



## Continuing Medical Education - News & Information

September 2011 - Volume 17, Issue 9

Multi-Agency Edition

### *Inside this issue:*

**(bold = new content)**

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### Journal CME Newsletter

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### From the Editor

#### **\*\* 2011 REMAC Protocol revisions take effect August 1 \*\***

Although normally scheduled for April 1, this year's NYC REMAC protocol update has been changed for August 1 implementation in the field and on certification exams.

**Until August 1, only the 2010 protocols are in effect.**

Always see [nycremasco.org](http://nycremasco.org) for the current approved protocols.

*REMEMBER: the protocols on the street are the protocols on the exam!*

### ***Mandatory REMAC Credentialing Fee***

A \$25 fee has been instituted by NYC REMAC for all new or recertifying paramedic credentials. On successfully completing a REMAC exam, candidates will receive a temporary letter verifying certification. They will soon after be mailed a memo directly from NYC REMSCO requiring a completed application, proof of NY State paramedic certification, and credentialing fee by money order only. On receipt, a permanent NYC REMAC certification card will be issued.

*Please direct inquires on this process to NYC REMSCO at 212-870-2301*

## Outline of August 2011 NYC REMAC protocol changes

see REMAC Advisories 2011-02, 2011-03, 2011-04 at [nycremsco.org](http://nycremsco.org)

### General Operating Procedures

- CPR: clarifies that REMAC follows AHA except as specified
- Advanced Airway Management: adds section making use of ETI and alternative airways equal except in non-cardiac arrest situations, limiting ETI to 2 total attempts
- Definition of Unstable Dysrhythmias: removes chest pain, SOB, possible MI from definition

### CFR Protocols

- 300 WMD, 301 Resp Distress/Failure, 320 Traumatic Arrest, 328 Burn: updated to match BLS protocols
- 304 Non-Traumatic Chest Pain: removes blood pressure assessment and assistance or patient with NTG admin

### BLS Protocols

- 403 Non-Traumatic Arrest: mandates AED availability & use; moves transport order to step 8
- 407 Wheezing: removes wheezing from list of assessment criteria; mandates OLMC contact for epinephrine to patients over 33 years-old
- 410 Anaphylaxis: mandates OLMC contact for patients over 33 years-old
- 413 Seizures: removes list of signs/symptoms
- 414 Poisoning or Drug OD: removes OLMC contact, information list, & order for dilution
- 426 Soft Tissue Injuries: adds tourniquet option
- 430 EDP: removes GCS from assessment

### ALS Protocols

\*\* “ETI” changed to “Advanced Airway Management”

- 500-A Smoke Inhalation\*\*: changes dopamine admin to Standing Order
- 500-B Cyanide Exposure\*\*: removes note on indications; changes dopamine admin to Standing Order
- 501 Resp Arrest: protocol deleted
- 503 Non-traumatic Arrest: limits switching from AED to ALS monitor only at the end of CPR cycle
- 503-B PEA/Asystole\*\*: removes atropine

- 504-A Suspected MI: moves aspirin to step 1; makes total doses of NTG unlimited under Standing Orders; removes morphine & Medical Control Options
- 504-B Cardiogenic Shock: moves fluid bolus and dopamine to Standing Order
- 505-A, B & C Dysrhythmias: adds note: if defibrillator’s maximum joule setting is less than 360, use equivalent cardioversion energies
- 506 APE: makes total doses of NTG unlimited under Standing Orders
- 507 Asthma & 508 COPD: makes total doses of albuterol unlimited under Standing Orders; mandates mixing of albuterol & ipratropium, limited to 3 doses
- 510 Anaphylaxis: changes methylprednisolone and dexamethasone to Standing Orders
- 515 Non-Cardiogenic Shock & 520 Traumatic Arrest: removes repeat of fluids under Medical Control Options
- 521 Head Injuries\*\*: clarifies indication for advanced airway management & moves it to step 2
- 528 Burns & 529 Pain Management: adds fentanyl to Medical Control Options
- 531 Severe Nausea/Vomiting: new protocol
- 543 Neonate Resus: removes meconium aspiration; moved IV/IO access, epi and fluid bolus admin to Standing Orders; removes Medical Control Options
- 550 Peds Resp Arrest: adds note referring to Peds AMS protocol; changes naloxone to weight-base dosing with titration; removes ET admin of naloxone
- 551 Peds Obstructed Airway: clarifies procedure with cuffed ET tube
- 553 Peds Non-Traumatic Arrest\*\*: increases joule settings
- 559 Peds Traumatic Arrest\*\*

### Appendices

- Appendix B Patient Assessment: clarifies transport decision; removes CUPS
- Appendix D AED Guidelines: appendix deleted
- Appendix I Hospital Listing: adds pediatric ages
- Appendix T Use of Tourniquets: appendix added

## REMAC Exam Study Tips

REMAC candidates have difficulty with:

- \* Epinephrine use for peds patients
- \* 12-lead EKG interpretation
- \* ventilation rates for peds & neonates

REMAC Written exams are approximately:

- |                  |                       |
|------------------|-----------------------|
| 15% Protocol GOP | 40% Adult Med. Emerg. |
| 10% BLS          | 10% Adult Trauma      |
| 10% Adult Arrest | 15% Pediatrics        |

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## Certification & CME Information

