Researchers take the inside route to halt bleeding

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Blood loss is a major cause of death from roadside bombs to freeway crashes. Traumatic injury, the leading cause of death for people age 4 to 44, often overwhelms the body's natural blood-clotting process.

In an effort to enhance the natural process, a team led by Erin Lavik, a new Case Western Reserve University biomedical engineering professor, and her former doctoral student, James P. Bertram, built synthetic platelets that show promise in halting internal and external bleeding.

Their work is published in *Science Translational Medicine*.

The researchers were inspired by studies showing there are few options to treat soldiers suffering from internal injuries in Afghanistan and Iraq. They wanted to develop a treatment medics can keep in their field packs.

"The military has been phenomenal at developing technology to halt bleeding, but the technology has been effective only on external or compressible injuries," Lavik said. "This could be a compliment to current therapies."

Blood platelets are the structural and chemical foundation of blood clotting, a complex cascade of events that works well with normal cuts and scrapes but can be overmatched by serious injury.

Using other's platelets can enhance clotting but carries risks of several complications. And these platelets must be refrigerated and have a short shelf life.

Bertram and Lavik developed platelets made from biodegradable polymers. The synthetic platelets are designed to home in and link up with natural platelets at the site of an injury.

In essence, adding artificial platelets to a traumatic injury site is akin to adding sand bags to a levy along a flooding river.

The natural platelets, activated by injury, emit chemicals that bind natural platelets and the additional synthetics into a larger clot that quickly stems the bleeding.

In testing, rat models injected with synthetic platelets prior to injury stopped bleeding in half the time of untreated models. Untreated models injected 20 seconds after injury stopped bleeding in 23 percent less time than models left untreated.

In another comparison, the artificial platelets resulted in clotting times about 25 percent faster than wounds treated with recombinant factor VIIa, which is the current state of the art treatment for uncontrolled bleeding in surgery and emergency rooms. While the recombinant factor is used on various injuries, its cost can be in the tens of thousands of dollars per treatment and is not used in patients suffering head or spinal cord injuries, due to risk of complications.

Lavik said her team made platelets from polymers already used in treatments approved by the Food and Drug Administration in hopes the new treatment might be approved faster. They also built the parts of the synthetic platelets that bind to natural platelets from relatively short pieces of proteins because they're more stable than longer pieces and cheaper.

To avoid formation of an artificial clot, each synthetic platelet is built with a surrounding water shield. Fluorescing compounds showed the synthetic platelets not bound in clots were flushed from the rat model's system in a day. No ill effects were seen in the following week.

Testing also showed the synthetic platelets remain viable after sitting on a shelf for at least two weeks.

Lavik is seeking grants to further test the platelets.

Provided by Case Western Reserve University

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