Out of Hospital Hemorrhage Control

Brandon B. Bleess, MD, EMT-T
@BBBleess

PLEASE SHARE!

- #ICEP18
- #FOAMed
- #FOAMems
- #FOANed
- #FOAMpara
- #StopTheBleed

DISCLOSURES

- Nothing to disclose
- Will discuss commercially available devices- not an endorsement of any particular product
- Opinions expressed are my own

OBJECTIVES

- Understand out of hospital hemorrhage control options with evidence supporting these methods
- Understand methods of patient access and transport options
- Discuss public access hemorrhage control and other public health initiatives related to hemorrhage control

WHY TALK ABOUT THIS?

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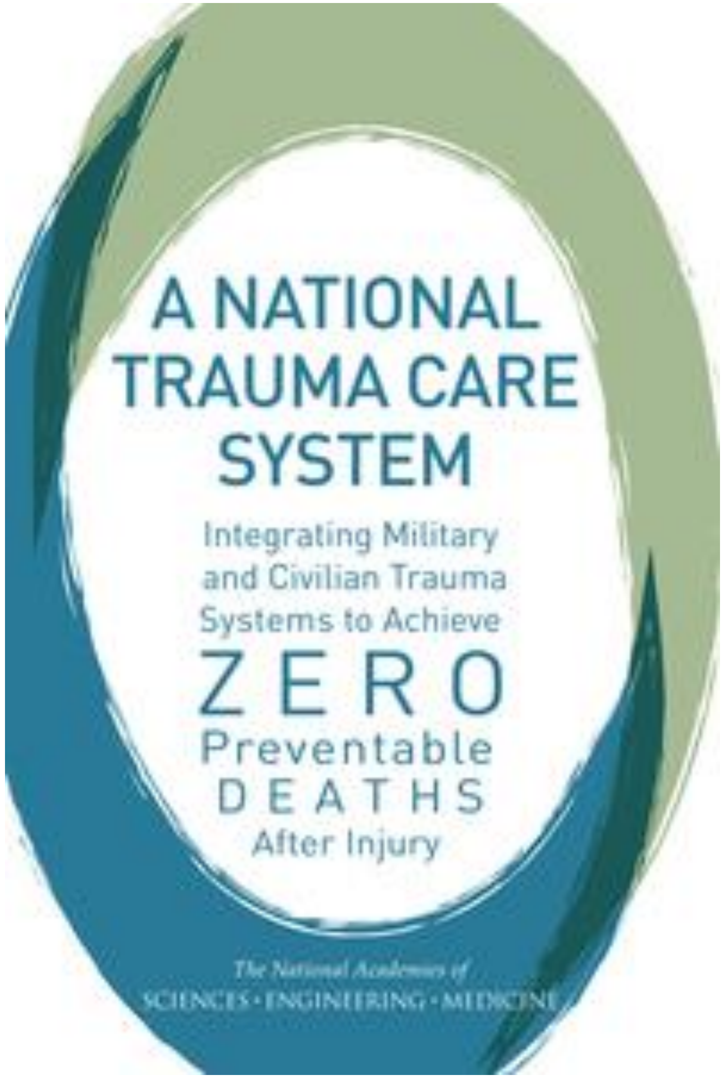
WHY TALK ABOUT THIS?

ZERO PREVENTABLE DEATHS

- Joint Project in 2016:
  - ACEP
  - ACS
  - NAEMSP
  - NAEMT
  - Trauma Center Association of America
  - Department of Defense
  - Department of Homeland Security
  - Department of Transportation



TOURNIQUETS

TOURNIQUET HISTORY

- *Tourner:* French for to turn
- 4th Century BC-Alexander the Great to control bleeding
- Roman Empire controlled bleeding from limb amputations during war-bronze straps with leather for comfort
- 1785: Sir Gilbert Blane suggested each Royal Navy sailor carry a tourniquet

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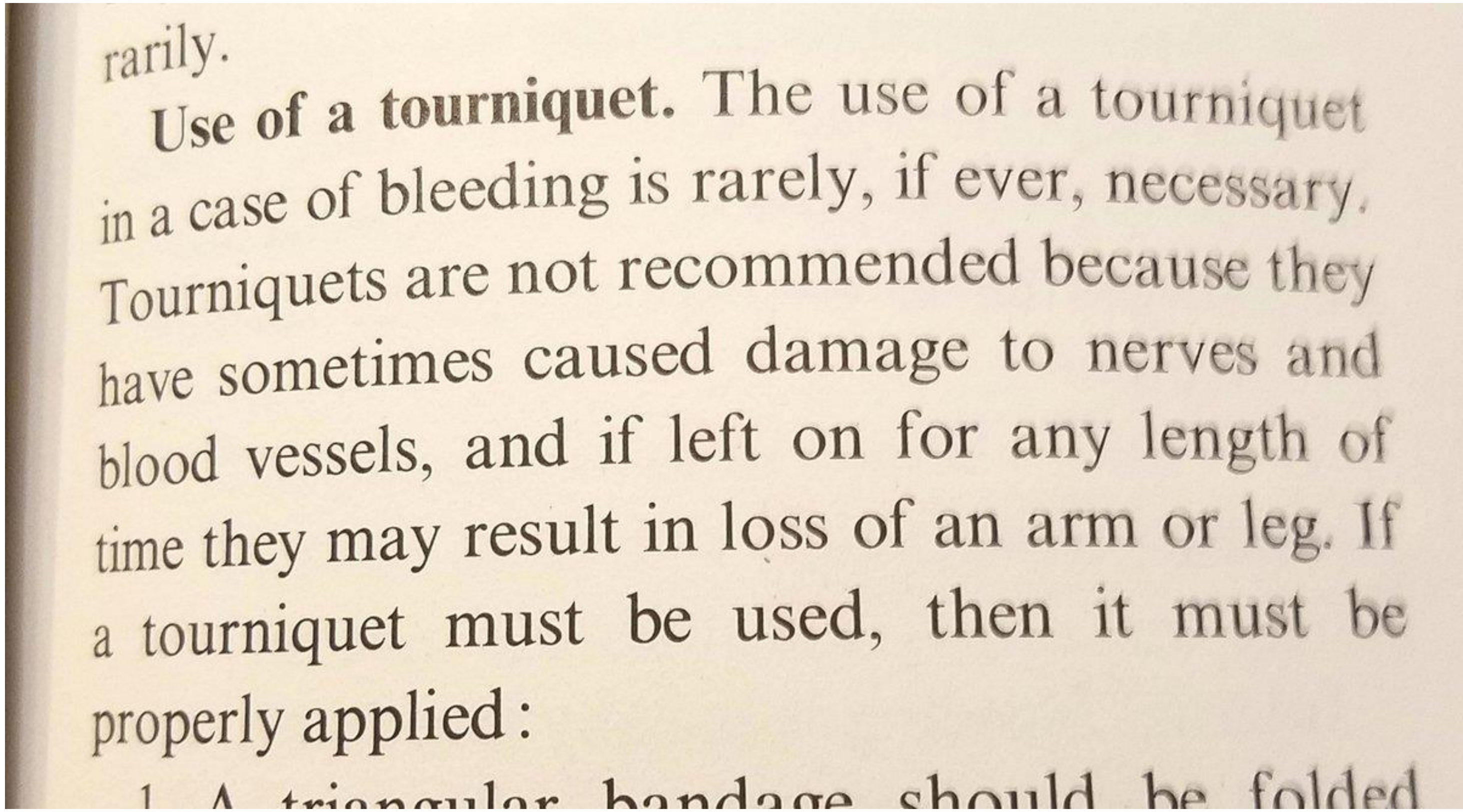
TOURNIQUET PAST

WHAT WOULD JOHNNY AND ROY DO?