- *Of the 36 hours of Physician Directed Call Review CME required for REMAC Refresher recertification, at least 18 hours must be ACR/PCR Review (which may include QA/QI Review). The remaining 18 hours may include ED Teaching Rounds and OLMC Rotation.*
- **Failure to maintain a valid NYS EMT-P card will invalidate your REMAC certification.**
- **By the day of their refresher exam all candidates must present a letter from their Medical Director verifying fulfillment of CME requirements. Failure to do so will prevent recertification.**
- **FDNY paramedics, see your ALS coordinator or Division Medical Director for CME letters.**
- **CME letters must indicate the proper number of hours, per REMAC Advisory # 2000-03:**
  - 36 hours - Physician Directed Call Review
    - ACR Review, QA/I Session (**minimum 18 hours of ACR/QA review**)
    - Emergency Department Teaching Rounds, OLMC Rotation
  - 36 hours - Alternative Source CME - **Maximum of 12 hours per venue**
    - Online CME
    - Lectures / Symposiums / Conferences
    - Journal CME
    - Clinical rotations
    - Associated Certifications:  
BCLS / ACLS / PALS / NALS / PHTLS

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**REMAC Refresher Written examinations** are held monthly, and may be attended up to 6 months before your expiration date. See the exam calendar at the end of this Journal. To register, call the Registration Hotline @ 718-999-7074 by the last day of the month prior to your exam.

**REMAC Quarterly Written and Oral examinations** are held every January, April, July & October. Registration is limited to the first 50 applicants. See the exam calendar at the end of this journal.

**REMAC CME and Protocol information** is available, and suggestions or questions about the newsletter are welcome. Call 718-999-2671 or email [swansoc@fdny.nyc.gov](mailto:swansoc@fdny.nyc.gov)

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REMSCO: [www.NYCREMSCO.org](http://www.NYCREMSCO.org)  
NYS/DOH: [www.Health.State.NY.US](http://www.Health.State.NY.US)

Online CME: [www.EMS-CE.com](http://www.EMS-CE.com) [www.MedicEd.com](http://www.MedicEd.com)  
[www.EMCert.com](http://www.EMCert.com) [www.WebCME.com](http://www.WebCME.com)  
[www.EMINET.com](http://www.EMINET.com)

### FDNY ALS Division Coordinators

<u>Citywide ALS</u>	<u>718-999-1738</u>	<u>Division 4</u>	<u>718-281-3392</u>
Lt. Joseph Pataky		Mike Romps	
<u>Division 1</u>	<u>212-964-4518</u>	<u>Division 5</u>	<u>718-979-7175</u>
Joseph Farrell		Joseph D'Agosto	
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Edwin Martinez		Hector Arroyo	
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Gary Simmonds		Cindy Corcoran	

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### FDNY EMS Medical Directors

<u>Dr. Glenn Asaeda</u>	<u>718-999-2666</u>	<u>Dr. Dario Gonzalez</u>	<u>718-281-8473</u>
Field Response Division 5 OLMC Director, REMAC Coordinator		Field Response Division 2 USAR/FEMA Director, OEM Liaison	
<u>Dr. David Ben-Eli</u>	<u>718-999-0404</u>	<u>Dr. Doug Isaacs</u>	<u>718-281-8428</u>
Field Response Division 3 Haz-Tac, PASU & EMS Resident Director		Field Response Division 1 EMS Training & Rescue Medic Director	
<u>Dr. John Freese</u>	<u>718-999-2790</u>	<u>Dr. Bradley Kaufman</u>	<u>718-999-1872</u>
Chief Medical Director Prehospital Research Director		Field Response Division 4 QA, EMD & EMS Fellowship Director	
EMS Fellows			
<u>Dr. Pamela Lai</u>	<u>718-999-0364</u>	<u>Dr. Michael Redlener</u>	<u>718-999-0351</u>

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### FDNY OLMC Physicians and ID Numbers

Alexandrou, Nikolaos	80282	Isaacs, Doug	80299
Asaeda, Glenn	80276	Jacobowitz, Susan	80297
Barbara, Paul	80306	Jameson, Angus	80309
Ben-Eli, David	80298	Kaufman, Bradley	80289
Cox, Lincoln	80305	Munjaj, Kevin	80308
Freese, John	80293	Schenker, Josef	80296
Giordano, Lorraine	80243	Schneitzer, Leila	80241
Gonzalez, Dario	80256	Schoenwetter, David	80304
Hansard, Paul	80226	Silverman, Lewis	80249
Hegde, Hradaya	80262	Soloff, Lewis	80302
Hew, Phillip	80267	Van Voorhees, Jessica	80310
Huie, Frederick	80300		

## HEMORRHAGE CONTROL

The ABCs of critical trauma patient management are essential tools for treating these patients. This month we will focus on the C, otherwise known as CIRCULATION! The goal of our prehospital treatment is to prevent these deaths by providing high quality, appropriate care in the field and delivering these patients quickly to the appropriate hospital facilities.

