

VASCULAR TRAUMA



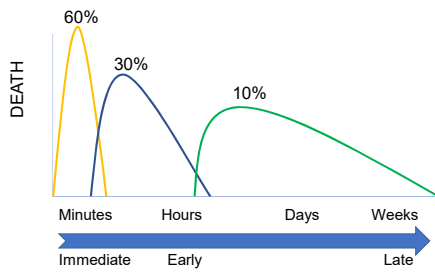
Raphael Blöchle, MD FACS MBA

Vascular & Endovascular surgery
General & Trauma surgery

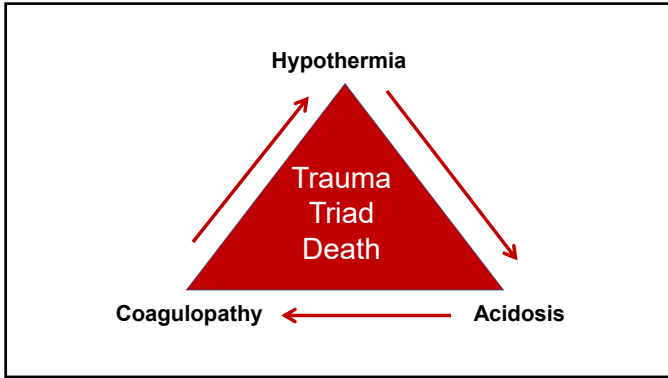
All generalizations are dangerous,
even this one.

[Alexandre Dumas](#)

Historic Trauma Trimodal Death Distribution



(Sobrinho & Shafl, 2013)



American College of Surgeons Classes of Acute Hemorrhage

Factors	I	II	III	IV
Blood loss	<15% (<750ml)	15-30% (750-1500ml)	30-40% (1500-2000ml)	>40% (>2000ml)
Pulse	>100	>100	>120	>140
B.P.	Normal	Normal	↓	↓↓
Pulse pressure	N or ↓	↓	↓↓	↓↓
Capillary refill	<2s	2-3s	3-4s	>5s
Resp. rate	14-20	20-30	30-40	>40
Urine output ml/hr	30 or more	20-30	5-10	Negligible
Mental status	Slightly anxious	Mildly anxious	Anxious & confused	Confused Lethargic

Classic Signs & Symptoms of Shock

- Changing mentation/Confusion
- Rapid Shallow Breathing
- Hypotension
- Tachycardia
- Weak Pulse
- Cool, clammy skin
- Prolonged capillary refill
- Narrowed pulse pressure
- Decreased urine output

Quickly Rule Out Blood Loss

- Chest – CXR / FAST
- Abdomen - FAST
- Pelvis – Exam / Xray
- Femur – Exam / Xray

Hard signs

- active arterial bleeding
- pulselessness
- distal ischemia
- expanding pulsatile hematoma
- bruit or thrill



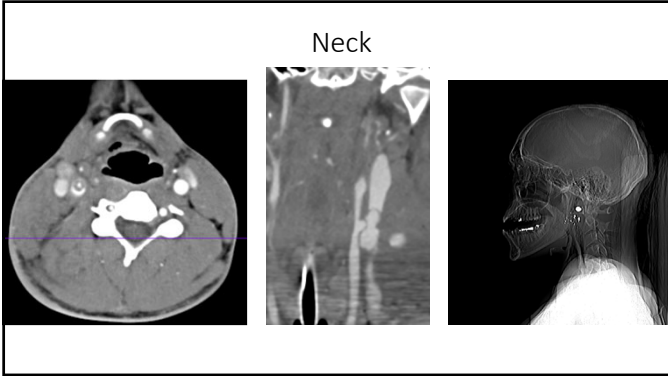
Soft signs

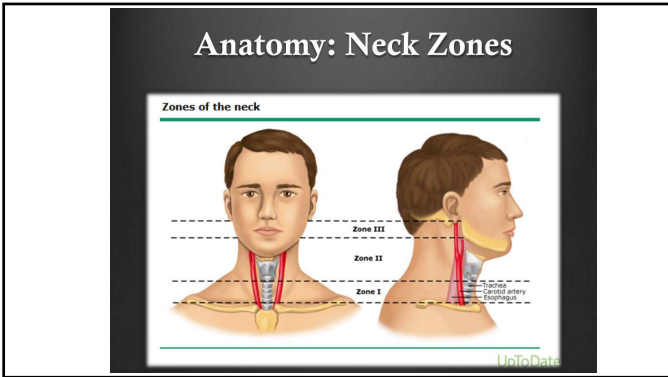
- neurologic injury
- hematoma
- unexplained hypotension
- mechanism
- “large blood loss at scene!”