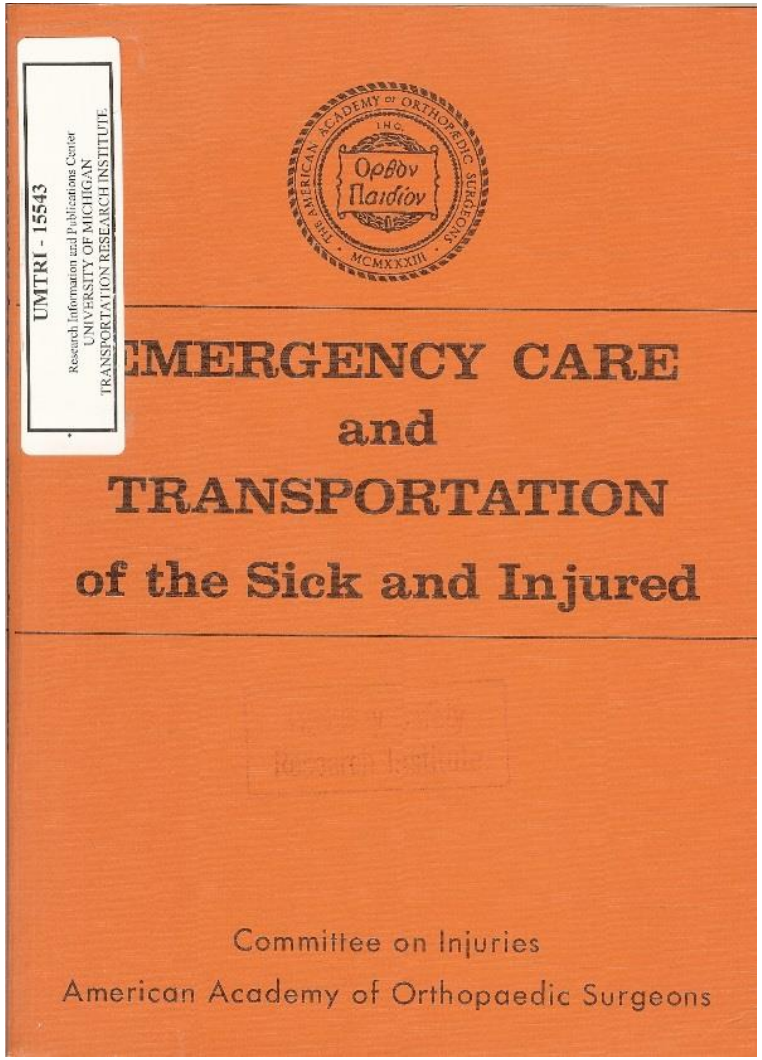
FIRST EMS TEXTBOOK



rarily.

Use of a tourniquet. The use of a tourniquet in a case of bleeding is rarely, if ever, necessary. Tourniquets are not recommended because they have sometimes caused damage to nerves and blood vessels, and if left on for any length of time they may result in loss of an arm or leg. If a tourniquet must be used, then it must be properly applied:

1. A triangular bandage should be folded



TOURNIQUET PRESENT

- Change of thought after Somalia where uncontrolled hemorrhage caused 22% of the fatalities
- Between 2005 and 2011, 2,000 American lives saved due to tourniquets in Iraq and Afghanistan
- Frequently noted in recent MCIs

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TOURNIQUET FUTURE

Salinas J, US Army ISR, 2014

- iTK- Intelligent Tourniquet
- Can be controlled remotely
- Pneumatic
- Responds to patient’s physiology

SHOW ME THE EVIDENCE

- 499 patients with 862 tourniquets applied to 651 limbs
- 87% survival rate
- 1.7% morbidity rates with nerve palsies
- 0.4% major limb shortening
- ***Survival with prehospital application (89% vs. 78%)***
- ***Application before the onset of shock (96% vs. 4%)***

Kragh J, J Emer Med, 2011

MORE EVIDENCE

- 550 injured soldiers and civilians with 125 deaths (22%)
- 91 patients with 110 tourniquets applied
- Eighty-six (78%) tourniquet applications were effective.
  - 94% of tourniquets applied to the upper limbs were effective
  - 71% of tourniquets applied to the lower limbs were effective
- Neurologic complications attributed to tourniquet applications in 7 limbs (6.4%) of 5 patients (5.5%)
- ***No case of death resulting from uncontrolled limb hemorrhage***

Lakstein D, J Trauma, 2003

MORE IDF DATA

- 23 healthy males, combat teams members
  - 11 non-medics
  - 12 medics
- Three tourniquets: IRT, CAT, SOFTT with 828 tourniquet applications
- Medics didn't have any advantage over non-medics
- Assessment scores: CAT > SOFTT > IRT (4.6, 4.0, 2.1)
- Failure rate: CAT > SOFTT > IRT (22%, 23%, 38%)
- Application time: CAT > SOFTT > IRT (18, 26, 52 seconds)

Heldenberg E, Disaster Mil Med, 2015

MORE COMPARISONS

- Effectiveness of tourniquets on a manikin thigh
- Three models of tourniquets
  - Rapid Application Tourniquet System (RATS)
  - Tactical Mechanical Tourniquet (TMT)
  - Combat Application Tourniquet (CAT)
- Two users conducted 30 tests each
- Effectiveness did not differ significantly by model (hemorrhage control and distal pulse cessation)
- Time to hemorrhage control and fluid loss: CAT=TMT > RATS
- CAT applied more pressure than TMT for hemorrhage control

Gibson R, J Spec Oper Med, 2016

WHAT ABOUT THE CHILDREN?

- Retrospective review of 88 pediatric casualties at US military hospitals
- Average Age 11 years (range 4-17 years)
- Survival rate 93% (7 dead and 81 survivors)
- Survivor and dead casualties were similar in all independent variables measured except hospital stay duration (median 5 days vs 1 day)
- Six casualties (7%) had neither extremity or external injury indicating tourniquet use
- Survival rate similar to non-pediatric studies

Kragh J, Pediatr Emerg Care, 2012

PRACTICE MAKES PERFECT

MAYBE NOT THE HOLY GRAIL?