### CASE PRESENTATION:

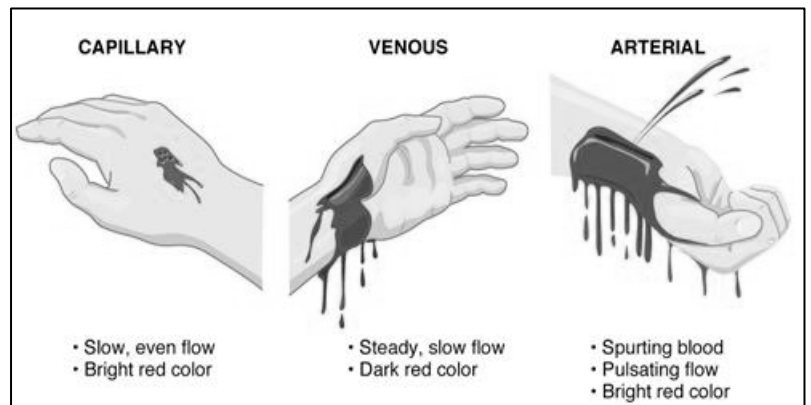
24 y.o. male jumping from building roof to roof missed his last jump and both upper extremities were partially amputated at the mid forearm where he hit the sharp side of the roof. He then fell backward and landed in a pile of garbage. A passerby saw him fall and immediately called 911. On arrival, the BLS team finds him awake screaming in pain. His breath sounds are equal bilaterally and he has no visible head injury. Vital signs are as follows: HR 124 BP, 100/60, RR 24. His right arm has an open fracture with significant displacement of hand with no pulsatile bleeding. His left arm is also obviously fractured, avulsed and “hanging” only from the skin of the dorsal aspect. From the wound, there is pulsatile bleeding. After calming him down, you get a sense that he is A and O x 3. You attempt to control the hemorrhage, then initiate transport to the closest trauma center.

- *Can we estimate his blood loss?*
- *What is our first step to addressing his most visible injury?*
- *What if the first step does not work?*
- *How much IV Fluid should this patient receive?*

### I. WHAT IS HEMORRHAGE?

When a blood vessel is disrupted, there is an open circuit within the usually closed circulatory system. Blood that is supposed to be contained is suddenly released from an injury site either into the body (internal bleeding) or out of the body (external hemorrhage).

The significance of the injury is dependent on the blood vessel type and size. Arteries are the thick-walled, muscular vessels that transport blood to the tissues. The pulse is palpated in these blood vessels which reflect a combination of the force of the heart’s contraction and the constriction or vasodilation of the blood vessels



themselves. As demonstrated in the accompanying picture, an arterial bleed has a pulsatile flow and is usually brighter red in color, secondary to the increased oxygen content. Arteries have a higher intravascular pressure and therefore require a higher pressure to tamponade an open, bleeding vessel. The aorta is the largest artery in the body. The femoral, carotid and brachial arteries are the largest vessels outside of the thoracoabdominal cavity.

Veins are more pliant, less muscular blood vessels that transport blood back from the body to the heart. The amount of blood in any vein depends on the diameter of the vessel. It is a low pressure system and therefore easier to tamponade with direct pressure.

Capillaries are the bridge between the arterial system and the venous system. They transport blood to organs for the cellular transfer of oxygen and other materials. The body's autonomic system selectively controls flow to certain capillary beds in times of stress to shut off the less essential areas. Bleeding from capillaries is usually oozing and is easily stopped by direct pressure or a pressure bandage.

### **Stopping the Bleed: Coagulation**

The coagulation system is designed to act when a blood vessel's lining, or endothelium, is disrupted. Platelets floating in the blood stick to the open surface and clump together to seal the hole in the vessel where blood is being lost. This platelet plug in turn stimulates a clotting cascade that creates a scaffold on which fiber can be placed to create a permanent seal.

Holding pressure on a wound allows the body's natural clotting mechanisms to take effect. If pressure is released too early, the clotting cascade proteins do not have time to form and the process is interrupted.

### **Shock in the Trauma Patient**

Shock can be defined as a state of inadequate tissue perfusion in which the delivery of oxygen at the cellular level is inadequate to meet metabolic needs.

When we inhale, oxygen, nitrogen and other gases from the atmosphere enter our lungs. Oxygen diffuses into the blood, where hemoglobin, found in red blood cells (RBCs) binds it. Each RBC has many molecules of hemoglobin that can each carry four oxygen molecules. This oxygen-rich blood is ready to be delivered to the cells and tissues where it is used to power the functions of all the systems in our body.

The heart then pumps blood through the blood vessels to deliver the blood to the body for use in various organs and body systems. The heart receives signals from the nervous system (autonomic: parasympathetic and sympathetic) as well as from circulating hormones (epinephrine, norepinephrine) that change the speed of the heart rate as well as the intensity of the pumping mechanism.

The blood vessels, arteries, veins and capillaries, are active components of the circulatory system. All arteries, and to a lesser extent veins, have muscles in the wall which control the diameter of the blood vessels which in turn controls the flow of blood.

These muscles respond to signals from the brain via the autonomic (sympathetic and parasympathetic) nervous system, as well as from circulating hormones such as epinephrine and norepinephrine, and other chemical signals that cause the muscles to either relax or contract leading to vasodilation or vasoconstriction, respectively. Pressure receptors in the carotid artery and heart send signals to the brain to let it know if there are any problems with the amount of blood circulating in the blood vessels.

The estimated circulating blood volume is approximately 70 mL/kg - for an average 70 kg person this corresponds to about 5 liters. As we will see, when the blood volume changes, the body will respond in predictable ways that can help the care provider understand how much blood a bleeding trauma patient may have lost.

