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The Layman's Guide to Hemostatic Agents

By Donald L. Parsons, PA-C, MPAS

Continued conflict around the world focuses attention on providing care to injured Soldiers on the battlefield. Hemorrhage always has been, and continues to be the leading cause of death in combat. Technology has focused on this problem and has provided a number of different products to address this important issue. Never before have we had an agent that would stop arterial bleeding, but now there are a number of different products that will accomplish this. Part of the confusion is, which of these products is the best? While this article will discuss each different agent it is not designed to point out which works better, or should be used preferentially. This article is designed to give the first responder information on what is available, how they work and point out any difficulty in their use. There are currently three different companies who have hemostatic agents being used by the military.

HemCon Medical Technologies Inc. (www.hemcon.com) makes the HemCon 4 x 4in. Bandage the original hemostatic product used primarily by the Army. They have recently expanded their product line to include smaller bandages (2 x 2in. and 2 x 4in.), a flexible tape product (Chitoflex 3 x 28in.), and a dental dressing. HemCon also makes a training bandage in the 4x4in. size.

Z-Medica Corporation (www.z-medica.com) makes the QuikClot line of products. Their QuikClot powder was their original product and is the primary Hemostatic agent used by the U.S. Marine Corps. In addition, they have recently added two newer agents called QuikClot ACS™ (Advanced Clotting Sponge) and ACS+™ and QuikClot® 1st Response™ (a smaller version of the ACS + sponge). These last two products are a new formulation of the ACS product which has much less exothermic reaction. The ACS, ACS+ and First Response products contain the QuikClot granules in a mesh bag that is inserted into the wound.

Medtrade Biopolymers Corporation (www.sammedical.com) makes a product called Celox (Cell locks) and is marketed by **Sam Medical Products**. This product is the newest hemostatic agent to enter the market. Celox is a granular blend of material that contains Chitosan. There may be other hemostatic agents on the market but these products are the primary hemostatic agents being used by the military today. Let's look at each a little closer.

HemCon Medical Technologies Inc.

The primary hemostatic agent produced by HemCon is their 4 x 4in. bandage. This bandage is the primary hemostatic agent in use by the United States Army. There is a CENTCOM message that directs every Soldier in theater to carry one of these bandages. The primary ingredient in the HemCon products is a proprietary Chitosan paste incorporated into their bandages. Chitosan is a naturally occurring material found in shrimp shells. There have been no known side effects from this material with people who have shrimp allergies.

The bandage must be placed into the wound with the cream colored active side down and the tan colored side up, away from the tissue. The bandage may or may not have "this side up" written on it. The Chitosan material has strong adhesive like properties that when in contact with blood or body fluids becomes a flexible super glue like adhesive that seals the hole in the bleeding blood vessel and stops the bleeding. Because of this mechanism of action the bandage must come in close contact to the bleeding blood vessel in order to seal it. It cannot just be placed over the surface of the wound. The bandage may be cut or folded to better fit the bandage into the

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wound. This can be a significant drawback to the use of this bandage, based on the size of the wound. This bandage would be difficult to get into a small diameter wound and works better in larger wounds where the bandage can be placed deep into the wound where it can come in close contact to the bleeding blood vessels. HemCon has recently developed smaller and more flexible (2 x 2, 2 x 4in.) bandages that will fit easier into smaller wounds. When the bandage is placed into the wound it should be placed where the bleeding is the heaviest. In addition, it should be backed up by a roll of kerlix gauze to apply uniform pressure while holding the bandage into the wound. Pressure must be held for a minimum of two minutes. If for some reason the bandage does not become adherent in the wound it must be removed and a new bandage applied as before. You cannot apply a new bandage over the top of the old bandage. This technique would not allow the active Chitosan side of the new bandage, to come into close contact with the bleeding vessel; the new bandage would simply stick to the back of the original bandage. In large wounds you may need to use more than one bandage. If the bandage has adhered but bleeding has not been completely controlled do not remove the original bandage, as it may still provide some ability to help stop the bleeding. Once bleeding has been controlled a pressure dressing should be applied to cover the wound, and the casualty rapidly evacuated to the next level of care. Continue to monitor the wound for rebleeding during evacuation. Wounds with the HemCon bandage applied cannot be immersed in water. This would cause the bandage to loosen and rebleeding could occur. If immersion is expected you must place a water tight bandage over the wound.