- Retrospective study of 12 public mass shootings
  - Average of 2.7 GSWs, 58% to head and chest vs 20% to extremity
  - Probable fatal wound was head or chest in 77% of cases
- Only 7% had "potentially survivable" wounds
- ***NO DEATHS FROM EXSANGUINATION FROM AN EXTREMITY***
- Pattern is different from combat--solution goes beyond tourniquets

Smith ER, Trauma Acute Care Surg, 2016

CONSISTENT DATA

- 107 victims (49 fatalities, 58 wounded) with 209 total GSWs
- Range of 1-13 GSWs per victim
- Mean 4.2 GSWs
- 6 single wounds (4 head wounds)
- No isolated extremity wounds

COMBAT COMPRESSION BANDAGES

ISRAELI BANDAGE

- Invented by Israeli military medic, Bernard Bar-Natan in 1998
- First used in Bosnia and Herzegovina with NATO
- Standard in US Army since 2003
- Allows pressure to be placed on the wound site

ISRAELI BANDAGE

OLAES MODULAR BANDAGE

- Developed by Ross Johnson, Special Forces Medic in 2006
- Named after Tony Olaes, Special Forces Medic KIA in Afghanistan
- Contains:
    - Occlusive plastic sheet
    - Removable gauze
    - Pressure bar that doubles as eye cup

OLAES MODULAR BANDAGE

SHOW ME THE EVIDENCE

- 10 healthy volunteers as representatives of medics and soldiers
- Evaluated the amount of pressure exerted by bandage with pressure bar over wound and surrounding areas (90° increments)
- Pressure bar very effective in elevating applied pressure while not applying unnecessary pressure over other areas (11.26 vs 30.08 PSI)
- Adding 2 twists increases pressure (14.18 vs 40.39 PSI)
- Perfusion of capillaries in hand and fingers found to be adequate (radial pulse and capillary refill)

Shipman N, Mil Med, 2009

WOUND PACKING

WOUND PACKING

- **Step 1: Stop the bleeding**
  - Immediately apply direct pressure to the wound and place your gloved fingers-with or without a dressing-into the wound to apply initial pressure to the target area and compress the source of bleeding.
- **Step 2: Pack the wound with gauze**
  - Completely and tightly pack the wound cavity to stop hemorrhage. Begin packing the gauze into the wound with your finger, while simultaneously maintaining pressure on the wound.

WOUND PACKING

WOUND PACKING

- **Step 3: Keep packing**
  - The wound should be *very* tightly packed, applying as much pressure as possible to the bleeding vessel. This pressure against the vessel is the most important component of hemorrhage control.
- **Step 4: Apply very firm pressure to the packed wound**
  - This step pushes the packing firmly against the bleeding vessel and aids in clotting.
- **Step 5: Secure a snug pressure dressing**
  - Place a snug pressure dressing over the wound. You may consider splinting or immobilizing the area--possible movement can dislodge the packing and allow hemorrhage to restart.

WOUND PACKING

HEMOSTATIC GAUZE

IDF RESEARCH

- 122 patients--133 hemostatic dressing applications
- 37 dressings (27.8%) junctional areas
- 92 dressings (72.1%) non-junctional areas
- 88.6% (31 of 35 available) successful in junctional areas
- 91.9% (57 of 62 available) successful in extremity applications

Shina A, J Trauma, 2015

HEMOSTATIC DRESSING IN SWINE

- 80 swine in five treatment groups (16 animals each)
- 5 different agents applied with 5 minutes of manual pressure
- Hemodynamic parameters were recorded over 180 minutes
  - Primary endpoints-initial hemostasis &incidence of rebleeding
- 15% (12/80) failed to achieve initial hemostasis
  - Not significantly different between groups (p= 0.11)
- Rebleeding rate 33%

  Not significantly different between groups (p= 0.25)

Littlejohn LF, Acad Emerg Med, 2011

STOP THE BLEED

- Launched in October of 2015
- Partnership between:
  - The White House
  - Department of Defense
  - ACEP
  - ACS-COT
- Effort to encourage bystanders to become trained, equipped, and empowered to help before professional help arrives

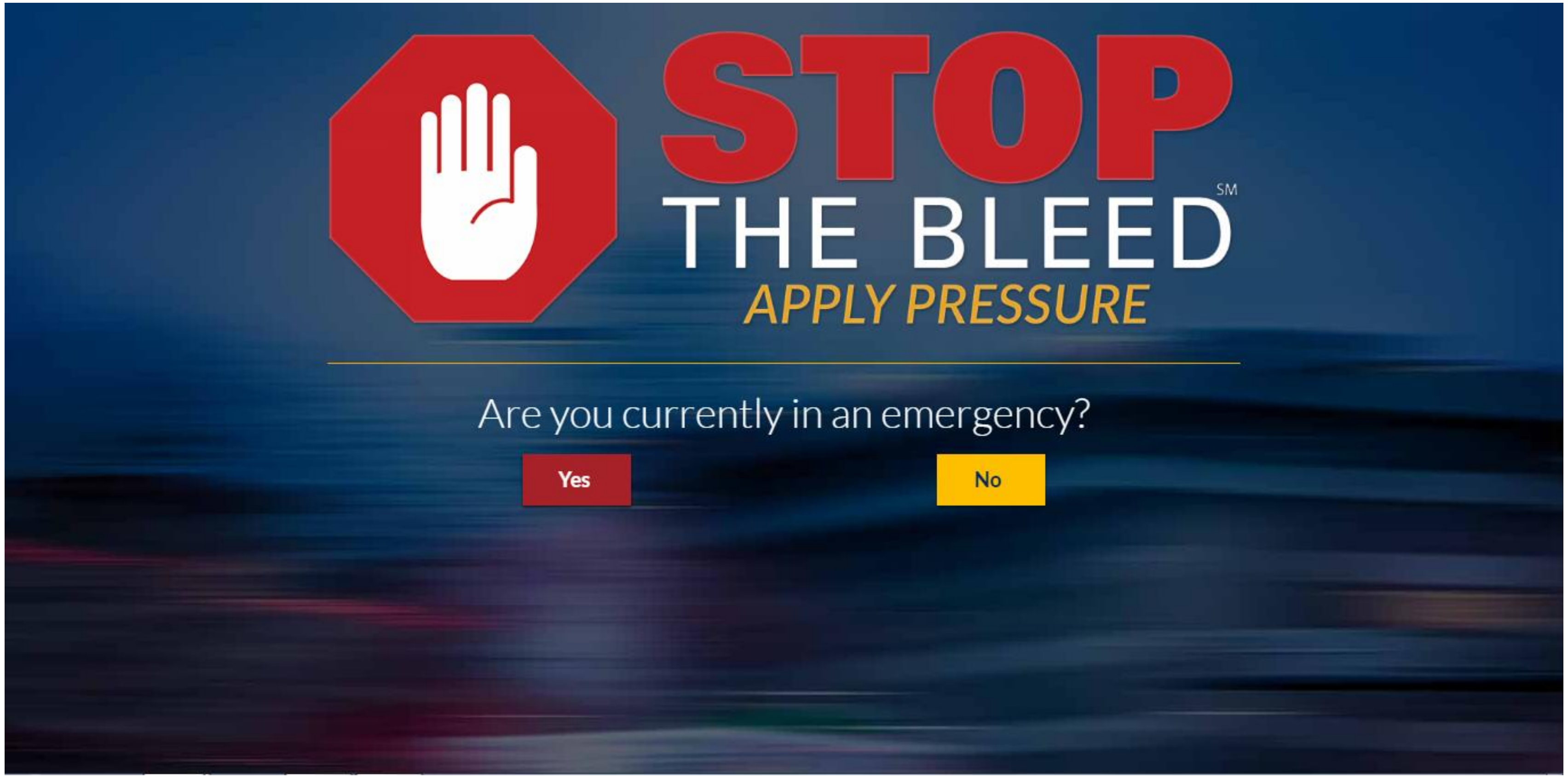
STOP THE BLEED

- Introduced through Presidential Policy Directive 8 (PPD-8)--aimed at strengthening national security through systematic preparation
- Similar to public access defibrillators
- Expand personal and public access to Bleeding Control Kits

