

“There’s a whole lot of bleedin goin on”

How to stop the gusher!

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## Objectives

- Examine the efficacy of tourniquet use and hemostatic gauze for exsanguinating extremity trauma.
- Review the history, controversies, and current recommendations for the use of these adjuncts in the pre-hospital arena.

## History of Tourniquet Use

- Ancient Romans were believed to be the first to employ tourniquets on the battlefield and in surgery.
- In 1517 German Surgeon Hans Von Gersdoff first depicted using a tourniquet during amputations.
- Wilhelm Farby, a German surgeon, first described using a “twisting stick” or windlass.
- In 1674 Etienne Morel, a French Army surgeon, introduced a stick into the bandage technique.
- John Louis Petit later modified it with a mechanical screw to control tension. He described “tourner”, the French verb “to turn”, hence the term tourniquet.

John Louis Petit-1718



## History

- During the civil war, Gross's manual of military surgery instructed regimental surgeons to ensure that every soldier must have in his pocket a stick of wood and a handkerchief, to "prevent their life current from running out of them"

## History

- In the Civil War, with poor evacuation, many hours passed before medical attention was received. There were therefore many instances of limb damage.
- Julian Chisolm, the Confederate Surgeon General, made the following comments in his Manual of Military Surgery:
  - "Recent experience, based upon the carelessness with which they are used, recommends their abolition from the field, as doing more harm than good to the wounded. Unless hemorrhage is very violent, threatening immediate destruction of life, the tourniquet is rarely required. The finger pressure of an intelligent assistant is better than any tourniquet made."

## History

- Military surgery progressed and the field dressing was introduced in 1870. Johann Von Esmarrch invented the Esmarrch dressing, also know as the cravat or triangular bandage.

## History

- World War II
- Rubber tubing
  - 6 foot x ½ inch latex
  - Size, weight, cost
  - One handed application upper arm





## History

- After the war use of TK's were de-emphasized.
- Not much documentation on use in Korea.
- Used in Vietnam however soldier survival attributed to rapid evacuation-MEDEVAC

## Tourniquets for Hemorrhage Control on Battlefield - 2003

- 4 year review Israeli Defense Force
- 550 injured, 125 deaths
  - None from extremity hemorrhage
- Tourniquets in 91 patients
- Ischemic time  $83 \pm 52$  min
- Neuro complications
  - 5 patients
  - 4 dissipated within 24hrs

## Survival With Emergency Tourniquet Use - 2009

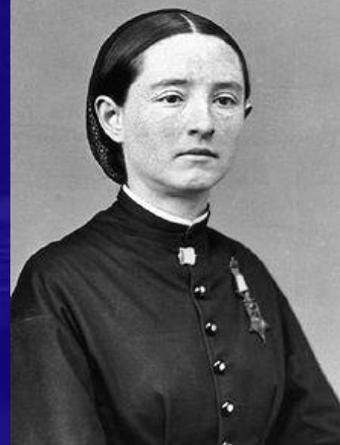
- Single site, prospective observational study
- Ibn Sina Hospital, Baghdad, Iraq
- Conclusions:
  - Survival higher in patients with vs patients without TK
  - Survival higher if normotensive before application
  - Nerve palsies rare and transient

## PHTLS

- Prehospital tourniquets are indicated if direct pressure or a pressure dressing fails to control hemorrhage.
- The tourniquet should be placed prior to extrication and prior to transport. There is a clear survival advantage if placement is done prior to the onset of shock.
- The tourniquet is tightened until hemorrhage ceases. An additional tourniquet can be placed next to the first tourniquet if bleeding control is inadequate following placement of the first tourniquet.
- The patient should be transported to a hospital with immediate surgical capabilities whenever possible.
- The time of tourniquet application should be documented and relayed to the trauma team upon arrival at the hospital.
- There are few, if any, significant complications attributed to tourniquet use. It is a safe procedure, should be performed by all EMS personnel, and saves lives.



## Hemostatic Agents



## Dr. Mary Edwards Walker

- First Female U.S. Army Surgeon
- Battle of Bull Run, July 21, 1861
- First and only female Medal of Honor recipient
- Pioneered the concepts of amputation, packing and cauterization for hemorrhage control
- Born: 26 November 1832, Oswego County, N.Y.

## Hemostatic Agents

- Quikclot
- Hemcon
- Celox
- Fibrin-Based Sealant

## Hemostatic Agents

- Used in recent years in the military setting
  - Iraq and Afghanistan
- Most agents absorb water in some capacity
  - This acts to concentrate the clotting factors in the wound and aid in clot formation.
- Some of the more advanced dressings have human coagulation factors implanted in the dressing to promote fibrin formation.

## Hemostatic Agents

- Quikclot
  - One of the longest on the market
  - Zeolite (silicone like) powder
  - Readily absorbs water
  - Leaves the larger platelets in the wound.
  - Currently on third generation
    - Combat Cloth

## Hemostatic Agents

- HemCon
  - Chitosan
    - Muco-adhesive properties
  - Becomes extremely sticky when in contact with blood
  - Adhesive like action seals the wound and controls bleeding

## Hemostatic Agents

- Celox
  - Another chitosan product
  - One of the newer agents on the market
  - Granular form so can be applied to deep narrow wounds

## Hemostatic Agents

- Fibrin-Based Sealant
- Represents the next generation of hemostatic products.
- Collaboration project between US Army and American Red Cross
- Dressing contains human fibrinogen, thrombin and calcium chloride
- Human studies are on-going

## Hemostatic Agents-Application

- Hemostatic Agents are placed directly into the wound
- They are an adjunct to conventional hemorrhage control methods.
- Document the type and number of dressings used.
- Report to ED staff that hemostatics were used.

## Hemostatic Agents-Conclusions

- Safe and effective.
- Should be in standard hemorrhage control protocol.
- Adjunct to conventional methods.



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