Junctional Tourniquets: Rethinking Exsanguinating Hemorrhage

Ameristar Convention Center
October 23, 2015

David K. Tan, M.D., EMT-T, FAAEM
EMS Section Chief, Division of Emergency Medicine
Washington University School of Medicine
Tactical Physician and Medical Director
St. Charles County Police Department
EMS & Police Combined Training

Spring/Summer 2014

- St. Louis County
- All fire agencies participated in joint training with St. Louis County law enforcement personnel
EMS & Police Combined Training

- Included the provision of hemorrhage control using tourniquets
Hemorrhage
Hemorrhage – Femoral Artery

What about those high femoral artery injuries where tourniquet placement is almost impossible?
Objectives

Describe the evolution of tourniquet usage in the management of exsanguinating hemorrhage

Define junctional hemorrhage and how standard tourniquets may not be sufficient to control bleeding

Review critical anatomy important to understand when using junctional tourniquets

List the various devices available for high junctional hemorrhage control
Tourniquet Usage

“Tourniquets are a measure of last resort…”
Tourniquet Usage

* Military experience translated to civilian usage in EMS and ED practice – safe and effective

- First choice option in tactical and mass casualty use
Tourniquet – Public Access

"Stop the Bleed" Program Aims to Equip Bystanders with Lifesaving Tools

BY SUSAN NICOL ON AUG 14, 2015

WASHINGTON, D.C. – “The fate of the wounded rests in the hands of the one who applies the first dressing,” Dr. Nicholas Senn’s remarks in 1898 remain true to this day, said Dr. Richard Hunt, director of medical preparedness policy for the White House National Security Council.

That’s why the public should have access to tourniquets and other bleeding control equipment, Hunt told members of the Federal Interagency Committee on EMS (FICEMS) this week.

The Town of Davie, Fla., has already added severe bleeding kits to community AEDs.
SO, WHERE WOULD YOU PUT THE TOURNIQUET?

Tourniquets: What We’re Teaching

- Axillary artery
- Brachial artery
- Radial artery
- Ulnar artery

Deep palmar arch
Superficial palmar arch
Digital arteries
Tourniquets: What We’re Teaching

SO, WHERE WOULD YOU PUT THE TOURNIQUET?

Keep it simple: High & Tight

Axillary artery

Brachial artery

Radial artery

Ulnar artery

Deep palmar arch
Superficial palmar arch
Digital arteries
Tourniquets: What We’re Teaching

SO, WHERE WOULD YOU PUT THE TOURNIQUET?

Keep it simple: High & Tight

STOP THE BLEEDING
But What About Junctional Injuries?
Junctional Hemorrhage

- Bleeding at compressible sites that are not amenable to standard tourniquet application
  - Axilla
  - Inguinal Crease
  - Iliac arteries
Four FDA-approved Junctional TQ

- Combat Ready Clamp (CRoC)
- Abdominal Aortic and Junctional TQ (AAJT)
- Junctional Emergency Treatment Tool (JETT)
- SAM Junctional TQ (SJT)
In vivo assessment of the Combat Ready Clamp to control junctional hemorrhage in swine

Kheirabadi, Bijan S. PhD; Terrazas, Irasema B. MS; Hanson, Margaret A. DVM; Kragh, John F. Jr. MD; Dubick, Michael A. PhD; Blackbourne, Lorne H. MD
Combat Ready Clamp (CRoC)
Combat Ready Clamp (CRoC)

30 subjects; 97% success rate

Factors associated with difficulty:
- BMI >26; greater difficulty localizing pulse/compressing tissue
- Baseline hypertension
The Abdominal Aortic & Junctional Tourniquet
The Only Device Indicated for Pelvic Junctional Bleeding

The Abdominal Aortic & Junctional Tourniquet™ (AAJT) is the only junctional tourniquet approved to treat hemorrhage in the pelvis, a common complication of lower junctional injuries.