STOP THE BLEED

STOP THE BLEED

https://stopthebleed.usuhs.edu



NATIONAL

STOP THE BLEED DAY

March 31

March 31ST, 2018

Supported by:

The Committee on Trauma

NAEMT

Illinois College of Emergency Physicians

EMERGENCY MEDICINE RESIDENCY · PEORIA ·

UNTIL HELP ARRIVES

- Launched in May 2017
- Collaboration between:
  - FEMA
  - HHS: ASPR
- Multiple Education Options:
  - Online interactive video course
  - Web-based training course
  - Hands-on, instructor-led training course

UNTIL HELP ARRIVES

- Program teaching the public to take these five steps in situations where someone may have a life-threatening injury due to trauma:
  - Call 9-1-1
  - Protect the injured from harm
  - Stop bleeding
  - Position people so they can breathe
  - Provide comfort

IT PLAYS IN PEORIA!

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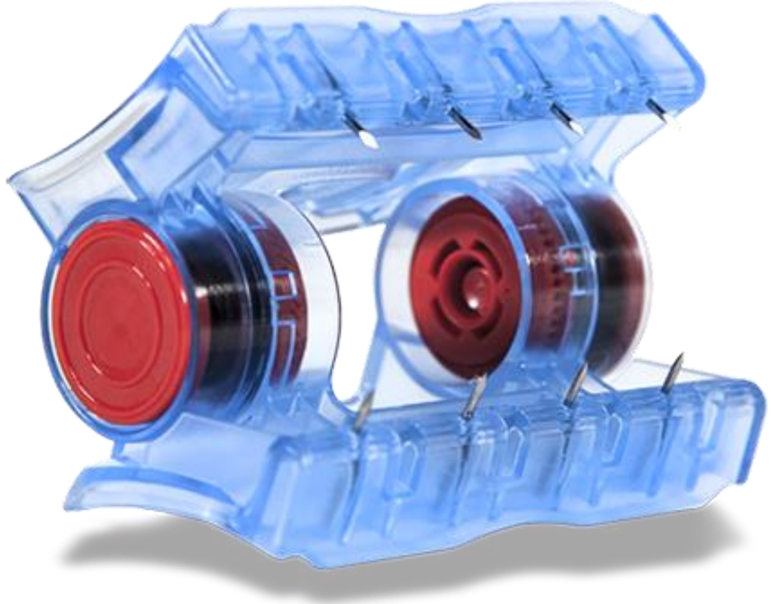
IT PLAYS IN PEORIA!

WOUND CLAMP



iTCLAMP

SWINE STUDY

- Lethal hemorrhagic injury to 20 swine
- 100% (10/10) of swine treated with iTClamp survived (Early & Late)
- 60% (3/5) treated with packing with standard gauze survived
- 0% (0/5) survival if the wound was left untreated
- iTClamp Superior:
  - Overall survival ($p<0.009$)
  - Total blood loss ($p=0.008$)
  - Survival time ($p=0.003$)

JUNCTIONAL TOURNIQUETS

JUNCTIONAL TOURNIQUET HISTORY

- Lister Abdominal Tourniquet
- Developed in 1862 by Dr. Joseph Lister
- Lister abandoned the tourniquet because it damaged other organs

JUNCTIONAL TOURNIQUETS

EVIDENCE FOR USE

- 30 users with 270 tests of simulated hemorrhage from a manikin
- Analyzed hemorrhage control, time to hemostasis, blood loss, & user ranked performance
- CRoC, Junctional Emergency Treatment Tool (JETT), and SAM Junctional Tourniquet (SJT)
- All tourniquet uses were 100% effective for hemorrhage control
- CRoC and SJT performed best in blood loss
- CRoC performed best in time to hemostasis
- Users did not differ in preference of model

Kragh J, Prehosp Disaster, 2016

MORE EVIDENCE FOR USE

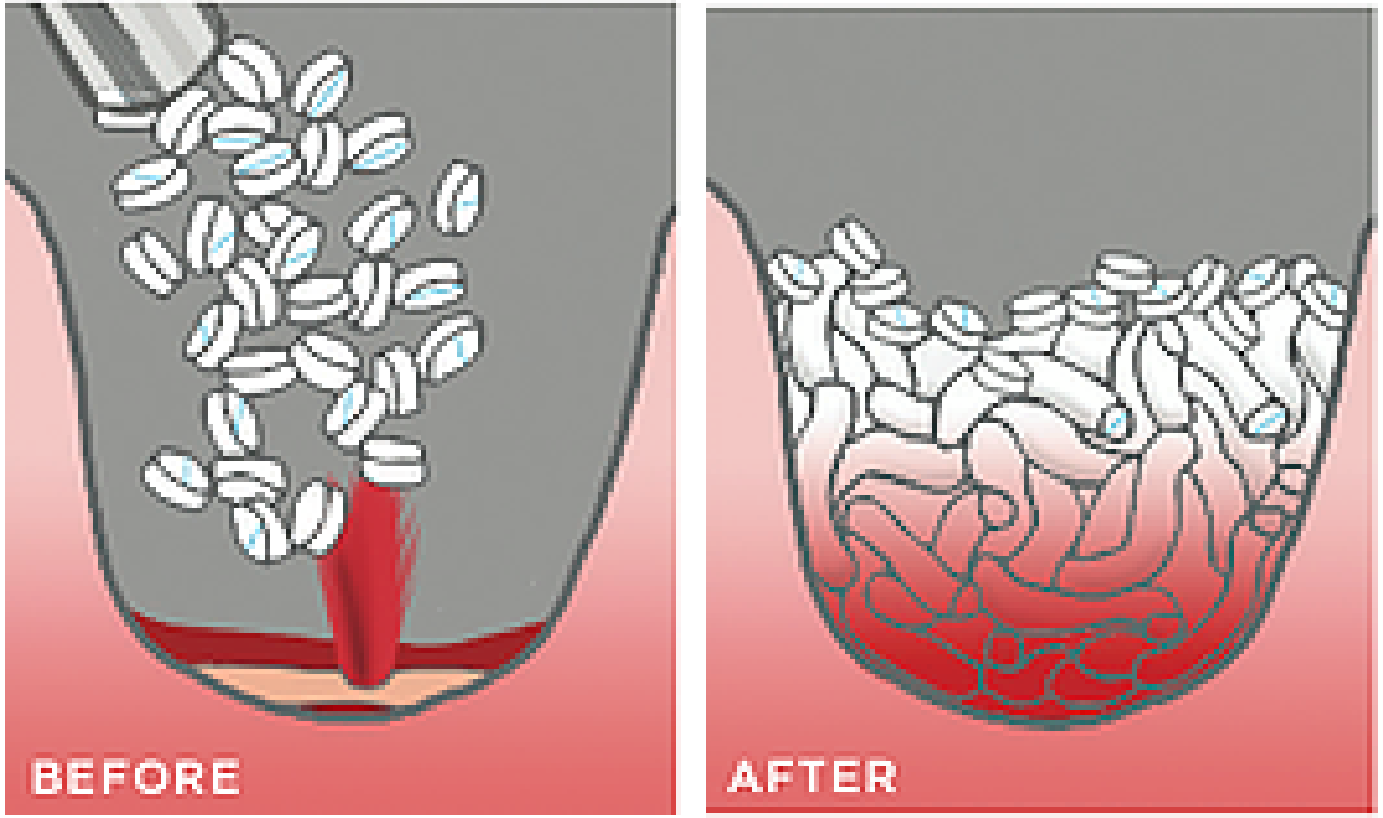
- 14 medics used 4 junctional tourniquets:
  - Combat Ready Clamp (CRoC)
  - Abdominal Aortic Junctional Tourniquet (AAJT)
  - Junctional Emergency Treatment Tool (JETT)
  - SAM Junctional Tourniquet (SJT)
- Assessment categories
  - Safety
  - Effectiveness
  - Time to effectiveness
  - Two categories of user preference