A breakdown in any of the components of this system can lead to shock. We will discuss the categories of shock as it relates to the trauma patient and concentrate on hemorrhagic shock.

## **II. CATEGORIES OF SHOCK**

**Cardiogenic Shock:** Inadequate cardiac pump function. A patient who has had chest trauma could potentially bruise the heart and can result in myocardial dysfunction that may cause the heart to pump ineffectively, and thereby prevent blood from reaching the end-organs that require the oxygenated blood.

**Distributive Shock:** Relative hypovolemia that occurs as blood vessels dilate resulting in the increase of size of the vascular space. An example of which is septic shock where there is a systemic inflammatory response to the overwhelming presence of bacteria in the blood resulting in hypovolemia.

**Neurogenic Shock:** Disruption in the ability of the sympathetic nervous system to control vessel dilation and constriction. This results in generalized vasodilation, hypotension and bradycardia. This form of shock is common with spinal cord injuries.

**Obstructive Shock:** Extra-cardiac obstruction to blood flow. A classic example of this is cardiac tamponade where blood accumulates between the heart and the pericardium. This eventually exerts enough pressure on the outside of the heart to prevent blood from returning to the heart and thus disrupts oxygen delivery to the body.

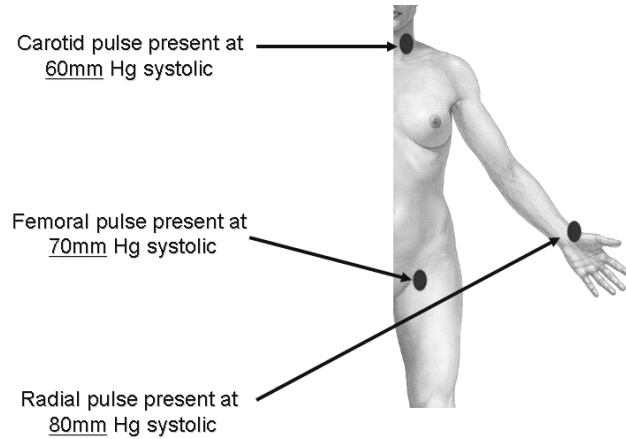
**Hypovolemic Shock or Hemorrhagic Shock:** Inadequate circulating volume. An uncontrolled loss of blood volume triggers protective mechanisms by the body to preserve blood flow to vital organs.

As stated earlier, the human body, specifically the cardiovascular system, has adapted to scenarios in which circulating blood volume decreases, either from hemorrhage or dehydration. Special pressure receptors (baroreceptors) located in the heart and carotid artery stimulate the sympathetic nervous system, along with epinephrine release from the adrenal glands, to increase cardiac output by increasing the strength and rate of cardiac contractions. These mechanisms also trigger the constriction of blood vessels to redistribute the blood to maintain perfusion to vital organs (brain, heart, kidneys) at the expense of the nonvital organs (muscles, GI tract, skin).

The above compensation mechanisms work well, but only up to a certain point. When these mechanisms can no longer overcome the amount of blood loss, a patient's blood pressure drops. A decrease in the blood pressure signals a switch from compensated shock to decompensated shock, which is a sign of impending death. It should be emphasized that a patient exhibiting signs of compensation is already in shock and is "not going into shock" when the blood pressure drops.

**QUICK TIP:**

*A bedside tool for estimating blood pressure is demonstrated in the image to the right. If the patient has a radial pulse, there is at least a systolic blood pressure of 80 mmHg. Presence of femoral pulse is correlated with at least 70 mmHg blood pressure and presence of a carotid pulse with a blood pressure of at least 60 mmHg.*



The hemodynamic profile in response to significant acute hemorrhage-induced hypovolemia commonly includes tachycardia, hypotension, and signs of poor perfusion, including cool, pale, clammy extremities with weak peripheral pulses. Arterial and venous vasoconstriction leads to a narrowing of the pulse pressure (difference between the systolic and diastolic pressures). Cerebral hypoperfusion (hypoxic state) causes alterations in mental status that ranges from subtle changes to confusion and, ultimately, severe lethargy. Associated head injury or substance intoxication can make it impossible to distinguish these symptoms with cerebral hypoperfusion. However, in the setting of trauma, systemic evidence for hemorrhage should be sought.

The American College of Surgeons classification of hemorrhage from their Advanced Trauma Life Support (ATLS) course is a useful guide for estimating blood loss. Below is a table summary. Not included is urine output which is indicative of kidney perfusion since this is something not evaluated in the prehospital setting.

**Classification of Hemorrhagic Shock**

	Class I	Class II	Class III	Class IV
Estimated Blood Volume Loss	< 750 mL	750-1500	1500-2000	> 2000
%	< 15%	15-30%	30-40%	> 40%
Heart rate	< 100	100-120	120-140	> 140
Blood Pressure	Normal	Normal	↓	↓↓
Mental Status	Normal	Anxious	Confused	Lethargic

Although this classification is helpful in estimating the severity of hemorrhage, it must be remembered that there can be significant individual variation related to baseline health status and other factors:

## **Age**

A young person, especially an athlete, may have a robust compensatory response to hemorrhage and may appear relatively normal on quick examination. Consider a person with a pre-injury blood pressure of 130/70 and a heart rate of 60, and post injury vital signs of 116/90 and a heart rate of 90. Upon closer look, the patient has a mild tachycardia, tachypnea, pale skin, and is anxious. Contrast this to an elderly patient who may have diminished capability to compensate for acute blood loss. Cardiac functional reserve is diminished with age. Older patients have a lower cardiac output, decreased cardiac reserve, and are less likely to tolerate hemodynamic stress as compared to younger patients. Aging of the electrical conducting system or pharmacologic activity of  $\beta$ -blockers or calcium channel blockers (in patients taking these medications) may result in a decreased heart rate response to catecholamines, therefore preventing a compensatory tachycardia during hemorrhage.