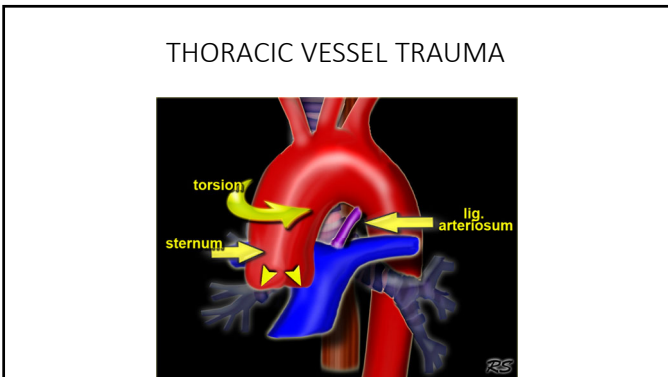
Vessel Injury Patterns

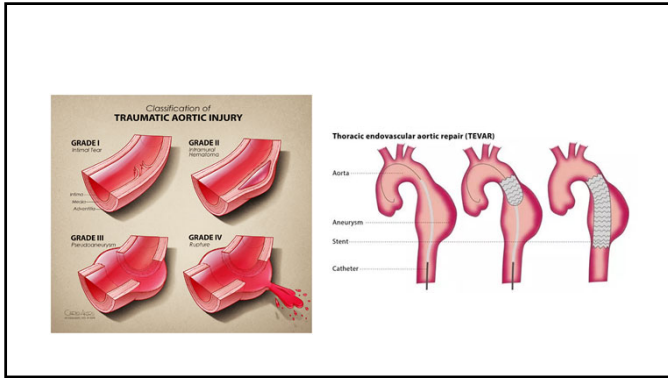
- Intimal flap
- Dissection
- Occlusion
- Thrombosis
- PSA
- AVF
- Transection

