





# Clotting Agents

**Here's the scoop on these lifesaving tools** BY ERIC DICKINSON

As history demonstrates, conflict often breeds remarkable innovation. The development of hemostatic "clotting" agents is among these breakthrough technologies. Pick up any police or military-supply catalog lying around your agency and turn to the first-aid products. Chances are you'll find one or more hemostatic agents listed, such as QuikClot, HemCon and Celox.

Designed for treating battlefield injuries where 90 percent of deaths occur due to blood loss, hemostatic agents help provide temporary control of life-threatening external bleeding by enhancing or accelerating the natural clotting process through various physical reactions between the agent and blood. Hemostatic agents prove particularly useful when extraction to a field hospital is delayed or when the injury occurs to areas where tourniquets are not effective or possible, such as the shoulders, torso and pelvis.

In the United States, traumatic deaths usually result from car accidents and falls, where bleeding is often internal and doesn't benefit from field hemostatic-agent use. Although deaths from external bleeding are not as common in the civilian world as in combat, they do occur, especially with law officers. In 2007, the National Law Enforcement Officers Memorial Fund reported an increase in officer deaths, many from gunshot wounds. At press time, 186 officer deaths occurred in 2007 (a 28-percent increase from 2006), with at least 69 from gunshot wounds (a 33-percent increase from 2006).

## Misinformation

Researching hemostatic agents can lead to a confusing quagmire of conflicting information and opinions about which products to use, when to use them and their effectiveness.

Individual military personnel and entire units returning from overseas have provided conflicting views of the same hemostatic agents. Uninformed distributors, sales staff and

catalogs can lead officers to believe hemostatic agents are the magic bullet of bleeding control and that training is not required for effective use. In fact, some law enforcement instructors have encouraged the use of these products by street officers without first understanding proper training or procedures for hemostatic-agent use or emphasizing the importance of basic first-aid skills.

On the flip side, others have claimed the perceived risk of additional harm to the patient is too great to make use of hemostatic agents. One presenter at a major national conference erroneously told attendees these agents would likely cause a patient to suffer a stroke when applied to a simple scalp laceration.

Understand the facts, pros and cons of each of these products before making your own decision about which one best fits your needs. Below, I provide overviews of three of the most popular hemostatic agents marketed to first responders.

## What's Available?

### QuikClot

Probably the most well known of the hemostatic agents currently on the market, QuikClot, from Z-Medica Corporation, is made of a zeolite material that promotes rapid clotting by absorbing water molecules from blood, leaving larger platelet and clotting-factor molecules behind in a heavily concentrated form.

The first version of the product, introduced in 2002, was a granular form that users poured into a wound. Some controversy surrounded the original formulation as claims surfaced that its use could cause burns to the patient on application. Some of these incidents were attributed to improper usage, though increased temperature still caused some concern.

Since its original formulation, QuikClot has evolved into improved variations, including QuikClot ACS+ and



QuikClot 1st Response for first responders, and two consumer versions, QuikClot Sport and QuikClot Sport Silver with anti-microbial properties. The composition now includes non-allergenic, X-ray detectable, granular beads of clotting agent contained in a porous mesh netting resembling a sponge. Users can apply and remove these newest formulations much more easily than the original version, and they generate little heat, preventing the burns reported in the past. These QuikClot products cost \$20–\$30 per unit.

QuikClot has been approved by the FDA, tested and recommended by the U.S. Navy, adopted by the U.S. Marine Corps for general issue, adopted by the U.S. Army for issue to field medics and adopted by the U.S. Air Force for inclusion in all first-aid kits. According to Z-Medica, QuikClot has saved more than 150 lives in Iraq and Afghanistan.

Law enforcement has successfully used QuikClot in a number of publicized incidents nationwide. A San Jose, Calif., police officer applied QuikClot and a pressure dressing to a civilian who suffered severe bleeding after putting his arm through a large window. Officers in Maricopa County, Ariz., used it to save the life of a range master who was hit by a .50-caliber ricochet in the abdomen and femoral artery. The Hillsborough County (Fla.) Sheriff's Office estimates its deputies have used QuikClot nearly 100 times, including an incident in which the product was credited with saving the life of an undercover deputy who sustained a gunshot wound to the abdomen.

### HemCon

Manufactured by HemCon Medical Technologies, the HemCon Bandage incorporates a hemostatic agent into a flexible bandage. The bandage becomes sticky when it comes in contact with blood or other moisture, and adheres to the wound site, sealing it. HemCon works through ionic interaction by drawing red blood cells and platelets to the bandage, forming a clot and creating an anti-bacterial barrier that protects the wound from infection. Though it's made of a shrimp-shell based component called "chitosan," repeated testing has shown it has no known side effects or allergy-causing properties.

The HemCon Bandage was the first hemostatic agent to be FDA approved and subsequently adopted by the U.S. Army for general issue to all deployed personnel. The manufacturer says HemCon has saved more than 100 lives in Iraq and Afghanistan.

HemCon is available in various sizes, ranging from small dental-use sizes to 4"x4" dressings. You can fold or cut the dressing to cover the wound, or stuff it into the wound cavity.

HemCon has also introduced the ChitoFlex bandage, which you can stuff into the cavity of small-diameter wounds. The company offers an inactive, or inert, bandage to include in training programs as well. HemCon products cost \$25–\$185 per unit.

Though it's seen extensive use in combat operations overseas, HemCon's most notable uses in the United States have



come from Tualatin Valley Fire & Rescue (TVF&R) near Portland, Ore. TVF&R conducted an extensive field study of the use of HemCon bandages from June 2005–Aug. 2007. During that time, personnel applied HemCon bandages on 74 patients, including several with wounds from edged weapons. The results of this study, expected to show positive overall performance, will be published in an upcoming issue of *The Journal of Emergency Medicine*.