## **Pregnancy**

During pregnancy, a woman's blood volume may increase almost by 50%. Heart rate and cardiac output are also increased. Because of these factors, a pregnant woman may not show signs of shock until there is a greater than 30% loss blood volume. Well before a pregnant woman may demonstrate signs of shock, the fetus may be affected since it is at a greater risk for hypoperfusion due to the low-pressure placental circulation. During the third trimester of pregnancy, compression of the vena cava may decrease venous return to the heart, thereby worsening the hypotension and tachycardia, even in the setting of less-severe hemorrhage. Elevation of a patient's right side, after they have been immobilized to a long board, may alleviate this problem.

## **Preexisting Medical Conditions**

Patients with preexisting medical conditions may have less ability to compensate for blood loss. Some of these conditions include coronary artery disease, implanted fixed-rate pacemaker (unable to develop compensatory tachycardia), and chronic obstructive pulmonary disease (COPD).

## **Medications**

Medications, especially those used for hypertension, may interfere with the body's compensatory mechanisms. As mentioned earlier,  $\beta$ -blockers and calcium channel blockers prevent the compensatory tachycardia that normally maintains perfusion. Other medications such as hydralazine and norvasc are detrimental by interfering with the blood vessels' ability to vasoconstrict. In addition to antihypertensive medications, patients on oral warfarin (Coumadin) as well as other anticoagulants, such as aspirin, and platelet agents (Plavix), have become commonplace and increase the risk of uncontrolled bleeding.

## **III. HEMORRHAGE MANAGEMENT**

### **Internal Hemorrhage**

There is a limited role for prehospital management of internal hemorrhage, other than recognition and rapid transport. These patients may ultimately require blood transfusions and operative treatment in the hospital.

### **External Hemorrhage**

External hemorrhage is the leading cause of preventable death in the military environment accounting for 9% of all fatalities that have occurred in wounds amenable to first aid. The current military conflicts in Iraq and Afghanistan have seen the highest rate of survival from these wounds. This may be attributed to improved body armor, better training of combat medics, and

advanced medical care which has included the use of hemostatic dressings, newer tourniquets, and a new approach in administering intravenous fluids.

Each year there are approximately 10 million emergency department visits in the United States for external hemorrhage. The severity of the injury is dependent on the source of hemorrhage (arterial, venous, or capillary) and the degree of vascular disruption. The control of external hemorrhage should proceed in a step-wise fashion with the use of escalating measures for more severe injuries.

## **Compression**

Direct pressure applied to a bleeding site is the initial and most important means for controlling external hemorrhage. The ability to control external bleeding depends on the source of bleeding (arterial or venous), the size of the defect in the blood vessel and the pressure within the vessel. Much like a pipe with water flowing through it, a vessel with a larger diameter and higher pressure would result in more rapid blood flow. Compression works to control hemorrhage by slowing the flow of blood from the wound so that the body's clotting process may work. Compression may be initiated with a gloved hand and then replaced with gauze dressings. The pressure should be maintained until bleeding is under control. Dressings should not be replaced once they become soaked as this may disrupt any clot that may have formed at the skin surface. Instead, additional dressings should be added on top of each other in cases of rapid blood loss. If this does not control the hemorrhage, a pressure dressing consisting of bulky dressings wrapped tightly with roller gauze may be applied.

Special considerations are cases of foreign bodies/impaled objects in wounds and fractures. If the wound contains an impaled object, direct pressure may be applied around the object to help control hemorrhage. The object should never be removed in the out of hospital setting as the object may be acting as a tamponade and may be helping to control the bleeding. If removed, this may cause worse hemorrhage. In addition, fractures, particularly femur and pelvis fractures, may result in internal hemorrhage. Pelvic fractures may accumulate as much as 3 liters of blood in the pelvis with unstable fractures. In cases of femur fractures, traction should be applied to prevent broken bone fragments from further lacerating blood vessels and damage other tissue.

## **Hemostatic Dressings**

Hemostatic dressings are special dressings that contain substances that help speed up the body's ability to develop a clot at the site of an injury. Many of these products were initially developed and used in combat trauma settings for severe uncontrolled bleeding in the prehospital setting. And while there are a number of hemostatic products on the market, the one which is employed for use by FDNY is QuickClot<sup>®</sup> for its ease of use, product stability and cost effectiveness. It is currently being issued to US forces in Iraq and Afghanistan as a hemostatic agent.

QuickClot<sup>®</sup> is used in cases of Mass Casualty Incidents (MCIs) and by Rescue Medics. It is released for use when a class order is issued by the 5M physician on call in cases of MCIs.