- All tourniquet uses were safe
- CRoC and AAJT had the highest percentage effectiveness
- SJT and JETT had fastest mean times to effectiveness
- SJT, AAJT, and JETT most preferred

Chen J, J Spec Oper Med, 2016

JUNCTIONAL TOURNIQUETS

X-STAT

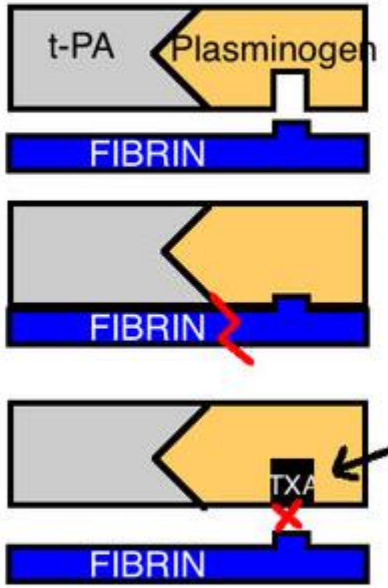


TRANEXAMIC ACID

TRANEXAMIC ACID

- Synthetic analog of lysine
- Antifibrinolytic by reversibly binding four to five lysine receptor sites on plasminogen or plasmin
- Prevents plasmin from binding to and degrading fibrin which preserves the framework of fibrin's matrix structure
- Eight times the antifibrinolytic activity of ε-aminocaproic acid

TRANEXAMIC ACID

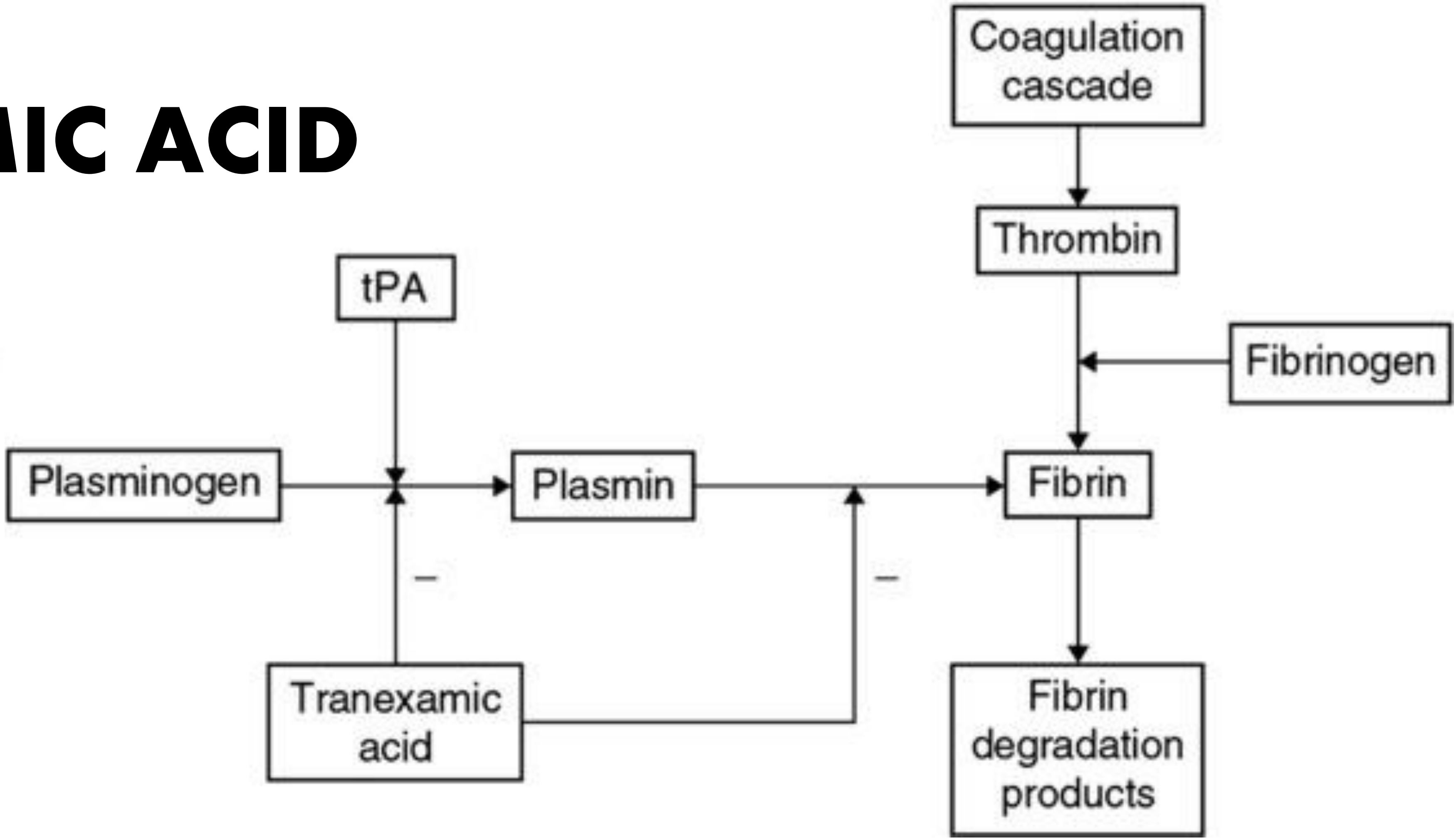


normally...
Activated Plasminogen binds to Fibrin

&

Breaks the Fibrin Clot

TXA interferes with the binding site



CRASH COURSE…

CRASH 2

Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

- Multicenter international study of 20,207 trauma patients within 8 hours of injury
- Primary Outcome—Death in hospital or within 4 weeks:
  - 14.5% vs. 16.0% (RR 0.91, 95% CI 0.85–0.97; p=0.0035)
- Secondary Outcomes:
  - Vascular occlusive events: 1.7% vs. 2.0% (p=0.084)
  - Surgical intervention: 47.9% vs 48% (p=0.79)
  - Blood Transfusion: 50.4% vs. 51.3% (p=0.21)

