Hemostatic Effects of Microporous Polysaccharide Hemosphere® in a Rat Model With Severe Femoral Artery Bleeding

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ABSTRACT

An appropriate hemostatic dressing for prehospital use should lower mortality due to uncontrolled hemorrhage. In this study, the investigators explored the hemostatic effects of Microporous Polysaccharide Hemosphere® (MPH) applied in a rat model with severe femoral artery bleeding. Twelve rats were randomly assigned to MPH and control groups: The femoral artery of each rat was pierced to initiate bleeding. Then, 0.25 g MPH was poured into the bleeding site. A 200-g scale weight was placed over the bleeding site for 30 sec. At 30-sec intervals, the scale weight was removed, and hemostasis was assessed visually. After 30 sec, if the bleeding had ceased, the test was scored and checked as “passed at 30 sec.” If the bleeding had not stopped, the same procedures were
repeated a maximum of 3 times. If hemostasis could not be achieved even after the third application, the test was scored as failed. The same sequence of procedures was repeated for the control group without use of MPH and with only standard compression. Application of MPH resulted in complete control of bleeding in 2 of 6, 4 of 6, and 6 of 6 rats at 30, 60, and 90 sec, respectively. In the control group, however, hemostasis could not be achieved in all 6 rats, even at 90 sec. The difference between the 2 groups was statistically significant ($P=.007$). Application of MPH and compression with a scale weight significantly decreased the time of hemostasis in the rat model with femoral arterial bleeding.

**Keywords:** uncontrolled hemorrhage; hemostasis; hemorrhage control; hemostatic dressing; Microporous Polysaccharide Hemosphere

**INTRODUCTION**

Uncontrolled hemorrhage continues to be the leading cause of death among military personnel. It is the second leading cause of death in civilians worldwide. Bleeding also leads to blood transfusions with their inherent risk of complications, as well as significant expense, among surviving victims.

Rapid and immediate intervention provided by an on-scene first responder or by the victim himself is one of the most effective methods of reducing a patient’s morbidity and mortality. During the past few years, tremendous advances have been made in the development of advanced hemostatic products that are used in traumatic bleeding. CELOX® (Chitosan Linear Polymer) (Medtrare Biopolymers Inc., Crewe, England), Microporous Polysaccharide Hemosphere® (MPH, TraumaDEX®; Medafor, Inc., Minneapolis, Minn), HemCon Bandage® (HemCon, Inc., Portland, Ore), Rapid Deployment Hemostat® (Marine Polymer Technologies, Cambridge, Mass), QuickClot® (Z-Medica, Wallingford, Conn), American Red Cross fibrin dressing, dry fibrin sealant dressing, bovine clotting factors, acetylated poly-N-acetylgulcosamine, mineral zeolite molecular sieve, poly-N-acetylgulcosamine, and microporous hydrogel-forming polyacrylamide are some of the products that are already available on the market. Some are now in use in prehospital settings, emergency departments, and operating rooms.

The ideal hemostatic dressing for prehospital use should (1) stop large vessel arterial and venous bleeding within a few minutes after it is applied to the wound; (2) provide a good outcome even after it is applied over an active bleeding site that causes pooling; (3) be ready to use, with no requirement for mixing or special preparations; (4) be simple to apply by the wounded victim, a bystander, or a medic/emergency medicine technician who has had minimal training; (5) be lightweight and durable; (6) be stable and functional at room temperature for at least 2 years and in extreme ambient temperatures (between −10°C and +55°C) for several weeks or longer; and (7) be safe to use, posing no risk of injury to the tissue to which it is applied. It must not allow transmission of bacterial or viral infection, it should be inexpensive, and it must be able to sustain hemostasis for at least several hours to permit safe evacuation of casualties to definitive care centers.

MPH seems to meet many, but not all, of these requirements. It is made from purified potato starch, is formed into 30- to 100-micron spheres with a microporous surface, and is poured directly into a bleeding wound. The pores, when applied directly