Synthetic platelet substitute for applications in vascular trauma and hemostasis
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Description:

Yale investigators have developed a new synthetic platelet to treat hemorrhage. The synthetic platelet resembles the shape of an activated platelet (star burst) and is made from FDA-approved materials, consisting of a nanosphere core and polyethylene glycol (PEG) arms. Our synthetic platelet is capable of forming a barrier to reduce membrane permeability and enhance the sealing on a disrupted blood vessel wall, which is extremely beneficial to promote synthetic platelet aggregation at the site of injury. The experimental results indicate clotting time can be controlled through various factors such as structure, dose and vessel type. The synthetic platelet has been tested in an in vivo rat femoral vessel injury model and the time required for blood extravasation to cease from the injured vessel has been demonstrated to be significantly shorter than without these synthetic platelets.

Field of Application: Insufficient hemostatic instances such as hemophilia, thrombocytopenia, or severe trauma; treatment of vascular trauma without localizing the site of injury; arrest hemorrhage from damaged vasculature in and outside the hospital (battlefield).

Value Proposition: Due to certain drawbacks in blood transfusion, such as the short shelf time of platelets (5-7 days), high cost of cryopreservation of platelets, and possibly spreading of blood-borne diseases, much interest has been focused on the novel synthetic platelets with stable quality and easy administration. Sales for blood therapeutics and transfusion in the U.S. market reached $5.5 billion in 2007. By 2012, the U.S. blood market has been forecasted to exceed nearly $7.3 billion, with a compound annual growth rate of 5.7%.

Advantages: This novel synthetic platelet substitute has significant advantages over the traditional blood transfusion therapy and other substitutes to arrest hemorrhage:
1) It is completely synthetic, which is extremely important in eliminating potential immunogenicity.  
2) The new technology provides unlimited supply and no dependency on donors or shelf life.  
3) Our synthetic platelet substitute is stable at room temperature, which allows it to be carried in a dried powder form, can be reconstituted with saline and intravenously injected immediately following an injury (for example, in the battlefield). This rapid and easy administration is probably the most significant advantage of this technology.  
4) It has the potential to mitigate both internal and external hemorrhage.  
5) Our synthetic platelet is biocompatible and biodegradable.  
6) Our synthetic platelet may be able to cross the Blood-Brain Barrier.

Stage of Development: The synthetic platelet has been tested in femoral vessel injuries in rats. Current work is focused on (1) in-vitro analysis to optimize the synthetic platelet structure; (2) the effect of the synthetic platelets in microvasculatures such as arterioles and venules; and (3) the in vivo analysis on the distribution of synthetic platelets in different organs such as lungs, liver, kidneys.

IP Status: PCT application filed.

Publications:


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