Novel Nitric Oxide Releasing Materials and Their Biomedical Applications

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Abstract

Blood/material interaction is critical to the success of implantable medical devices, ranging from simple catheters, stents and grafts, to complex extracorporeal artificial organs which are used in thousands of patients every day. There are two major limiting factors to clinical application of blood contacting materials: 1) platelet activation leading to thrombosis, and 2) infection. Despite a thorough understanding of the mechanisms of blood–surface interactions, and decades of bioengineering research effort, the ideal non-thrombogenic prosthetic surface remains an unsolved problem. One approach to improving the hemocompatibility and bactericidal activity of blood-contacting devices is to develop materials that release nitric oxide (NO), a known potent inhibitor of platelet adhesion/activation and also an antimicrobial agent. Healthy endothelial cells that line the inner walls of all blood vessels exhibit a NO flux of 0.5 – 4.0 $x10^{-10}$ mol cm^{-2} min^{-1}, and materials that mimic this NO release are expected to have similar anti-thrombotic properties. Further, studies have shown that materials that release such NO fluxes can prevent microbial biofilm formation. In this presentation, the potential of incorporating NO donor molecules such as diazeniumdiolates or S-nitrosothiols (RSNOs) into various biomedical grade polymers will be discussed, as will the resulting hemocompatibility and antibacterial properties of such materials determined via short-term (4 h) and long-term (7 d) *in vivo* experiments using appropriate animal models.