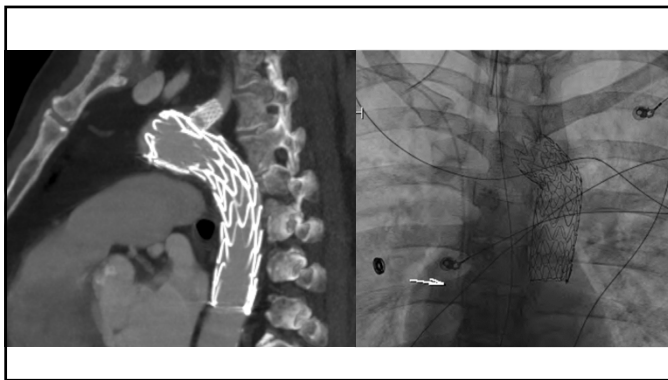


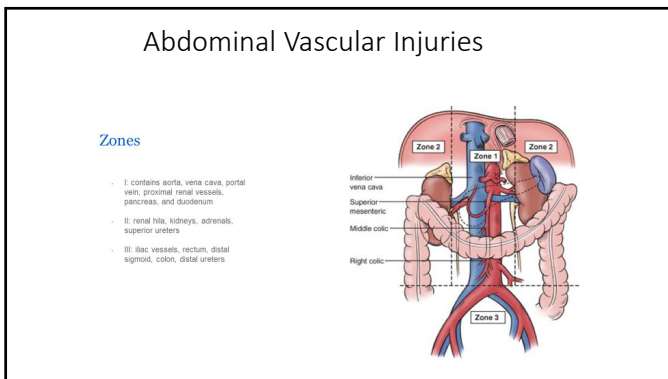








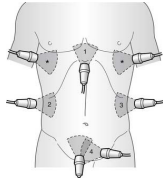




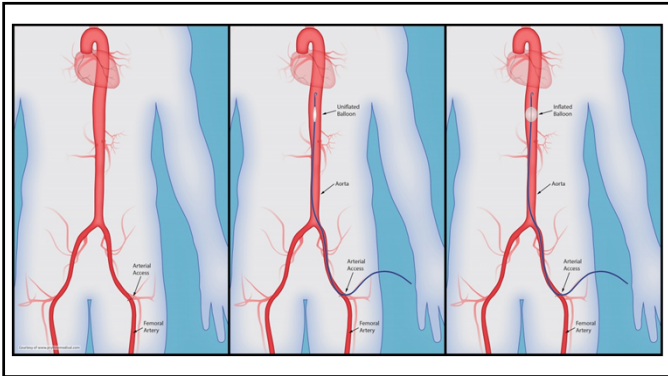
Retroperitoneal Hemorrhage

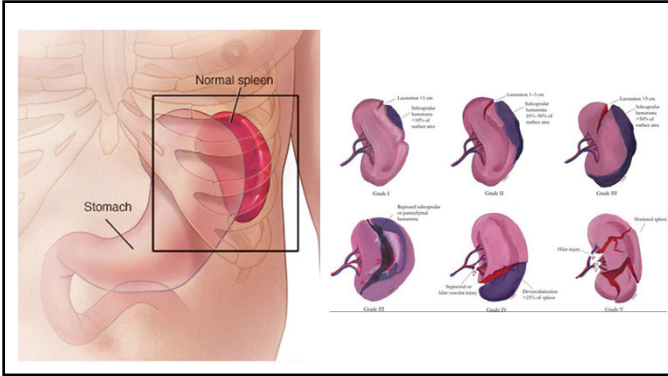
• Grey-Turners Sign

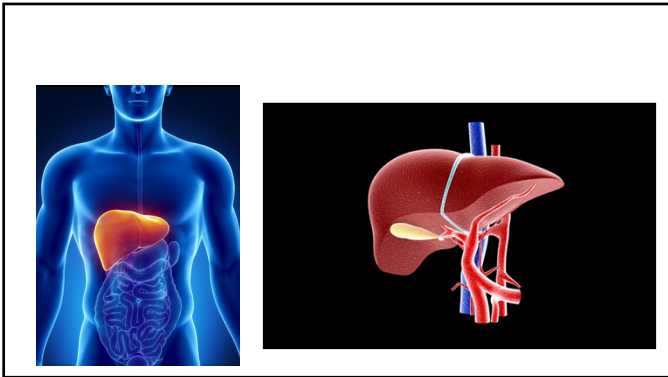
• FAST exam

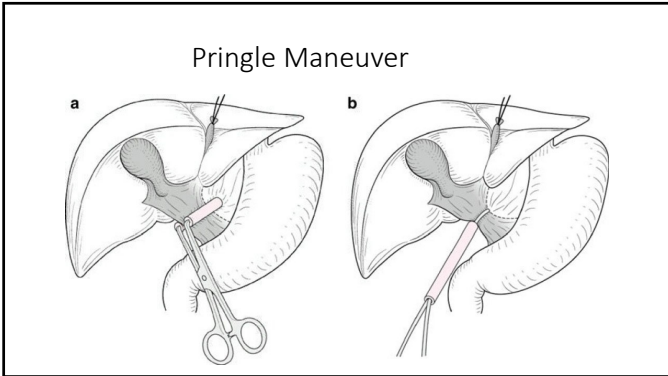












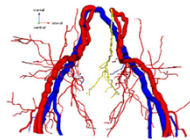
Fracture Associated Blood Loss

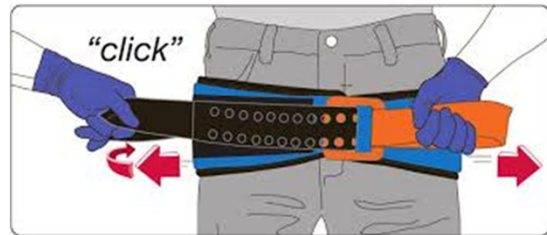
Fracture	Blood Loss (ml)
Humerus	500-1500
Elbow	250-750
Radius/Ulna	250-750
Pelvis	750-6000
Femur	500-3000
Tibia/Fibula	250-2000
Ankle	250-1000



