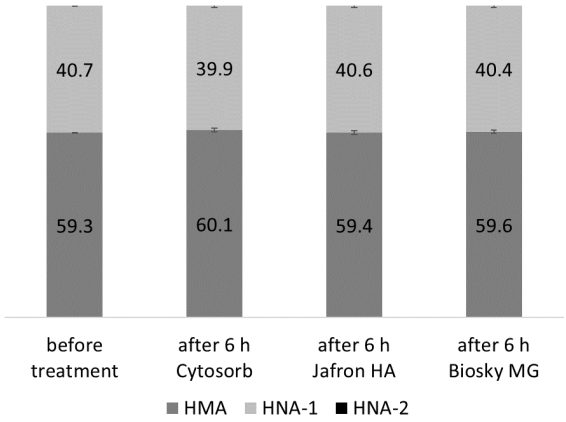

Figure 1: Amount of HMA, HNA-1 and HNA-2 in plasma before and after an 6 hour in-vitro treatment of human plasma. The values are given as a percentage (n=3).

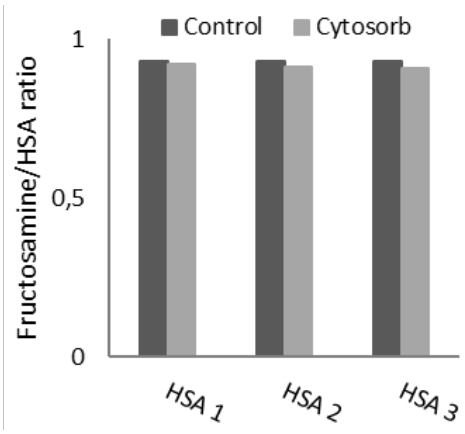

Figure 2: Fructcosamine to HSA ratio after 2 hours incubation with Cytosorb and without adsorbent (control).

Discussion

Our results are not consistent with *in-vivo* studies that have demonstrated a transient improvement in the redox status of albumin during treatment [2]. It can be assumed that the elimination of various toxins and the stabilization of the patient in the ICU may lead to an improvement in the redox status of albumin *in vivo*, which is not observed *in vitro*.

The changes in albumin investigated in this study have no influence on the affinity of albumin to hydrophobic neutral resins based on PS-DVB.

References

1. Imai et al., Adv Exerc Sport Physiol, 11(3): 109-113, 2005.
2. Oettl et al, Ther Apher Dial, 13(5):431-436, 2009.