Back to Basics: Emergency Hemorrhage Control — A Skill for Life

Steven Chin, MD
Disaster Medical Director
PIH Health Hospital – Whittier
PIH Health Hospital Disaster Resource Center
Emergency Tourniquet Project

Steven Chin, MD, FACEP
Disaster Medical Director
PIH Health Hospital
Whittier, California

Funded by Hospital Preparedness Program Grant #5U90TP000516

© Chin 2015

2013 Boston Marathon Bombing

“Tourniquets save lives. They buy you time to get to definitive care.”

~ Dr. Ricky Kue
Assistant Medical Director
Boston EMS

Outline

- Concepts:
  - Time to bleed to death
  - MARCH algorithm
- Applications:
  - Direct pressure
  - Pressure dressing
  - Tourniquet
- Implementation:
  - Risk of tourniquets?
  - Special situations
- Summary
Course Objectives

1. Identify the treatment priorities for a trauma patient: MARCH
2. Be able to apply a pressure dressing
3. Be able to apply a CAT tourniquet
4. Understand how to improvise a windlass tourniquet

Disclaimers

- The views expressed in this presentation are those of the author and do not reflect the official policy or position of PIH Health Hospital or the County of Los Angeles
- The author declares he has no financial interests in any products discussed in this presentation
- Permission is granted to distribute this presentation for non-commercial, educational use only
Lessons From the Battlefield

TCCC: Tactical Combat Casualty Care

- Three most common preventable causes of death:
  1. Extremity hemorrhage
  2. Tension pneumothorax
  3. Airway obstruction

Time to Death

- Bleed to death in minutes
TCCC Treatment Priorities

■ “MARCH” algorithm:
  - Massive Hemorrhage Control
  - Airway
  - Respirations
  - Cardiovascular
  - Head injury/Hypothermia
Basic Vascular Anatomy

Hemorrhage Control Skills
Hemorrhage Control Techniques

Methods to control hemorrhage

- Direct pressure
- Elevation
- Pressure points
- Tourniquet

https://en.wikipedia.org/wiki/Tourniquet

Call the Plumber!!!

If a pipe bursts, what do you do?

1. Plug the hole
2. Shut off the water
Practical Applications

- Direct pressure
- Pressure dressing
- Tourniquet
  - Technique
  - Manufactured tourniquet
  - Adapted tourniquet
  - Field expedient tourniquet
- Special consideration

Direct Pressure

- Place heel of protected hand directly over site of bleeding
- Press directly toward center of limb
- Compress vessel against underlying bone
Pressure Dressing: Elastic Wrap and Gauze

1. Place folded dressing directly over wound
2. Wrap wide ACE™ wrap twice over wound
3. Next, wrap once high, then once low to lock dressing in place
4. Complete wrapping
5. Check for bleeding control and loss of pulse
6. If pulse is lost, treat dressing as a tourniquet

Pressure Dressing: Elastic Wrap and Gauze (cont.)
Pressure Dressing:
Gauze and Elastic Bandage

Apply direct pressure.

Start over wound.
Wrap tightly over wound.

Wrap above wound.
Wrap below wound.

Continue over wound.
Secure wrap.

Check for bleeding and pulse.
Pressure Dressing: Cravat or Roll Gauze

1. If available, place folded dressing directly over bleeding site
2. Place center of cravat directly over bleeding site/gauze
3. Wrap tails around limb and pull tight
4. Tie full knot directly over wound site
Pressure Dressing: Cravat or Roll Gauze (cont.)
Tourniquet Basics

Goals:
- Control hemorrhage
- Avoid additional damage

Design:
- Applies adequate pressure to stop bleeding
- Not too narrow (>1 inch wide)

Basic Tourniquet Technique

- Place 2 to 3 inches proximal to bleeding site
- Tighten until bleeding stops and distal pulse eliminated
- Note time applied
- Mark forehead with “T”
Combat Application Tourniquet (CAT)

CAT Instruction Sheet

1. Apply tourniquet proximal to the bleeding site. Route the band around the limb and pass the tip through the inside slit of the buckle. Pull the band tight.

2. Pull the band just tight and securely fasten the band back on itself.

3. Pass the tip through the outside slit of the buckle. The friction buckle will lock the band in place.

4. Turn the rod until bright red bleeding has stopped and the distal pulse is eliminated.
CAT: One-Handed Application

1. Insert limb thru loop of band. Apply proximal to bleeding site
2. Pull band very TIGHT
3. Fasten band around limb up to rod clip
4. Twist rod until bright red blood stops and distal pulse eliminated
5. Lock rod into clip
   5.1. Check for bleeding and distal pulse
6. Adhere band over rod, in clip and around limb
7. Secure rod and band with strap
   7.1. Mark time and “T”

CAT: One-Handed Application (cont.)