HemCon's newest product is a flexible tape made exclusively from Chitosan. This 3.x 28in. 4 mm tape works by the same properties as the original Chitosan bandage. The ChitoFlex tape was designed to address wounds that cannot be addressed by tourniquets. This product is ideally suite for non-compressible injuries or through and through type injuries where the source of bleeding is not readily apparent. This product with its smaller size can be packed into smaller diameter wounds and works in the same manner as the 4 x 4 bandage. Pack the Chitoflex tape directly into the wound where the bleeding is the heaviest. It must be packed into the wound rapidly to prevent the bandage from sticking to the applier's bloody hands. Back it up by packing the wound with roller gauze also. Hold pressure on the wound for two minutes and apply a pressure bandage over the wound. All of the instructions for use of the original bandage apply to the use of the Chitoflex tape as well.

HemCon's final product is a small dental bandage designed to control excessive bleeding from dental procedures.

Z-Medica's newest product is a new formulation of its zeolite material that generates significantly less heat than its other products. QuikClot ACS+ and QuikClot 1st Response are both similar to the original ACS products as they are mesh gauze bags that contain the newly formulated granules. The ACS+ contains one 100gm bag of material that has ribbed dividers which differ from the original ACS container. The 1st Response container has one smaller 25 Gm mesh bag per container. Their application is the same as the original ACS product.

The directions for use of the ACS+ and 1st Response products are:

WARNING: Avoid contact with wet skin. Product reacts with small amounts of water and can cause burning. Stop burning by brushing away granules and flooding the area with large volume of water. If ingested, immediately drink two or more glasses of water.

DIRECTIONS - READ BEFORE USE

1. Tear outer package open at tabs.
2. Using gauze, remove excess blood with a wiping motion and pack wound with mesh bags. Use enough mesh bags to completely fill the wound. More than one mesh bag may be required for treatment of large wounds and/or multiple wounds.
3. Apply direct pressure over mesh bags in the wound until bleeding stops.
4. Product will feel warm. Wrap and tie bandage to maintain pressure.
5. Seek MEDICAL CARE immediately. Show the empty pack to medical personnel.

PRODUCT REMOVAL

1. Gently remove mesh bag(s) from the wound.
2. Proceed with normal irrigation and/or suction until all loose beads, if any, are removed.
3. Device contains a blue x-ray detectable element (1 in long x 0.11 in diameter

The Company no longer ships QuikClot® ACS, and will substitute the ACS+ and 1st Response products, but for those who may continue to have the older products, the directions for use are as follows:

1. Apply direct firm pressure to wound using sterile gauze dressing or best available substitute.
2. If bleeding is stopped or nearly stopped after approximately one minute of pressure, wrap and tie bandage to maintain pressure on wound and seek Medical Care.
3. If moderate to severe bleeding continues, hold packet away from face and tear open at tabs.
4. Use wiping motion to remove gauze and excess blood – immediately start slow pour of one QuikClot packet directly