Pelvic Hemorrhage Control

- Pelvic Binders or External fixation
- Angiography
- Open Reduction and Internal Fixation







Skeletal/soft-tissue group		
1	Low-energy	Stab wounds, simple closed fractures, small-caliber gunshot wounds
2	Medium-energy	Open or multiple-level fractures, dislocations, moderate crush injuries
3	High-energy	Shotgun blast (close range) high-velocity gunshot wounds, crush injury
4	Very high-energy	Above + gross contamination, soft tissue avulsion
Shock group		
1	Normotensive hemodynamics	BP stable in field and in operation theatre
2	Transiently hypotensive	BP unstable in field but responsive to intravenous fluids
3	Prolonged hypotension	Systolic BP less than 90mmHg in field and responsive to intravenous fluids only in operation theatre
Ischemia group		
1	None	A palpable limb without signs of ischemia
2	Mild	Pulse reduced or absent but perfusion normal
3	Moderate	Pulseless, paresthesia, diminished capillary refill
4	Advanced	Pulseless, cool, paralyzed and numb without capillary refill
Age group		
1	<30 years	0
2	>30 - <50 years	1
3	>50 years	2
*Points < 2: If ischemia time exceeds six hours, BP, blood gases		

Femur Fracture

- 500-3000cc blood loss, femoral artery may be torn
- TRACTION SPLINTS ARE PART OF HEMORRHAGE CONTROL







Primary Principles:
ABCs of Bleeding

C • Compression: Stop the Bleeding (continued)

Application of a C.A.T. Tourniquet (4 of 9)

Step 4. Twist the windlass rod until the bleeding has stopped.



Photo courtesy of Peter T. Pines, MD, FACSP

Bleeding Control Basic v. 1.0 Introduction | Principles | A.Alert | B.Bleeding | C.Compression |