### **QuickClot<sup>®</sup>**

QuickClot<sup>®</sup> is composed of gauze that has been impregnated with the active ingredient kaolin. Kaolin



is a naturally occurring inert mineral that has been used for decades to stop hemorrhage. When QuickClot<sup>®</sup> is applied to the wound site, it absorbs liquid, resulting in an increased concentration of clotting factors, platelets, and red blood cells to stimulate clot formation. In addition, kaolin promotes the activation of several clotting factors and platelets.

In early versions of the product, reports of tissue damage and poor wound healing were found. This was the result of the fact that the absorptive property of the active ingredient is an exothermic reaction that would generate heat, resulting in tissue damage. Wound site temperatures were measured to be as high as 105° F, depending on the blood flow and amount of QuickClot<sup>®</sup> used. This version of the product was subsequently discontinued in 2008. The latest generation product currently in use has addressed these problems by prehydrating the kaolin so that it absorbs liquids less exothermically as well as repackaging the active ingredient in surgical mesh.

There are currently no contraindications or known allergic reactions to QuickClot<sup>®</sup>. It is stable at ambient temperature extremes and does not require special packaging or preparation before use. Severe wounds may require multiple QuickClot<sup>®</sup> dressings for hemostasis, and just as with the use of gauze dressings, when multiple dressings are used, the initial dressing should not be removed to prevent clot destabilization. Hemostasis typically occurs within 3-5 minutes of application. Dressings may be kept in place for up to 24 hours and should not be reused.

The data is limited in demonstrating the efficacy of QuickClot<sup>®</sup> and other hemostatic dressings. Most of the evidence is based on animal models or anecdotal use by the military in combat settings. A recent study has shown that because of the 3-5 minute activation time, hemostatic dressings perform as well as standard gauze dressings in combat settings. It is important to emphasize that QuickClot<sup>®</sup> is not a substitute for standard hemostasis treatment and is simply an adjunct to help control severe hemorrhaging.

While uncontrolled hemorrhage accounts for up to 80% of early civilian trauma deaths, a small percentage of these are from isolated extremity injury. Most of the civilian trauma hemorrhage is due to liver and cardiac injuries, with almost one third involving a major vessel injury. Based on our quick transport times to trauma centers and the type of injuries we encounter, hemostatic dressings such as QuickClot<sup>®</sup> are to be used only in MCI situations.

## **Tourniquets**

Much controversy and debate has been made over tourniquets since their first use in 1674. Concerns are due to tourniquet-related tissue ischemic or neurologic injuries that result in extremity amputation. Most complications are caused by improvised tourniquets, inappropriate use and inadequate compression.

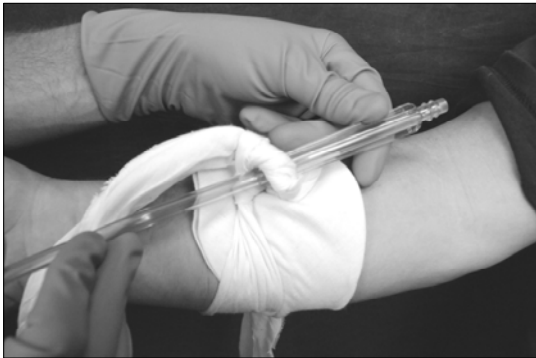
A narrow, constricting tourniquet can cause irreversible injury to underlying tissue, including contractures, rhabdomyolysis and compartment syndrome, skin necrosis, and nerve injury. This is why improvised tourniquets and commercial tourniquets should be at least one inch in



width to spread the pressure exerted and thereby decrease tissue damage. A common mistake is inadequate compression that fails to occlude the artery and only occludes the venous return which results in an increased rate of blood loss. When applying a tourniquet it should be fully applied with high enough pressure to completely impede both arterial inflow and venous outflow.

It is important to note that the pressure required to stop hemorrhage exponentially increases with the circumference of the extremity. For example, the pressure required to occlude a hemorrhaging artery in the thigh is significantly greater than that required to do the same in the arm. In addition, there is an inverse relationship between tourniquet width and the tension used for arterial occlusion. Thus, as the width of the tourniquet increases, the amount of pressure required for hemorrhage control is decreased as the force of the tourniquet is distributed over the larger surface area of the tourniquet.

Anecdotal reports of benefit from tourniquet use have been seen in modern warfare from both the Korean and Vietnam conflicts as well as in Afghanistan and Iraq. Retrospective reviews of prehospital tourniquet use by the Israeli Defense Forces (IDF), who allow liberal use of tourniquets, revealed improvement in extremity hemorrhage control and very few adverse limb outcomes when tourniquet use was less than 6 hours. During the Iraq and Afghanistan conflicts, tourniquets were provided to each soldier. In a study performed at a combat support hospital, 232 patients were observed to have had an application of a tourniquet. 90% survival was reported when the tourniquet was applied prior to the presence of shock, whereas only a 10% survival was observed after shock ensued. Transient nerve palsy was reported in 1.7% of patients and zero amputations were shown to have been caused by tourniquets.



Tourniquets have recently been approved for use by New York City REMSCO. Several tourniquets are currently being tested with a final product to be implemented soon. In the interim, improvised tourniquets may be created by using applying a blood pressure cuff proximal to the wound and inflating it until hemorrhaging has ceased. Cravat dressings may also be utilized, but it is important to ensure that the width of the material be greater than one inch to prevent ischemia. A rigid suction catheter handle or a large OPA may be used to tighten and secure the tourniquet. A tourniquet should be placed on exposed skin at least 2 inches proximal to the injury and should spare the joints as much as possible. The affected extremity and the tourniquet should be left uncovered so that the injury is easily identified when transferring care to the hospital. This month's video will review this application in further detail.