into wound. Stop pour as soon as dry granules cover wound area. Use only enough QuikClot to stop bleeding. If bleeding continues open second packet of QuikClot and continue to use as directed. **QuikClot ACS:** Use wiping motion to remove gauze and excess blood. Immediately pack wound with mesh bags. Use enough mesh bags to cover the wound surface, making sure the beads inside are distributed over the wound.
5. Reapply firm pressure to QuikClot covered wound using sterile gauze. Hold pressure for 5 minutes. Wrap and tie bandage to maintain pressure. **QuikClot ACS:** Using sterile gauze apply firm pressure over the mesh bags in the wound for at least three (3) minutes. Wrap or tie bandage to maintain firm pressure
Seek Medical Care immediately. Discard unused granules in open pack, or mesh bags and show empty pack to medical personnel.
WARNINGS
Sterility not guaranteed if package is damaged or opened.
Discard damaged or open packages
Avoid breathing dust or getting in eyes. Dust may irritate eyes, nose, throat and skin. If inhaled, get to fresh air. Flush eyes with water for 15 minutes. Product contains trace amount of quartz.
Long term biocompatibility has not been determined.
Keep away from children
CAUTION: Do not store QuikClot packages in direct sunlight.
QuikClot® is a registered trademark of Z-MEDICA Corporation.

Medtrade Biopolymers Corporation.

This company produces Celox, the newest hemostatic agent on the market today. It is distributed by **Sam Medical Products**. This product is a proprietary granular mixture with Chitosan as a base product. It is designed to be poured directly into the bleeding wound and have pressure applied with a gauze roll. The mechanism of action is dual fold. Its cationic polymers bind strongly to the anionic groups on the surface of red blood cells. This clumps the red cells together effectively creating a clot. In addition Celox™ absorbs water. The clot itself is malleable, moldable, and at times has the appearance of a "geode" i.e. clotted blood on the surface and unused granular material in the center. This center of unused material is an available resource of Celox (cationic polymer) if any re-bleeding occurs. Because Celox™ clots independently of the normal clotting factors it clots heparinized blood and cold (hypothermic blood).
Directions for use:
1. Tear open the package.
2. Blot excess blood from the wound using gauze.
3. Immediately pour entire contents of pouch into the wound.
4. Apply firm pressure directly to the wound for 5 minutes using a gauze pad. If any bleeding persists apply direct pressure for an additional 5 minutes.
5. Apply a pressure bandage over the wound.
6. Evacuate the casualty ASAP.
7. Show empty package to medical personnel.
8. For removal of product; thoroughly irrigate all material from the wound prior to standard wound protocols.

As you can see there are a number of different agents with different mechanisms of action that will stop serious arterial and venous bleeding. Never before in the history of Military medicine have we had bandages, and powders that would stop life-threatening bleeding. However, none of these products are the panacea for all serious bleeding wounds. Some have advantages, and disadvantages. It is your responsibility to evaluate these different products and develop protocols and confidence in the use of these different hemostatic agents. I have personally used all of these products in a live tissue lab and they all work to control severe arterial and venous bleeding. However, so does a wound filled with roller gauze. It has been my experience that these products work better to control life-threatening bleeding if the wound is not gushing out blood. I have had better experience with all the hemostatic agents by shutting off the blood supply to the wound prior to applying these different agents. The application of a tourniquet or by applying proximal pressure above the wound allows for better visualization of the wound and easier application of the hemostatic agent. Each of these agents requires a few minutes to setup or marinate in the wound. By applying pressure or a tourniquet it gives you time to apply the specific hemostatic agent of choice, pack some gauze on top of the agent, apply a tight pressure bandage and hold pressure on the wound, before releasing slowly the proximal pressure or the tourniquet and seeing what the results of the hemostatic agent are.

It has also been my experience that training these products is difficult for the individual medical officer or NCO. How do you demonstrate the effectiveness of a hemostatic agent without a bleeding model? It is important that individual soldiers, combat lifesavers, combat medics, Nurses, PAs and MDs have had the opportunity to touch, see, and smell the specific agent your unit is planning on using. They need to apply some of these agents into simulated wounds to better understand how they will be applied on the battlefield. The first time they ever apply one of these agents should not be on an actual bleeding casualty. Training must be accomplished with each of these agents prior to use in combat.

Hemorrhage continues to be the leading cause of preventable death in battle. Every Soldier, not just the medic needs to know how to control bleeding and save lives on the battlefield. These hemostatic agents present a new approach to controlling hemorrhage and are another tool in the medic's aid bag to help stop life-threatening bleeding.

