



PIH Health Hospital Disaster Resource Center Emergency Tourniquet Project

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2013 Boston Marathon Bombing



www.cnn.com/2013/05/17/us/gallery/john-tlumacki/



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

**~ Dr. Ricky Kue
Assistant Medical Director
Boston EMS**

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Outline

■ Concepts:

- Time to bleed to death
- MARCH algorithm

■ Applications:

- Direct pressure
- Pressure dressing
- Tourniquet

■ Implementation:

- Risk of tourniquets?
- Special situations

■ Summary

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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**

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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



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Time to Death

■ Bleed to death in minutes



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TCCC Treatment Priorities

■ “MARCH” algorithm:

- Massive Hemorrhage Control
- Airway
- Respirations
- Cardiovascular
- Head injury/Hypothermia

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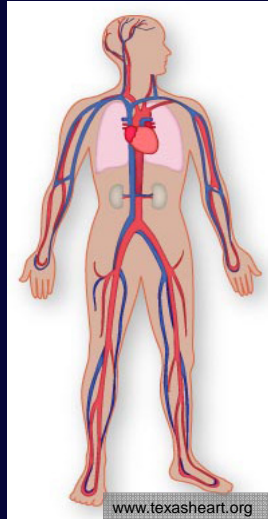
Massive Hemorrhage



www.cnn.com/2013/05/17/us/gallery/john-tlumacki/

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Basic Vascular Anatomy



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Hemorrhage Control Skills

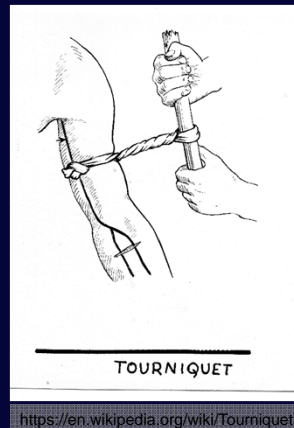


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Hemorrhage Control Techniques

Methods to control hemorrhage

- Direct pressure
- Elevation
- Pressure points
- Tourniquet



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Call the Plumber!!!



If a pipe bursts, what do you do?

1. Plug the hole
2. Shut off the water

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Practical Applications

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

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Direct Pressure

- **Place heel of protected hand directly over site of bleeding**
- **Press directly toward center of limb**
- **Compress vessel against underlying bone**



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Pressure Dressing: Elastic Wrap and Gauze



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Pressure Dressing: Elastic Wrap and Gauze (cont.)

- 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**

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Pressure Dressing: Gauze and Elastic Bandage



Apply direct pressure.

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Start over wound.

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Wrap tightly over wound.

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Wrap above wound.

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Wrap below wound.

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Continue over wound.

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Secure wrap.

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Check for bleeding and pulse.

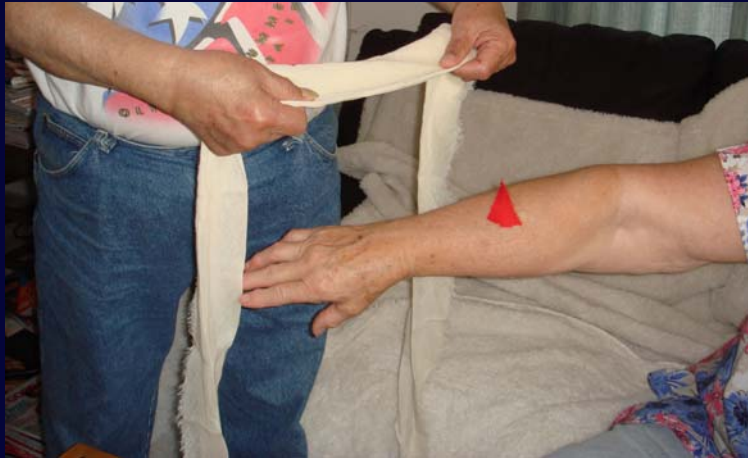
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Pressure Dressing: Cravat or Roll Gauze

- 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.)



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Tourniquet Basics

Goals:

- **Control hemorrhage**
- **Avoid additional damage**

Design:

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

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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"**

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Combat Application Tourniquet (CAT)



www.narescue.com/combat-application-tourniquet-c-a-t

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



3 Pull the band very tight and securely fasten the band back on itself.



4 Twist the rod until bright red bleeding has stopped and the distal pulse is eliminated.

www.narescue.com/combat-application-tourniquet-c-a-t

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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
- 5.2. If bleeding, tighten or place 2nd tourniquet proximal, next to first
6. Adhere band over rod, in clip and around limb
7. Secure rod and band with strap
- 7.1. Mark time and "T"

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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"

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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

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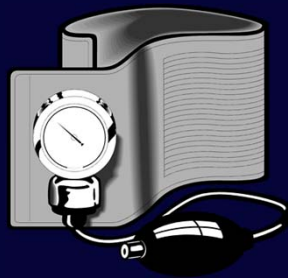
Improvised Tourniquets



Adapted Tourniquet

Blood Pressure Cuff

- Tape cuff closed after inflation
- Clamp inflation hose



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Field Expedient Tourniquet

- Belt
- Improvised windlass
 - Bandana and stick
- Anything you tie around the extremity

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Medic Saves Shark Attack Victim With Boogie Board String



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

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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**

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Improvised Windlass Tourniquet (cont.)



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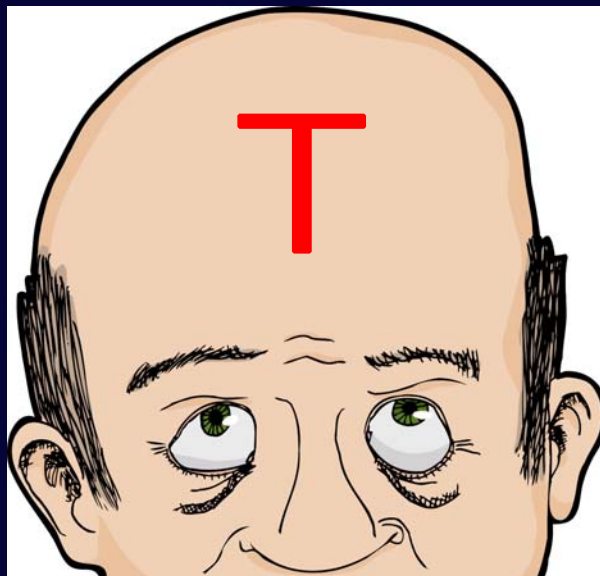
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Continued Bleeding

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

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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!

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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.”

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Emergency Tourniquet Kit (ETK)

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



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Training Materials

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



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Special Considerations

- Arrive with an improvised tourniquet
- Pain and removal
- Proximal injuries
- Hemostatic agents

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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**

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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**

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Proximal Injuries

Proximal or junctional injuries

- Direct pressure
- Packing
- Junctional tourniquet
- Hemostatic agent

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Hemostatic Agents

- Thrombin
- Surgicel
- Hemcon
- Combat gauze

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Administrative Steps

- Add to "formulary"
- Add policy and procedures
- Establish resupply ... one time grant
- Consider adding hemostatic gauze

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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"

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Summary

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

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


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Both Sydney and Celeste Corcoran Survived the Bombing



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www.cnn.com/2013/05/17/us/gallery/john-tlumacki/




driving readiness in
dynamic times

Disaster Planning for
California Hospitals

Questions?




CALIFORNIA
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Thank You!

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