### Celox

Celox is the newest entry into the hemostatic-agent market. Manufactured by Medtrade Products Ltd., of Crewe, England, and marketed in the United States by SAM Medical Products, Celox is packaged in a granular form much like the original QuikClot. But unlike the original QuikClot, Celox does not generate any heat because it's also made of chitosan. FDA-approved, Celox works in hypothermic conditions and on blood affected by thinning medications. Removal at the hospital requires irrigation of the wound site. The price per unit ranges from \$15–\$24.

Two new Celox products are just now hitting the market. The first is an applicator designed to better treat small, penetrating wounds, such as gunshot and stab wounds. The applicator allows a responder to inject the hemostatic agent into the wound at the source of the bleeding instead of placing it on top. The second new product is a soluble bag (there are three bags per system) containing the hemostatic agent. Responders can insert the bags deep into the wound cavity, where they dissolve within a few seconds, much like a Listerine breath strip.

In spite of its relative infancy on the market, Celox has seen increasing field use in the United States and has shown positive results during animal testing and increasing combat deployment overseas. Expect to see and hear more about Celox products over the next few years.

### Usage

First responders supplied with a hemostatic agent must take time to understand the issues regarding its use.

For instance, a truly life-threatening bleed that might benefit from a hemostatic agent may not allow a granular agent to clot effectively before the blood flow pushes the agent out of the wound. You may need to apply tourniquets and pressure points to slow such bleeding enough to apply the agent. Once you slow the high-pressure blood loss, you must still get the agent into contact or close proximity to the source of the bleeding.

Some hemostatic agents, such as bandages and sponges, may prove difficult to insert deeply enough to contact the affected artery or organ. Once applied, most hemostatic agents require you to maintain direct pressure on the wound for 2–5 minutes, giving the agent the opportunity to work.

You must determine whether a hemostatic agent is really necessary in each case. *Example:* Some wounds, such as scalp lacerations, can bleed heavily but are generally easy to control using conventional methods.



Hemostatic agents may have to be removed or flushed from the wound prior to surgery. Hospital staff may remain hesitant to remove an agent until they feel confident about the product's characteristics. They may not be happy to get their first education in hemostatic agents from the back of a package.

Finally, keep in mind that wind or premature contact with perspiration, rain and mud can affect agents.

#### Education & Preparation

As with any valuable tool, you will increase the effectiveness of hemostatic agents by doing your homework and training before deploying them. Read and understand the manufacturer's information regarding the product. Don't trust the distributor's claims or advertising. Contact the manufacturer with questions, and take advantage of all formal training the company offers. Learn the proper procedure for using the product. Find out if there are any additional complications or contraindications.

Consult with your local EMS. Contact your local ground and air medical assets. What are the realistic response and transport times a patient will face? Are your local EMS providers familiar with hemostatic agents and their use? Don't automatically believe sales personnel's claims that these products are used by EMS in your area.

Consult with your state's EMS oversight agency for their opinion on the use of these products. One state's EMS bureau issued a memo recommending a popular hemostatic agent not

be used, and a state-run police academy has recommended no hemostatic-agent usage. Even if a state permits their use, your local EMS's medical director/physician may not. These agencies or medical directors may or may not have any authority over law enforcement's use of hemostatic agents in your area, but it will help to have their support if your use of the agents is questioned.

Consult with local hospitals that may receive the patient. Although a manufacturer may have physicians on its payroll promoting the use of a product, this doesn't mean a particular product has been fully accepted throughout the medical community. Some civilian emergency-room physicians will give you a blank stare if you ask them about hemostatic agents. Ensuring the emergency-room and surgical staff are familiar with the properties, use and removal of your chosen hemostatic agent may save precious minutes and increase the patient's odds of survival.

Estimate product and training expenses. Ensure your agency's administration understands the monetary cost involved. Hemostatic agents can be expensive. How much will it cost to outfit your officers? Does your chosen agent have a shelf life and require periodic replacement? You'll also need to order dressings and bandages.

You must provide training time to make officers proficient with the product and with conventional bleeding-control methods, including direct pressure, elevation, pressure points and tourniquets. The Army originally thought →→

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training wasn't required but quickly found that improper use of hemostatic agents was primarily responsible for their failure in the field. Failure translates into death. The Army's training program has since evolved, and success rates have increased.

### Final Thoughts

Hemostatic agents may increase the likelihood of survival for a patient with severe external bleeding, particularly when transport times are extended and bleeding can't be controlled by conventional means alone. Though rare in civilian life, injuries such as the fatal one sustained recently by Washington Redskins player Sean Taylor from a compromised femoral artery in the pelvic area demonstrate the need for these products.

Hemostatic agents are not a magic bullet, however. Just as you've learned not to assume a single punch, baton strike or bullet will stop a threat, neither should you assume a single bleeding-control method will stop all life-threatening blood loss.

Hemostatic agents remain relatively new in the toolbox. While they are seeing active military service, they have less history with civilian hospitals and EMS. Military medicine is sometimes developed and approved based on the best information available at the time, whereas new products and methods often take years of clinical trials and research to spread throughout the civilian medical community. It may take time before these products are fully accepted and integrated into

civilian medical response nationwide.

*Bottom line:* Do your research, take advantage of training opportunities and decide whether hemostatic agents will benefit your own situation. **LOM**

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### MANUFACTURER INFORMATION

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