Army Burn Management Course

The VA Knowledge Network will air the 2006 U.S. Army Burn Management Course February 26 – March 2, 2007. Information regarding the program is listed in the VA Learning Catalog.

Please take this opportunity to note the following important information:

1. Site registration is not required because EES has registered once for the entire VA.
2. PARTICIPANTS MUST REGISTER in advance.
3. VAKN will show each day one time only. There will be no rebroadcasts.
4. Even though site registration is not required, each site should designate a facilitator - which will typically be the satellite coordinator. The site facilitator is responsible for verifying hours claimed by signing/initializing the Student Log In Sheet. See site facilitator information at the link below f or copies of this form.
5. The website http://www.cs.amedd.army.mil/ddl/BMTC07/BMTC07.html has information for facilitators and the link for participant registration.
6. At this time, the Army is not planning a Physician Assistant Recertification program for 2007. This Army Burn Management program does provide CME hours for Physicians Assistants so you may want to target this audience in addition to physicians, nurses, etc

The information below is taken from the facilitators guide.

CME Credits: Pre-approved for a maximum of **20 hours** of clinical Category I CME hours by the American Academy of Physician Assistants. **Participants should only claim those hours actually spent participating in the CME activity.** This CME/CE may only be claimed on the actual days of broadcast as no current mechanism is in place to claim CME for material viewed at a later date. Other providers may claim CME, if eligible under either of the above categories. **The site facilitator is responsible for verifying hours claimed by signing/ initialing the Student Log In Sheet.**

NOTE: In order to receive CME, each participant must register online at: http://www.cs.amedd.army.mil/ddl/BMTC07/BMTC07.html (Click on the link for 2006 Management of Burns & Multiple Trauma Rebroadcast). Anyone who fails to register will not receive CME/CE credit. Certificates will be emailed to participants ONLY after receiving required Student Log and Critiques Sheets.

Night Stalker PA Recognized for Contribution to Aviation

By Kimberly T. Laudano, 160th Special Operations Aviation Regiment (Airborne) Public Affairs

FORT CAMPBELL, Ky. (USASOC News Service, Feb. 8, 2007) – Capt. Scott M. Gilpatrick, Certified Aeromedical Physician Assistant, was awarded the 2006 Army Aviation Association of America Medicine Award for his contributions to Army Aviation while serving in the 160th Special Operations Aviation Regiment (Airborne).

"I am honored to be nominated for this award, especially as the award is usually given to doctors," he said. "I was very surprised someone took the time to nominate me during this busy time in our unit's history."

Maj. Shawn F. Kane, the 160th Senior Regiment Flight Surgeon, submitted the award nomination because he felt

Gilpatrick was truly deserving of it. "His contributions to our mission and (the ground forces we support) are immeasurable."

The AAAA annual awards program recognizes outstanding achievements in Army aviation. The AAAA Medicine Award is presented to the flight surgeon or aeromedical physician assistant who best exemplifies the contribution to Army aviation during the awards period

For Gilpatrick, the award is a reflection of all of the medical professionals in the 160th.

"It says, as a section, we go above and beyond what's expected of any other team of aviation health care providers," Gilpatrick explained. "We not only provide great care to our aviators and crew, we provide the (ground forces) we support with world class casualty evacuation (CASEVAC) coverage."

According to his nomination packet, Gilpatrick made significant contributions in aviation medicine, special operations aviation medicine tactics, techniques and procedures and training special operations aviation medical personnel over the past year. The nomination submission says that these contributions were instrumental in saving the lives of countless special operations forces personnel and the successful completion of numerous missions in support of the Global War on Terrorism.

Recognition of Gilpatrick's and the unit's medical accomplishments through this award has potential to expand support for the importance and feasibility of similar programs and capabilities in conventional units.