VIDEO
CAT: Two-Handed Application

1. Route band around limb and pass red tip thru inside slit of buckle. Apply proximal to bleeding site
2. Pass red tip thru outside slit of buckle
3. Pull band very TIGHT
   3.1. Fasten band back on itself
4. Twist rod until bright red blood stops and distal pulse eliminated
5. Lock rod into clip
   5.1. Check for bleeding and distal pulse
   5.2. If bleeding, tighten or place 2nd tourniquet proximal, next to first
6. Secure rod with strap
   6.1. Mark time and “T”

CAT: Two-Handed Application (cont.)

VIDEO
Tighten the Band on the CAT

- Failures of the CAT have been due to loose bands
- Be sure to pull the band tightly through the buckle prior to twisting the bar
- No more than 3 fingers should fit under the band when pulled tight
Adapted Tourniquet

Blood Pressure Cuff
- Tape cuff closed after inflation
- Clamp inflation hose

Field Expedient Tourniquet

- Belt
- Improvised windlass
  - Bandana and stick
- Anything you tie around the extremity
Vacationing medic Marie Hildreth used a boogie board string as a tourniquet for the 12-year-old's arm, and a string from a beach tent to stop the bleeding on her leg.

**Improvised Windlass Tourniquet**

1. Wrap cravat or other material around limb and tie tight half knot. Apply proximal to bleeding site
2. Place rod or long stiff item on knot
3. Tie full knot over rod
4. Twist rod until bright red blood stops and distal pulse eliminated
5. Tie end of rod to secure
   5.1. Check for bleeding and distal pulse
5.2. If bleeding, tighten or place 2nd tourniquet proximal, next to first
6. Mark time and write “T” on forehead
Improvised Windlass Tourniquet (cont.)
PIH Health Hospital Disaster Resource Center
Emergency Tourniquet Project

[Image of person applying tourniquet]

PIH Health Hospital Disaster Resource Center
Emergency Tourniquet Project

[Image of person applying tourniquet]
Continued Bleeding

- Tighten first tourniquet
- Apply second tourniquet next to first
- Place additional tourniquet proximally over femur or humerus

Are Tourniquets Really Dangerous???

Complications of Tourniquet Use:
- Pain
- Nerve/muscle damage
- Loss of limb/rhabdomyolysis

Mitigating Factors:
- Acceptable warm ischemia time is 2 hrs
- Life over limb!
Tourniquets Can Be Used Safely!

From the *Journal of Trauma*, Kragh, et.al. studied 428 tourniquets on 232 patients:

- No limbs lost due to tourniquet
- No amputations due solely to tourniquet
- Tourniquet duration was NOT associated with increased morbidity

“The benefits (of using tourniquets) far outweighed the risks in our experience.”

Emergency Tourniquet Kit (ETK)

- 4 orange (operational) CAT tourniquets
- 6 triangular bandages for field expedient tourniquets
- Poly-envelope/velcro for mounting
Training Materials

- 2 blue (training) CAT tourniquets
- 6 triangular bandages to practice field expedient tourniquets
- 1 USB drive with training material

Special Considerations

- Arrive with an improvised tourniquet
- Pain and removal
- Proximal injuries
- Hemostatic agents
Pre-Existing Improvised Tourniquet

If a patient arrives with an improvised tourniquet:

- And is bleeding, apply a second tourniquet above first
- And is not bleeding, consider applying a second tourniquet above first, especially if pulse not eliminated

Pain and Tourniquet Removal

- Tourniquet will cause pain
- Tourniquet should not be removed until you are prepared to manage the bleeding

Remember:
- Tourniquets are electively used in the operating room every day for up to 2 hours at a time
Proximal Injuries

Proximal or junctional injuries
- Direct pressure
- Packing
- Junctional tourniquet
- Hemostatic agent

Hemostatic Agents
- Thrombin
- Surgicel
- Hemcon
- Combat gauze
Administrative Steps
- Add to "formulary"
- Add policy and procedures
- Establish resupply ... one time grant
- Consider adding hemostatic gauze

Practice and Training
- Repetition and muscle memory
- See one, do one, teach one
- Practice, practice, practice
- Use pulse oximetry to measure success
- Spread the word ... teach your “family”
Summary

1. MARCH
2. Direct pressure or tourniquet
3. Spread the word

The life you save may be your own or your family’s!

Both Sydney and Celeste Corcoran Survived the Bombing

Steven.Chin@PIHHealth.org
Questions?

Thank You!

Steven Chin, MD
steven.chin@pihhealth.org