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Evaluation of Human Amnion Hemocompatibility as a Substitute for Vessels

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Abstract : Objectives: An important issue in tissue engineering (TE) is hemocompatibility. The current engineered vessels are seriously at risk of thrombus formation and stenosis. Amnion (AM) is the innermost layer of fetal membranes that consists of epithelial and mesenchymal sides. It has the advantages of low immunogenicity, anti-inflammatory and anti-bacterial properties as well as good mechanical properties. We recently introduced the amnion as a natural biomaterial for tissue engineering. In this study, we have evaluated hemocompatibility of amnion as potential biomaterial for tissue engineering. Materials and Methods: Amnions were derived from placentas of elective caesarean deliveries which were in the gestational ages 36 to 38 weeks. Extracted amnions were washed by cold PBS to remove blood remnants. Blood samples were obtained from healthy adult volunteers who had not previously taken anti-coagulants. The blood samples were maintained in sterile tubes containing sodium citrate. Plasma or platelet rich plasma (PRP) were collected by blood sample centrifuging at 600 g for 10 min. Hemocompatibility of the AM samples (n=7) were evaluated by measuring of activated partial thromboplastin time (aPTT), prothrombin time (PT), hemolysis, and platelet aggregation tests. P-selectin was also assessed by ELISA. Both epithelial and mesenchymal sides of amnion were evaluated. Glass slide and expanded polytetrafluoroethylene (ePTFE) samples were defined as control. Results: In comparison with glass as control (13.3 ± 0.7 s), prothrombin time was increased significantly while each side of amnion was in contact with plasma ($p<0.05$). There was no significant difference in PT between epithelial and mesenchymal surfaces (17.4 ± 0.7 s vs. 15.8 ± 0.7 s, respectively). However, aPPT was not significantly changed after incubation of plasma with amnion epithelial and mesenchymal surfaces or glass (28.61 ± 1.39 s, 31.4 ± 2.66 s, glass, 30.76 ± 2.53 s, respectively, $p>0.05$). Amnion surfaces, ePTFE and glass samples have less hemolysis induction than water considerably ($p<0.001$), in which no differences were detected. Platelet aggregation measurements showed that platelets were less stimulated by the amnion epithelial and mesenchymal sides, in comparison with ePTFE and glass. In addition, reduction in amount of p-selectin, as platelet activation factor, after incubation of samples with PRP indicated that amnion has less stimulatory effects on platelets than ePTFE and glass. Conclusion: Amnion as a natural biomaterial has the potential to be used in tissue engineering. Our results suggest that amnion has appropriate hemocompatibility to be employed as a vascular substitute.

Keywords : amnion, hemocompatibility, tissue engineering, biomaterial
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