Arm vs Window



Motorcycle vs Tree

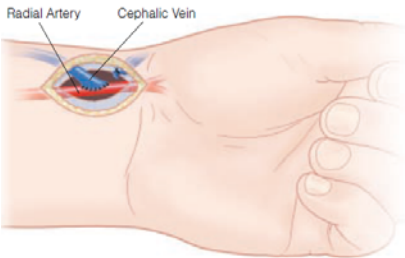


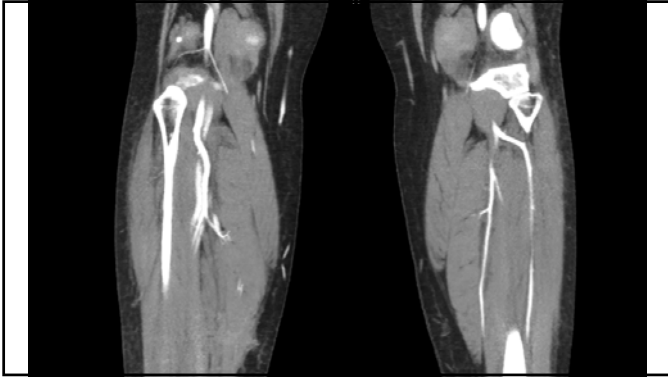
Hand vs Shotgun





AVF





Aneurysmal Degeneration

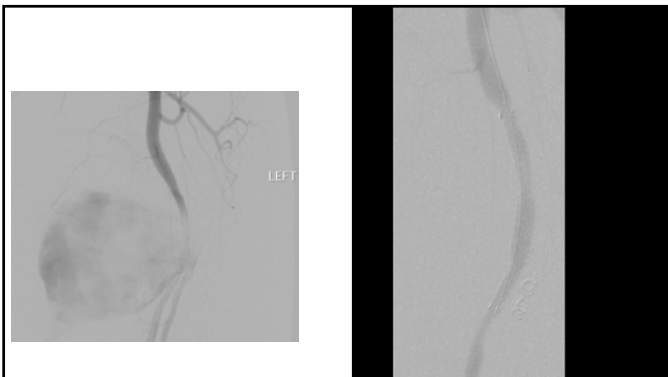


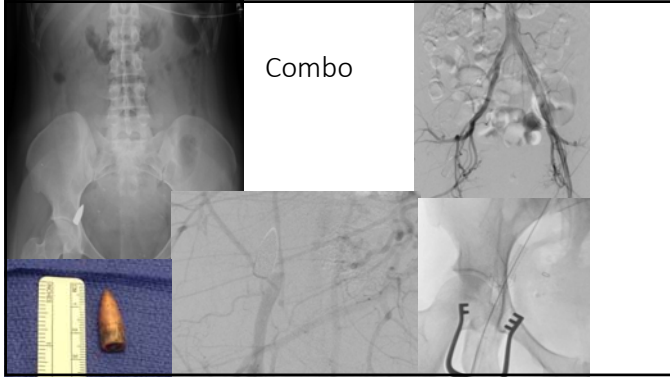
WHERE'S THE TOURNIQUET?











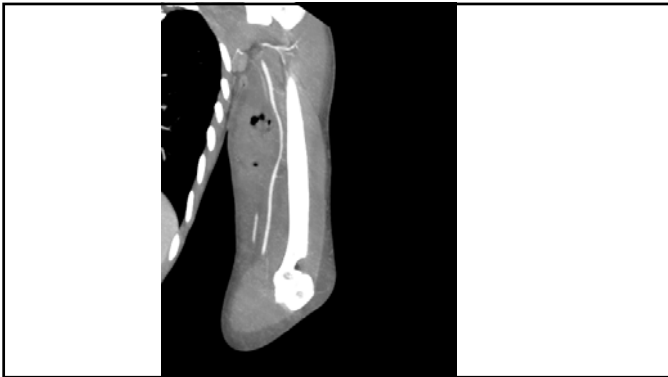


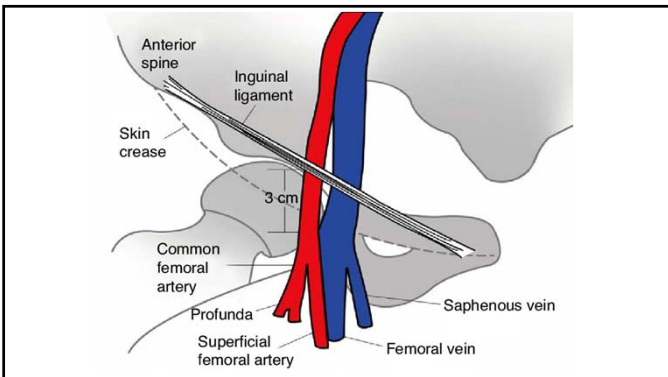


IMPRESSIONS:
NON-INVASIVE LOWER EXTREMITY ARTERIAL EXAM OF
THE RIGHT AND LEFT LEG
INVOLVING DUPLEX IMAGING, PULSE VOLUME RECORD-
ING, PHOTOPLETHYSMOGRAPHY, ANKLE
BRACHIAL INDEX (R-1.09, L-1.07) AND TOE BRACHIAL
INDEX (R-0.75, L-0.72)
REVEALS:

ADEQUATE ARTERIAL PERFUSION TO THE LEGS AND
DIGITS AT REST BILATERALLY.
ANKLE BRACHIAL OBTAINED USING PERONEAL AR-
TERY HYPOPLASTIC POSTERIOR TIBIAL
ARTERY,

History NOTES:
STATUS POST LEFT ANKLE INJURY
DECREASED DORSALIS PEDIS PULSE





Sources



- 1. My glove box
- 2. Erie County Medical Center ORs
- 3. American College of Surgeons "Stop the Bleed" program
- 4. Valentine Exposures in Vascular Surgery
- 5. Input from various surrounding police departments
- 6. Flag half mast from milwakeeindependent.com
- 7. Google search for Sesame Street letter C with Cookie Monster