CRASH COURSE…

CRASH2
Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage

- Second publication with a priori subgroup analysis
- Death due to bleeding:
    - <1 hour from injury: 5.3% vs. 7.7% (RR 0.68, 95% CI 0.57-0.82; p<0.0001)
    - 1-3 hours from injury: 4.8% vs.6.1% (RR 0.79, 95% CI 0.64-0.97; p<0.0001)
    - >3 hours from injury: 4.4% vs. 3.1% (RR 1.44, 95% CI 1.12-1.84; p<0.0001)
- All-cause mortality:
    - <1 hour from injury: RR 0.87, 95% CI 0.76-0.97
    - 1-3 hours from injury: RR 0.87, 95% CI 0.77-0.97
    - >3 hours from injury: RR 1.00, 95% CI 0.90-1.13

TXA MATTERS…

Military Application of Tranexamic Acid in Trauma Emergency Resuscitation (MATTERs) Study

Jonathan J. Morrison, MB ChB, MRCS; Joseph J. Dubose, MD; Todd E. Rasmussen, MD; Mark J. Midwinter, BMedSci, MD, FRCS

- 896 patients looking at 24 hour, 48 hour, and in-hospital mortality
- TXA: 293 patients and Non-TXA: 603 patients
  - Massive Transfusion & TXA : 125 patients
  - Massive Transfusion & Non-TXA: 196 patients
- Injury Severity Score: 25.2 vs. 22.5 ($p < .001$)
- TXA independently associated with survival (OR= 7.228; 95% CI, 3.016-17.322)

TXA MATTERS…

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Jonathan J. Morrison, MB ChB, MRCS; Joseph J. Dubose, MD; Todd E. Rasmussen, MD; Mark J. Midwinter, BMedSci, MD, FRCS

- Mortality TXA vs. Non-TXA:
  - 24 hours: 9.6% vs. 12.4% (p=0.2)
  - 48 hours: 11.3% vs 18.9% (p=0.004)
  - In-hospital: 17.4% vs 23.9% (p=0.03)
- Mortality TXA vs. Non-TXA in Massive Transfusion
  - 24 hours: 9.6% vs 14.8% (p=0.17)
  - 48 hours: 10.4% vs. 23.5% (p=0.003)
  - In-hospital: 14.4% vs. 28.1% (p=0.004)

TXA MATTERS…

Military Application of Tranexamic Acid in Trauma Emergency Resuscitation (MATTERs) Study

Jonathan J. Morrison, MB ChB, MRCS; Joseph J. Dubose, MD; Todd E. Rasmussen, MD; Mark J. Midwinter, BMedSci, MD, FRCS

- 24-hr transfusion mean:
  - PRBCs:
    - TXA: 11.8 (21 in Massive Transfusion)
    - Non-TXA: 9.8 (22.5 in Massive Transfusion)
  - FFP:
    - TXA: 10.3 (11.5 in Massive Transfusion)
    - Non-TXA: 8.6 (14.3 in Massive Transfusion)

- Pulmonary Embolisms: TXA-8 vs. Non-TXA-2
- Deep Venous Thrombosis: TXA: 7 vs. Non-TXA: 1

Gayet-Ageron A, Lancet, 2017

META ANALYSIS

- Meta-analysis of 2 randomized trials with more than 1000 patients each (CRASH-2 and WOMAN)
- 40,138 patients total
  - CRASH-2: 20,127 patients
  - WOMAN: 20,011 patients
- 3,558 total deaths
  - 1,408 (40%) of deaths from bleeding
  - 884 (63%) of the bleeding deaths occurred within 12 hours of onset

META ANALYSIS

- Overall Survival from Bleeding:
  - 96.6% vs. 96.0%
  - OR 1.20; 95% CI 1.08 – 1.33; p = 0.001
- Vascular Occlusive Events
  - 0.2% vs. 0.3%
  - OR 0.73; 95% CI 0.49 – 1.09; p=0.1204
- Effect of Treatment Delay on Survival:
  - Survival decreased by 10% with every 15 minutes of treatment delay until 3 hours

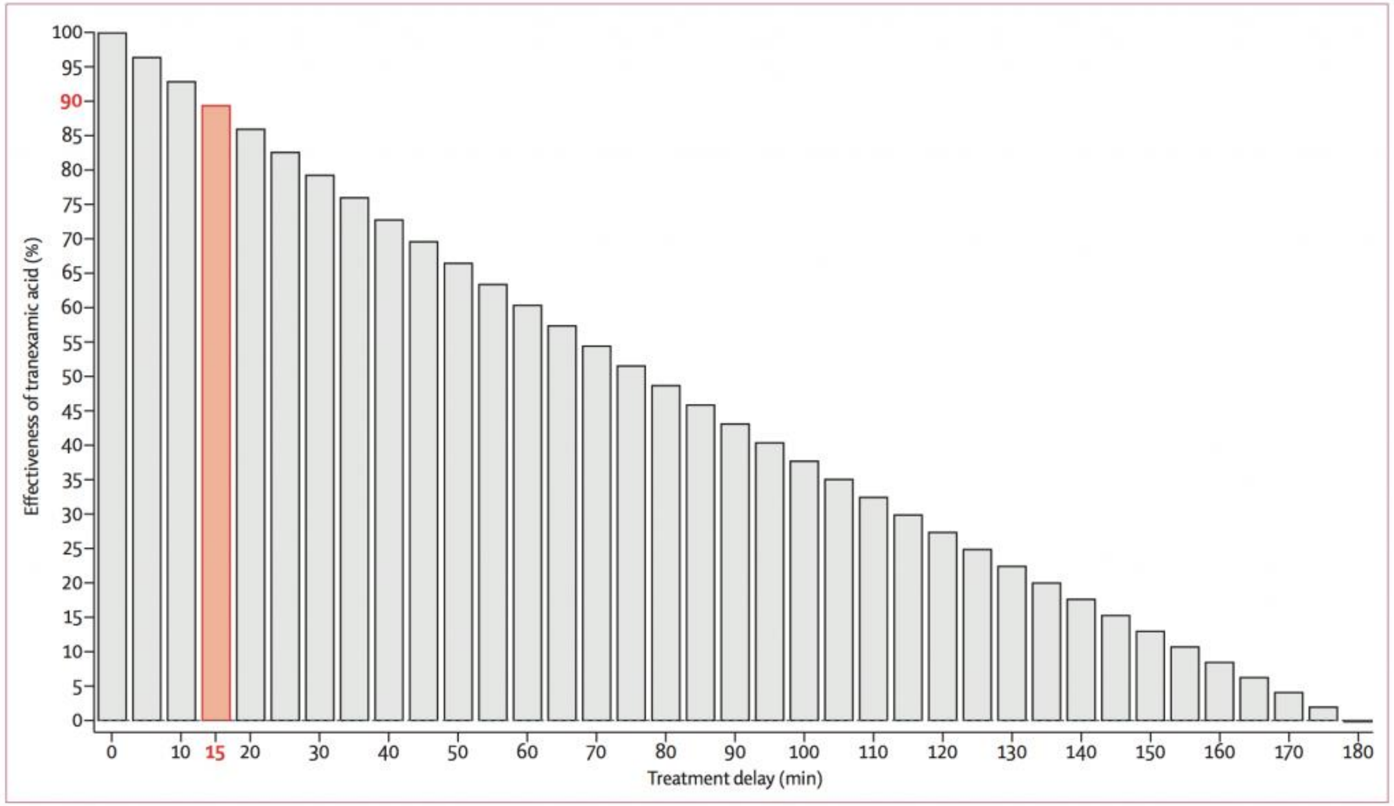


***Figure 4*: Reduction in effectiveness of tranexamic acid with increasing treatment delay**
The bars represent the estimated treatment effectiveness (y-axis, estimated by [(OR at time $t-1$)/ (OR at $t=0-1$) × 100] in %) at 5-min intervals of treatment delay. The bar highlighted in red shows the estimated treatment effectiveness (90%) with a treatment delay of 15 min.