Tourniquets should never be removed in the prehospital setting. Doing so may result in recurring hemorrhage and complications similar to crush syndrome, including rhabdomyolysis which is the breakdown of skeletal muscle tissue being released into the blood stream.

#### **IV. INTRAVENOUS FLUIDS IN TRAUMA RESUSCITATION**

In the prehospital setting, it has been the standard of care in trauma patients to insert two large-bore IV catheters and infuse up to 3 liters of crystalloid fluid even if the patient is not hypotensive. However, research has not demonstrated improved survival of these patients and in some cases has shown increased mortality with fluid administration.

The drawback of administering large volumes of intravenous fluids is that it may worsen bleeding through injured vessels by the following:

1. clots plugging the vessel hole may become dislodged from the increase in blood pressure;
2. an increase in rate of hemorrhage due to increased blood pressure;
3. large amounts of fluids may produce hemodilution (making the blood less concentrated and/or dilution of clotting factors).

A relatively new concept being used by the military and trauma centers is permissive hypotension where the systolic blood pressure is raised without reaching normotension. Blood pressures are typically raised to reach a mean arterial pressure of 60 to 70 mmHg. A large study conducted in the 1980s compared the mortality rate of two groups of patients who sustained penetrating abdominal or thoracic injuries; one group was resuscitated only to SBP < 90 mmHg while another group was resuscitated to normotension. A significant reduction in the mortality of the fluid-restricted group was found. A similar study in 2002 showed that while the overall mortality rate was identical between the two groups of patients, fewer complications and earlier hemostasis was observed in the fluid-restricted group.

It should be emphasized that these studies were applied to patients with uncontrolled bleeding. A hypotensive trauma patient with an isolated extremity injury with severe hemorrhage will likely still benefit from immediate prehospital fluid resuscitation, provided that the bleeding is controlled with direct compression, tourniquets or hemostatic agents.

Patient groups in which permissive hypotension may be detrimental include: head trauma, pregnancy, elderly patients with cardiovascular disease, and entrapped patients with crush injury. Certainly more research, especially in the prehospital setting, needs to be performed. However fluids should be limited in patients with a normal mental status and a systolic blood pressure > 90 mmHg.

#### **V. CONCLUSION**

In conclusion, not much has changed in prehospital trauma management over the past few decades. While some ideas like tourniquets are recycled, several new innovations such as hemostatic dressings and permissive hypotension hold promise for improved patient outcomes. However, more research in the prehospital setting needs to be done before it can be implemented as the standard of care.

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## CME JOURNAL 2011\_J0 09: HEMORRHAGE CONTROL QUIZ

1. What is the average circulating blood volume for a 70 kg adult?
  - A. 1 liter
  - B. 3 liters
  - C. 5 liters
  - D. 10 liters
  - E. 15 liters
2. Hypovolemic shock can be from which of the following:
  - A. blood loss
  - B. inadequate cardiac pump function
  - C. sympathetic nerve damage
  - D. tension pneumothorax
  - E. pericardial tamponade
3. Which is not a sign of shock?
  - A. tachycardia
  - B. hypotension
  - C. agitation
  - D. seizures
  - E. pale, cool skin
4. A patient presents with an impaled meat cleaver through his right upper chest and arm. He is hemodynamically stable and there is minor bleeding from around the weapon. You should:
  - A. remove the object and put direct pressure on the wound
  - B. check if the object is easily removed, if so, remove
  - C. apply gauze dressing and remove once soaked through
  - D. apply gauze around object and stabilize with pressure
  - E. do nothing to object, transport

5. A small explosion in a factory causes a complex lower extremity injury in one employee. She has significant oozing bleed from the wound. Direct pressure does not stop the bleeding. What is NOT an appropriate intervention?
- A. a thin tourniquet
  - B. CAT tourniquet
  - C. QuickClot
  - D. pressure bandage
  - E. direct pressure
6. The human body responds to blood loss by all of the following except:
- A. baroreceptors signal to the brain that there is less circulating blood volume
  - B. the adrenal glands produce epinephrine which constricts blood vessels
  - C. platelets start to plug the hole in the blood vessel
  - D. the heart slows down
7. Which of the following is not a drawback of IV placement and administration of large volumes of intravenous fluid?
- A. clots plugging the vessel may become dislodged
  - B. hemodilution
  - C. increased hemorrhage
  - D. hemoconcentration
  - E. possible delayed transit times
8. A 65 y.o. male with history of coronary artery disease and seizure disorder is hit by a car. On scene, he is a little confused, blood pressure of 100/70 and a pulse of 60 and has significant bleeding from an upper extremity wound. What medication or class of medication would prevent him from a normal response to bleeding?
- A. ACE inhibitor
  - B. beta blocker
  - C. anti-hyperglycemic medication
  - D. opiate
  - E. Dilantin
9. Which of the following is **not** a likely consequence of improper tourniquet application?
- A. increased rates of infection
  - B. compartment syndrome
  - C. rhabdomyolysis
  - D. nerve injury
  - E. amputation
10. Mental status changes of confusion are seen at what class of hemorrhagic shock?
- A. mental Status not included
  - B. Class I
  - C. Class II
  - D. Class III
  - E. Class IV

# Journal CME Credit Answer Sheet

Based on the CME article, place your answers to the quiz on this answer sheet.