"Hopefully this award will show the Aviation Medicine Community that Aeromedical Physician Assistants are valuable members of a unit's Aviation Medicine Program," said Gilpatrick. "I also hope it shows that an aviation unit's medical section can provide CASEVAC coverage to the ground force units they support, beyond the conventional medical evacuation (MEDEVAC) unit's mission."

Gilpatrick's contributions to aviation medicine are based on core principles he believes in and passes along to his fellow medics.

"Every Soldier you take care of should be looked at as a family member. Take care of them like you would your brother or sister," he said. "Also, make whatever unit you happen to be in better by doing something new and improved to usual operations."

Making a difference

For more than six months during the 2006 award period, Gilpatrick served as a joint task force flight surgeon. He flew more than 100 missions, including some 300 night vision hours, in direct support of the task force.

Gilpatrick was also responsible for planning all of the medical support for aviation missions and ensuring the overall casualty evacuation plan for the joint task force was feasible.

"I had to plan for missions that included all aspects of casualty care, from the time someone was hurt on the battlefield to their subsequent arrival at a surgical facility, usually via 160th aircraft," he explained.

Kane said Gilpatrick performed superbly in a position designated for a lieutenant colonel and a senior flight surgeon because of his expertise, professional knowledge and experiences. "He is a respected professional amongst his medical colleagues as well as the aviator and ground force leadership in the special operations community."

While deployed, Gilpatrick simultaneously maintained an aviation medical program at three geographically separated locations. This program included flying duty medical exams, daily provision of primary care medicine and a comprehensive post deployment screening program.

"Captain Gilpatrick provided outstanding aviation medical guidance and clinical advice to his special operations combat medics at those outstations," said Kane. "Even in the immediate absence of an aeromedical physician assistant, his aviators were always assured the best care possible and his commanders were always assured the best guidance."

When he's not deployed, Gilpatrick dedicates time and energy into providing medical care to the Soldiers in his unit and training his medical personnel.

Kane said the aviators and commanders know that Gilpatrick is truly their ally and advocate and that they actively seek care instead of hiding and compounding their medical issues. This is significant because the aviators and crew members in Gilpatrick's unit have remained continuously deployed for more than five years and that operation tempo takes a heavy toll on readiness related to chronic and challenging medical conditions. "Crewmembers and commanders trust and respect (Captain Gilpatrick's) recommendations," he said.

"They know that if they have to be grounded it is in the best interest of their health and the units' mission and most importantly it will be for the minimum amount of time."

Tough, realistic training is another contribution Gilpatrick continues to provide toArmy aviation. He regularly plans, resources and conducts aviation combat focused medical training, including three joint trauma management training events in the past year. Kane said the events were all based on lessons learned in combat and have reinforced or validated unit TTPs.

"Captain Gilpatrick has used his prior experiences and skills as a ground force medic to ensure that unit medical personnel are combat multipliers," Kane said. "The unit's medical personnel have been crossed trained in numerous non-medical tasks to ensure survivability of not only themselves

but their patients." This training includes live fire movements, rotary wing close air support and fast roping. All of this training has proved invaluable in combat and made the SOAR medical personnel unique and highly sought after medical providers, said Kane.

Gilpatrick also examines ways to optimize existing medical training. For example, SOAR medics must be able to lift a critically injured Soldier into a helicopter regardless of environment. Proficiency in this skill can be a matter of life or death, with the requirement usually presenting itself in extremely challenging situations. In response, Gilpatrick increased the number and complexity of injured personnel hoist training events in the past year. "The unit has conducted and is now even more proficient in high angle, confined space, urban and over water hoist missions," said Kane. "Personnel from the 160th have conducted all of those hoist operations in actual combat situations in both Iraq and Afghanistan theaters of operations."

Because of Gilpatrick's dedication and determination, Kane said that he is a true "quiet professional," completing every mission at a standard well above that of his peers or superiors and goes out of his way to take care of his Soldiers. "These qualities along with his proven combat record, aviation medicine skills and ability to train medical personnel make him truly deserving of the recognition associated with the AAAA Medicine Award."

