

Sialic acid changes in permeability alterations of the glomerular barrier during experimental sepsis

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Several studies have demonstrated that sialic acids are glycocalyx components that contribute to maintain the architecture and the functions of the glomerular charge barrier, preventing the passage of anionic proteins such as albumin. Experimental investigations on sialic acid synthesis gene mutants, on induced nephrosis, on diabetes, and on glomerular injury after desialylation demonstrated charge barrier dysfunction that seems to be related to decrease of these carbohydrate components rich in anions. To our knowledge, no study has examined whether sepsis-related change in permeability of glomerular barrier is associated with sialic acid altered expression. The aim of this study was to evaluate changes of sialic acid in glomerular barrier, in the early stages of an experimental animal model of polymicrobial sepsis. For this purpose experiments were performed on adult male rats which were randomly assigned to two groups: 1) sham-injured (n=6); 2) Caecal Ligation and Puncture (CLP) (clinically relevant model of polymicrobial infection that mimics human sepsis) (n=8). CLP group was also divided into 3 subgroups related to 3 time points: $t_1=3$ h, $t_2=7$ h and $t_3=15$ h. The presence of sepsis, was revealed by TNF- α plasma level and microbiology of peritoneal fluid was examined with bacteriologic techniques. Urinary albumin levels were evaluated to test the functional damage of the glomerular barrier. Sialic acids in glomerular barrier were investigated using MAA, SNA and PNA lectins, in combination with enzymatic and chemical treatments in order to characterize different glycosidic linkages of the sialoderivatives and to obtain information on their structure. The results showed plasma TNF- α level significantly increased after the CLP induction as compared to sham-injured animals. Bacteriologic techniques revealed a polymicrobial infection after the CLP surgical procedures. The albuminuria was significantly increased in CLP group. Lectin histochemistry showed presence of sialic acids with different glycosidic linkage (α -2,3, α -2,6) in the glomerular barrier of both the study groups, but with lesser extent during sepsis. Moreover, the amount of sialic acids with acetylic groups was major in sepsis group. These findings suggest that altered glomerular permeability in the sepsis might be related to the decrease of sialic acids. In addition, the increase of acetylic groups could be a compensatory mechanism in attempt to prevent desialylation by bacterial sialidase and probably to hinder the action of circulating proinflammatory molecules during sepsis.

Key words

Sialic acids, lectins, sepsis, glomerular barrier