Respondents with a minimum grade of **80%** will receive **1 hour** of Online/Journal CME.

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Submit answer sheet by  
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September 2011 CME Quiz		
1.		<b>Required for BLS &amp; ALS providers</b>
2.		
3.		
4.		
5.		
6.		<b>Required for ALS providers only</b>
7.		
8.		
9.		
10.		

## Citywide CME – September 2011

*Sessions are subject to change without notice. Please confirm through the listed contact.*

Boro	Facility	Date	Time	Topic	Location	Host	Contact
BK	Kingsbrook	TBA	TBA	TBA: call to inquire →	ED Conference Room	Dr Hew	Manny Delgado 718-363-6644
	LICH	TBA	1200-1500	TBA: call to inquire →	Avram Conference Room "G"	Dr Vlasica	Aaron Scharf 718-780-1859
		TBA	0900-1200	TBA: call to inquire →	Avram Conference Room "A"		
	Lutheran	4 <sup>th</sup> Wed	1730-1930	Call Review <b>RSVP</b> →	Call for location →	Dr Chitnis	Dale Garcia 718-630-7230 <a href="mailto:dgarcia@lmcmc.com">dgarcia@lmcmc.com</a>
	Methodist	9/21	1900-2100	Lecture: Stroke <b>RSVP</b> →	506 6 <sup>th</sup> St, Brooklyn East Pavilion Auditorium	Dr. Schenker	718-780-5040
MN	NY Presbyterian	TBA	TBA	TBA: call to inquire →	Weill Cornell Campus A-950	Dr Ewy	RSVP: <a href="mailto:ssamuels@nyp.org">ssamuels@nyp.org</a> Ana Doulis 212-746-0885 x2
	NYU School of Medicine	TBA	TBA	TBA: call to inquire →	Schwartz Lecture Hall 401 E 30 Street	TBA	Jessica Kovac 212-263-3293
QN	FDNY-BOT	Cancelled until further notice		---	---	---	---
	NYH Queens	Thursdays	0800-0900	Call Review/Trauma Rounds	East bldg, courtyard flr	Dr Sample	Mary Ellen Zimmermann RN 718-670-2929
	Mt Sinai Qns	last Tues	1800-2100	Lecture or Call Review	25-10 30 Ave, conf room	Dr Dean	Donna Smith-Jordan 718-267-4390
	Parkway Hosp	3 <sup>rd</sup> Wed	1830-2130	Call Review	Board Room, 1st flr		<a href="mailto:pabruzzo@capitolhealthmgmt.com">pabruzzo@capitolhealthmgmt.com</a>
	Queens Hosp	2 <sup>nd</sup> Thurs	1615-1815	Call Review	Emergency Dept		
4 <sup>th</sup> Thurs		718-883-3070					
SI	RUMC	TBA	1400	TBA: call to inquire →	MLB conf room	Dr Ben-Eli	William Amaniera 718-818-1364

## 2011 NYC REMAC Examination Schedule

Month	<u>REMAC Refresher Exam</u> (Written only - CME letter required)		<u>REMAC Quarterly Exam - \$100 fee</u> (Written & 3 Orals Scenarios)			NYS/DOH Written Exam
	Registration Deadline	Exam Date (on Wednesdays)	Registration Deadline	Written @18:00	Orals @09:00	
January	12/31/10	1/19/11	Thursday 1/6/11	Thursday 1/20/11	Thursday 1/27/11	1/20/11
February	1/31/11	2/23/11				
March	2/28/11	3/23/11				3/24/11
April	3/31/11	4/20/11	Thursday 4/7/11	Thursday 4/21/11	Tuesday 4/26/11	
May	4/30/11	5/25/11				5/20/11
June	5/31/11	6/22/11				6/16/11
July	6/30/11	7/20/11	Thursday 7/7/11	Thursday 7/21/11	Thursday 7/28/11	
August	7/31/11	8/24/11				8/18/11
September	8/31/11	9/21/11				
October	9/30/11	10/26/11	Thursday 10/6/11	Thursday 10/20/11	Tuesday 10/25/11	
November	10/31/11	11/16/11				11/17/11
December	11/30/11	12/21/11				12/15/11

The **REMAC Refresher Written examination** is offered monthly for paramedics who meet CME requirements **and** whose REMAC certifications are either current or expired **less** than 30 days. To enroll, call **718-999-7074** before the register registration deadline above. Candidates may attend an exam no more than 6 months prior to expiration. Refresher exams are held at 07:00 or 18:00 hours at FDNY-EMS Bureau of Training, Fort Totten, Queens.

The **REMAC Quarterly Written & Orals examination** is for initial certification, **or** for inadequate CME, **or** for certifications expired **more** than 30 days. Registrations **must** be postmarked by the deadline above. Email [swansoc@fdny.nyc.gov](mailto:swansoc@fdny.nyc.gov) for instructions. You are encouraged to **register at least 30 days** prior to the exam - seating is limited. The exam fee as above is by **money order only**. The Quarterly is held at FDNY-EMS Bureau of Training, Fort Totten, Queens.