
The reactivity of potentially thromboresistant polymers was determined in sheep by measurement of the lifespan of Cy3-labelled platelets. Materials were tested as tubing (90–125 cm x 2.5·4 mm i.d./o.d.) immersed in a 7 cm silicone rubber omentum, jugular v. shunt.

Platelet lifespan decreased to the length of the basic silicone rubber shunt increased from 7 cm (‘shunt control’; 78.3 ± 11.6 ± 10 hrs.) to 50 cm (T96.0 ± 7.5 hrs.; n=7; p<0.001 vs. shunt control) but was longer in sheep without a shunt (T96.1 ± 11.2 hrs.; n=21; p<0.001 vs. shunt control), probably because of artificial activation of platelets in blood sampling by needle puncture in the absence of a shunt. Of sixteen polymers studied in 42 sheep (n=117), all significantly shortened platelet lifespan except polyurethane (T97.2 ± 12.1 hrs.; n=12) and non-cross-linked silica-free polydimethylsiloxane (T96.8 ± 13.9 hrs.; n=9). Polyacrylate acrylate (PMA) (T97.2 ± 5.4 hrs.; n=11; p<0.001 vs. shunt control) was passivated by exposure to platelet-free plasma before whole blood (T90.3 ± 5.6 hrs.; n=5; p<0.05 vs. untreated PMA). Thus, the adsorbed film of plasma constituents has a lasting and decisive effect on thromboresistance of the surface. The long-term behavior of an artificial surface may be dictated by the events of the first few seconds of blood-surface contact.

EARLY PLATELET ACTIVATION DURING PERFUSION OF A HOLLOW FIBER ARTIFICIAL KIDNEY. B. K. Kim and W. L. Balsam. Memorial Hospital, Pawtucket and Brown University, Providence, Rhode Island, USA.

Studies of early platelet changes caused by contact with artificial surfaces in a flow-system were done by the use of a bench-model of a hollow fiber (silicone rubber) mini-kidney. The artificial device contained 64 fibers in a polyurethane casing and was inserted in a silicone rubber circuit provided with a roller pump. Human platelet-rich plasma was used for perfusion. Perfusion at 60 ml/h at a rate of 6 ml/min caused no decrease in platelet count and no visible thrombus formation in the fibers. However, after perfusion for 5 ml there was a significant increase in ADP induced platelet aggregation with values of 73 ± 10%) (control 56 ± 6%). The vWF release rose to 80 ± 8.5% after 5 min. Collagen induced platelet aggregation also increased with values of 81 ± 9.3% (control 67 ± 5.3%) after 5 min and 82 ± 6.5% after 30 min. Platelet F3 availability measured by the Kollin clotting time was 108 ± 5.5 sec before perfusion and became progressively enhanced during perfusion. The Kollin clotting time became 93 ± 2.9 sec after 5 min, 64 ± 1.7 sec after 15 min, 76 ± 3.3 sec after 30 min and 71 ± 3.7 sec after 60 min. Platelet release of 3H-epinephrine was only 2% to 3% after 60 min perfusion. The content of purine nucleoside phosphorylase (a catabolic enzyme) and of β-glucuronidase (a lysosomal enzyme) detected in the plasma medium after 60 min perfusion were only 2% to 4% of the respective platelet enzyme activity. It was concluded that contact with silicone rubber surfaces during short-term perfusion of hollow fibers caused significant platelet activation with enhancement of platelet aggregability and platelet F3 availability in the absence of significant degrees of release reaction.


The long-term implantation of cardiac prosthesis has been hampered by the lack of thromboresistant blood interfacing materials. Glutaraldehyde treated pericardium and glutaraldehyde treated, gelatin-coated rubber have been utilized for the blood contacting materials of our devices. These "biolized" cardiac prostheses were implanted in calves: 8 total artificial hearts for up to 5 months, 7 left ventricular assist devices for up to 7 months, and a passive pump implanted in the aorta for 3-1/2 years. The blood-solid interaction and endothelialization of these materials were chronologically followed at an ultrastructural level using scanning and transmission electron microscopy.

The devices implanted up to 40 days were covered by a thin layer of fibrous material. The adhesion of blood corpuscles were minimal except for the region of diaphragm-housing junction. The majority of the adhered platelets were "contact" and "spread" platelets. Once this fibrous rich layer was formed, no significant thrombus formation was observed. The endothelialization was observed in the portion of the pericardium surface adjacent to the inflow valve in the heart implanted for 145 days. The coverage of the endothelial cells was more complete in the passive pump. Although Weibel-Palade bodies were observed in the cytoplasm of these cells, they were characterized by the sparse microvillous projections, small number of pinocytotic vesicles, and widely opened intercellular junctions. In the subendothelial layer, no basement membrane was observed.

The study showed the aldehyde treated collagen and gelatin are suitable materials as blood contact surfaces of the cardiovascular devices.