Capt. Scott M. Gilpatrick, Certified Aeromedical Physician Assistant, was awarded the 2006 Army Aviation Association of America Medicine Award for his contributions to Army Aviation while serving in the 160th Special Operations Aviation Regiment (Airborne).
Photo by Kimberly T. Laudano.

Improvising to Save Lives, Medics Use Unusual Tools to do their Job in Combat

By Lisa Burgess, Stars and Stripes Mideast edition, Thursday, February 1, 2007

BAGHDAD — The military calls them "field-expedient solutions." In plain English, they're alternate methods that work better under the pressure of combat.

Whatever you call it, war has a way of bringing out the creativity in troops — particularly when it comes to helping wounded buddies.

For example, here on the east side of Baghdad, just about every Humvee crew that's logged heavy mission time on the mean streets has learned to strap a hard backboard on their vehicle in addition to or instead of the Army's standard stretcher.

The standard-issue litters "do not fit inside up-armored Humvees, unless they are cut down," Capt. Arne Oas, 35, a physician's assistant from Haymarket, Va., who is with the 2nd Infantry Division's Headquarters and Headquarters Company, 2nd Brigade, Special Troops Battalion at Forward Operating Base Loyalty.

"Maybe they fit inside regular Humvees at one time, but they don't fit inside the ones we have now, with all the armor," Oas said.

Lisa Burgess / S&S
Cpt. Arne Oas shows both a standard stretcher - cut down to fit the interior of the vehicle - and a rigid backboard. The backboard normally lies flat in the back as it's toted around and then removed when needed.

Even if the handles on the stretchers are sawed off — which most units know enough to do — "the patient bows up in a weird position" in the stretcher when it's stuffed across the center console of the Humvee, Oas said.

The hard backboards, which are traditionally only used for patients suspected of having spinal injuries, are much shorter and fit inside the Humvee without modifications, he said.

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Since they're not flexible, they are also much more comfortable for patients, Oas said — not to mention the troops who may have them in their laps as they ride in the back with the patient, trying to keep pressure on wounds or just needing a quick ride back to the FOB in an emergency. And in trauma medicine, every minute counts.

Another "field expedient" tool adopted by the aid station staff here at FOB Loyalty is the "rescue hook," or seat-belt cutter, firefighters carry to get victims out of car crashes.

The rescue hooks are designed to cut through the tough, crash-resistant material that vehicle seat belts are made out of in seconds, when an explosion or fire in the vehicle is imminent. That same hook makes quick work not just of clothing, but more importantly, of body armor, no matter how tangled, bloody, or mangled, Oas said.

The hooks work much more quickly than the standard trauma shears that come with every aid kit, he said.

"Two quick movements — zip, zip, one on each side — and that vest is off, so we can start working," he said.

The rescue hooks, which cost about $25 each, are not standard Army equipment, so if medics and others like them, they usually have to purchase their own.

But Capt. Gerald "Wayne" Surrett, 35, brigade surgeon for the 2nd Infantry Division's 2nd Brigade Combat Team, said he just placed an order to equip his entire team with the small devices.

One of the most unconventional tools at the FOB Loyalty aide station is the tuning fork, used to detect broken bones. The station has no X-ray machine.

If a vibrating tuning fork is placed in the right spot on the bone, right above a suspected fracture, the vibration will hurt, Oas said.

"You can tell by the way a patient reacts that the bone is broken," Oas said. "He'll go, 'Oh, man, that hurts!' If there's nothing wrong, it doesn't hurt at all."

The tuning fork trick, which is about 90 percent accurate, sounds weird, but it is well-known to the special operations community, Surrett said.

Lisa Burgess / S&S
Cpt. Arne Oas, 35, a physician's assistant, holds two "field expedient" tools used the FOB Loyalty aid station team: a tuning fork (left), to diagnose fractures, and a "rescue hook," or seat-belt cutter, to quickly remove clothing and body armor.