Gayet-Ageron A, Lancet, 2017

A MOMENT FOR PAUSE?

- 455 US military casualty patients
- 173 patients (38.0%) received a massive transfusion and 139 (30.5%) received TXA
- Tranexamic acid administration was an independent risk factor for venous thromboembolism (OR 2.58; 95% CI, 1.20-5.56; p= .02)

Johnston L, JAMA Surgery, 2017

A MOMENT FOR PAUSE?

- 3,775 combat trauma patients
- No statistically significant association between TXA use and mortality
- TXA associated with increased risk of DVT in total sample (HR, 2.00; 95% CI, 1.21-3.30; p= 0.02)
- TXA associated with increased risk of PE in total sample (HR, 2.82; 95% CI, 2.08-3.81; p< 0.001)

Howard J, J Trauma, 2017

GUIDANCE ON PREHOSPITAL USAGE

- Joint statement from:
  - NAEMSP
  - ACEP
  - ACS-COT
- Insufficient evidence to support or refute prehospital
- System integration key
- TXA in pediatric patients not recommended outside of research

SPECIAL CONTRIBUTION

GUIDANCE DOCUMENT FOR THE PREHOSPITAL USE OF TRANEXAMIC ACID IN INJURED PATIENTS

Peter E. Fischer, MD, MS, FACS, Eileen M. Bulger, MD, FACS, Debra G. Perina, MD, FACEP, Theodore R. Delbridge, MD, MPH, Mark L. Gestring, MD, FACS, Mary E. Fallat, MD, FACS, David V. Shatz, MD, FACS, Jay Doucet, MD, MSc, FACS, Michael Levy, MD, FACEP, Lance Stuke, MD, MPH, FACS, Scott P. Zietlow, MD, FACS, Jeffrey M. Goodloe, MD, NRP, FACEP, Wayne E. VanderKolk, MD, Adam D. Fox, DPM, DO, FACS, Nels D. Sanddal, PhD, NREMT

WHAT ABOUT OUR KIDDOS?

- 766 patients 18 years or younger
- 66 (9%) received TXA
- TXA associated with decreased mortality (OR, 0.27; 95% CI, 0.85–0.89; p= 0.03)
- Similar trend for severely injured (ISS > 15) and transfused patients
- No difference in thromboembolic complications or other cardiovascular events
- TXA demonstrated significant improvements in discharge neurologic status as well as decreased ventilator dependence (6% vs. 22%; p< 0.01)

Eckert MJ, J Trauma, 2014

WHAT ABOUT OUR KIDDOS?

- The Royal College of Pediatrics and Child Health in the United Kingdom issued an Evidence statement in November 2012 entitled *“Major trauma and the use of tranexamic acid in children”*
- Dosages:
  - 12 y/o or older: 1 g loading dose over 10 minutes within the first 3 hours post-injury, followed by a 1 g infusion over 8 hours
  - <12 y/o: Loading dose of 15 mg/kg (maximum dose 1 g) followed by an infusion of 2 mg/kg/hour for at least 8 hours or until the bleeding stops

TXA PROTOCOLS

- Indications: Symptomatic trauma patients
- Initial Bolus 1g over 10 minutes
- Infusion of 1g over 8 hours

Tranexamic Acid Protocol
ALS ONLY

Indications:
Any trauma patient ≥ 14 years of age, at high risk for ongoing internal hemorrhage and meeting one or more of the following criteria:

- Systolic BP < 90mmHg
- Patients ≥ 65 years of age with systolic BP < 110mmHg.
- Tachycardia > 120 beats per minute with signs of hypoperfusion (confusion, altered mental status, cool extremities, etc.)

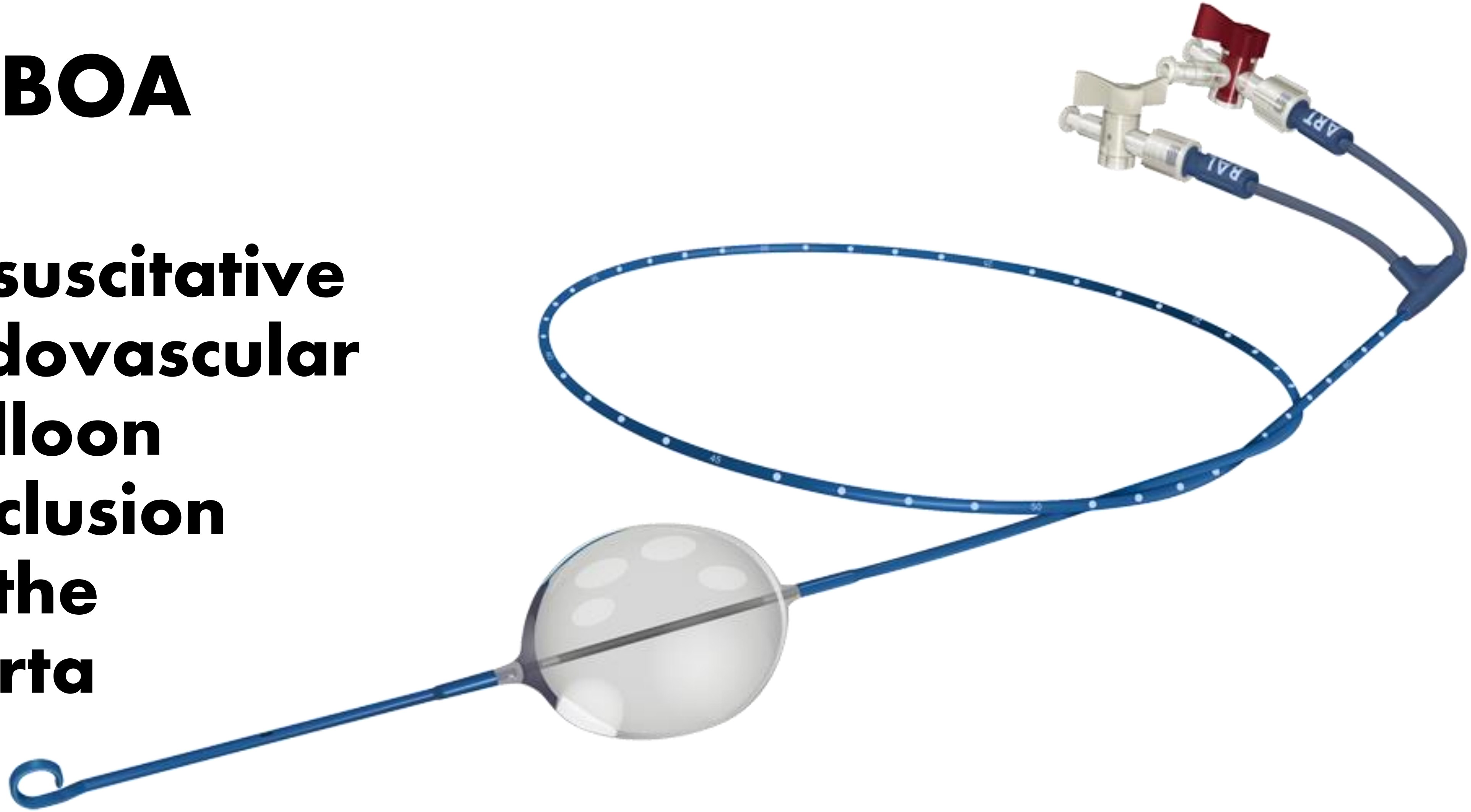
Contraindications:

- Injuries > 3 hours old.
- Evidence of Disseminated Intravascular Coagulation (DIC)
- Patients < 14 years of age.
- Hypersensitivity to the drug.

1. **How Supplied**: 10mL vial containing 1000mg
2. **Preparation**: Mix 1000mg of TXA in 250 mL of 0.9% Normal Saline.
3. **Administration**: Infuse over 10 minutes
   - 10 gtts/mL tubing at a drip rate of 4 gtts/second.
   - Infusion pump (if available) at 1500mL/hr.
4. Notify receiving hospital of TXA administration.
5. Clearly document mechanism of injury, time injury/incident occurred, indications for use and time TXA was administered.

REBOA

Resuscitative
Endovascular
Balloon
Occlusion
of the
Aorta



EVIDENCE FOR USE

- REBOA vs. Resuscitative Thoracotomy (REBOA n=24, RT n=72)
- No differences in injury severity scores or mechanism of injury
- Overall survival: REBOA vs. RT (37.5% vs. 9.7%; p=0.03)
- More deaths in the ED for RT (45/72) vs. REBOA (4/24) (62.5% vs. 16.7%; p< 0.001)
- REBOA had fewer early deaths and improved overall survival (37.5% vs. 9.7%, p = 0.003)

Moore L, J Trauma, 2015

MORE EVIDENCE

- 114 patients (REBOA, 46; Open Occlusion, 68)
- 62.3% overall hemodynamic improvement (REBOA, 67.4%; open, 61.8%)
- 36.0% achieving stability (systolic blood pressure consistently >90 mm Hg for 5 minutes)
  - REBOA: 22/46 (47.8%) vs. Open: 19/68 (27.9%); (p=0.014)
- Complications of REBOA were uncommon
  - Pseudoaneurysm, 2.1%; Embolism, 4.3%; Limb ischemia, 0%
- Time to occlusion: REBOA-6.6 minutes; Open-7.2 minutes; (p= 0.842)
- Overall survival was 21.1% (24/114)
  - No significant mortality difference between REBOA and open
  - REBOA (13/46), 28.2%; Open (11/68), 16.1%; (p= 0.120)

Dubose J, J Trauma, 2016

NOT SO FAST…

- Retrospective analysis of the Japan Trauma Data Bank (196 centers)
- 1807 patients: REBOA (n=351) vs. No REBOA (n=1456)
- REBOA demonstrated absolute higher in-hospital mortality (61.8% vs. 45.3%; 95% CI 10.9% to 22.0%); p=<0.0001)
- Adjusted in-hospital mortality in REBOA subjects not significant (16.4%; 95% CI, -0.6% to 33.3%)

Inoue J, J Trauma, 2016

PREHOSPITAL REBOA

- Dr. Gareth Davies-Chair and Medical Director of the London Air Ambulance
- May 2014, 32-year-old male fell 15 meters
- Doctor-paramedic team arrived 34 min after the injury
- Pelvic, ribs, lumbar spine, and dissection of descending aorta (ISS 45)
- Transfused 12 units PRBC, 8 units FFP, 2 units Cryoprecipitate, and 1 unit of platelets.
- 15 days in ICU and discharged on day 52 with a full recovery

BLOOD PRODUCTS

- Many Flight Systems are carrying blood products
- 2 Ground EMS Systems carrying blood products
- In first two months CCEMS transfused blood products 12 times:
    - 4 auto-vs.-pedestrian accidents
    - 1 fall from height
    - 1 gunshot wound
    - 1 motor vehicle incident with entrapment
    - 1 laceration from an assault
    - 1 cardiac arrest from bleeding related to cancer
    - 3 cases of hemorrhagic shock related to internal/GI bleeding
- 11/12 arrived at the hospital alive

WHY WHOLE BLOOD

- Whole blood is superior to crystalloids and colloids
- Administration is easier than blood components. Whole blood is simplest way to deliver the functionality of lost blood back to the patient
  - Serious Hazards of Transfusion (SHOT) study from the U.K. found that 78% of the incident reports resulted from human error
- Safety of whole blood is similar to component therapy
  - U.S. military has successfully transfused over 10,000 units of whole blood across the world

PREHOSPITAL BLOOD

- 8,536 potential patients, 1,677 eligible.
- Represent the most severely injured patients
  - Injury severity score of > 24 and mortality rates of 26%
- Varying Transports
  - 716 were transported by Hermann LifeFlight
  - 169 were transported by other air ambulances
- Only 19% (137/716) of LifeFlight patients given blood products
- 942 units (244 RBCs and 698 plasma) on LifeFlight helicopters with 1.9% waste rate
- Decreased mortality trend at 6-hour (OR 0.23, 95% C.I. 0.106–1.056, p=0.088)
  - Admitted to the ICU/IR/OR/Morgue: 6-hour mortality was lower among those transported by LifeFlight (OR 0.23, 95% CI 0.062–0.890, p=0.033)

Holcomb J, Prehosp Emerg Care, 2015

NON-TRADITONAL TRANSPORT

- Identified penetrating trauma patients with OR for mortality with police vs. EMS transport in the National Trauma Databank
- 88,564 total patients
  - 97% transported by EMS
  - 2.8% transported by PD

Wandling MW, J Trauma, 2016

NON-TRADITONAL TRANSPORT

- Unadjusted mortality: 17.7% for PD transport and 11.6% for EMS
- After risk adjustment PD transport no increased in mortality (OR=1.00, 95% CI: 0.69-1.45)
- 87.8% of PD transports in 3 cities (Philadelphia, Sacramento, and Detroit)
  - Unadjusted mortality: 19.9% for PD transport and 13.5% for EMS
  - Risk Adjusted mortality no difference (OR=1.01, 95% CI 0.68-1.50)

Wandling MW, J Trauma, 2016

RECENT DATA

- PD transported 30% of victims at Pulse (15 patients)
- Aurora movie theater-60 victims to hospital
  - 27-28 PD
  - 13-14 POV
  - 20 EMS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QUESTIONS?

Bleess@uic.edu

BBBleess

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