Using Self-Cleaning Materials to Extend the Life of Stents and Catheters

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As blood flows inside stents/hemodialysis catheters, there is a tendency for elements of blood, such as fibrinogen, to adhere to stents/catheters, leading to clot formation and requiring further surgery. Every year, 40,000 people need stent restenosis surgery, which can sometimes be prevented by using drug-eluting stents, but these are expensive, well beyond the income of most people in the developing world. There is a cheaper solution - coating stents/catheters with self-cleaning materials that will inhibit the adhesion of fibrinogen. This idea was tested by creating a simulated cardiovascular system, consisting of a pump, three tubes of 316L stainless steel (used to make stents) and two tubes of medical grade silicone (used to make catheters) connected in a circuit. The insides of two steel tubes and one silicone tube were coated with self-cleaning materials using the sol-gel method, while the other tubes were left uncoated to be used as controls. All the tubes were individually weighed. Artificial blood mixed with bovine fibrinogen was created and then pumped through the system for two weeks. Afterwards, the system was dismantled, each of the tubes was air-dried for 24 hours and reweighed. This experiment was repeated four more times. The average fibrinogen adsorption on the coated steel tubes was 33 % less than that on the uncoated tubes, and for silicone tubes, the corresponding number was 16%. This demonstrates that a coating of self-cleaning materials can reduce the adhesion of fibrinogen on 316L stainless steel and silicone, the materials used to make stents and hemodialysis catheters respectively. Thus, a coating of self-cleaning materials on stents/catheters can inhibit clotting and potentially save thousands of lives and dollars.

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