- Pelvic Bleeding
- Stabilize the Pelvis
- Inguinal Bleeding
- Axilla Bleeding

- Safest Junctional Tourniquet (JxnTQ)
- Only JxnTQ with Human Safety Data
- Best JxnTQ for confined space rescue
- "The one that works"

Designed by Special Operations personnel who have confronted the problem of junctional hemorrhage.

Hemorrhage Stops Here™

www.compressionworks.net
www.speeroptech.com

NSN#: 6515-01-616-4999
TOLL FREE: 1-888-427-6231
Abd and Aortic Junc’l TQ (AAJT)

*Approved in 2011; largest “footprint” of the four JxnTQ on the market*
Junc’l Emergency Tx Tool (JETT)

30 subjects; 97% success rate

Factors associated with difficulty:

- BMI > 26; greater difficulty localizing pulse/compressing tissue
- Baseline hypertension
Junc’l Emergency Tx Tool (JETT)

*Approved for inguinal hemorrhage and as a pelvic ring stabilizer
SAM Junctional Tourniquet (SJT)
SAM Junctional Tourniquet (SJT)

* Indicated for inguinal and axillary bleeds
* Also for pelvic fx stabilization
Head-to-Head Comparison

- 120 applications studied
  - All 4 types applied 3 times each per volunteer at the inguinal region (the common FDA indication)
- Evaluated for effectiveness, comfort, safety

**Performance of Junctional Tourniquets in Normal Human Volunteers**

John F. Kragh, Jr., MD, Russ S. Kotwal, MD, MPH, Andrew P. Cap, MD, PhD, James K. Aden, 3d, PhD, Thomas J. Walters, PhD, Bijan S. Kheirabadi, PhD, Robert T. Gerhardt, MD, Robert A. DeLorenzo, MD, Heather F. Pidcocke, MD, Leopoldo C. Cancio, MD
Figure 1. The junctional tourniquet effectiveness percentages varied by model. The CRoC, the SJT, and the JETT had the highest effectiveness percentages; their differences were not statistically significant. Tourniquet use was for 60 seconds; early effectiveness was during the first 15 seconds, and late effectiveness was during the last 15 seconds. For each of the four models, differences for early and late effectiveness were not statistically significant.
Head-to-Head Comparison

Figure 4. The average pain scores varied by model of junctional tourniquet. The AAJT was the most painful junctional tourniquet ($p < 0.0001$); the other three devices were not different from each other ($p > 0.1662$ for all three). Note that the rank order from least pain to most pain was the same order as the subjects’ ranking of performance from best to worst (Figure 5).
Head-to-Head Comparison

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*No major safety issues (adverse events) noted with the performance study*
# Head-to-Head Comparison

<table>
<thead>
<tr>
<th>Name Nickname</th>
<th>Combat Ready Clamp</th>
<th>Abdominal Aortic and Junctional Tourniquet</th>
<th>Junctional Emergency Treatment Tool</th>
<th>SAM Junctional Tourniquet</th>
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<tbody>
<tr>
<td>Maker</td>
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<td>Indication(s)</td>
<td>Battlefield, difficult inguinal bleeds; axilla bleeds</td>
<td>Battlefield, difficult inguinal, pelvis, axilla bleeds</td>
<td>Difficult inguinal bleeds</td>
<td>Difficult inguinal bleeds; difficult axilla bleeds; pelvic fracture immobilization</td>
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Important to Note:

- Requires basic anatomical knowledge and specific training
  - Unlike C.A.T. where general public could likely utilize it effectively with simple instructions (like an AED)
- Each device has unique training requirements and pitfalls
  - EMS Providers would need dedicated training for each device prior to response and deployment
Summary

✿ Limb tourniquets are now widely accepted and practiced by EMS and Law Enforcement alike

✿ Junctional hemorrhage may be an increasing threat in the era of explosive devices and active shooter threats

✿ Same goal: save as many lives as possible
  ▸ JxnTQ may help us reach that goal
Questions?