Department of Surgery

ESSENTIALS OF VASCULAR INJURY :

WHAT EVERY PHYSICIAN SHOULD KNOW

Wasin Panchawirat, MD, FRCST
Vascular surgery , Maharaj Nakhon Si Thammarat hospital

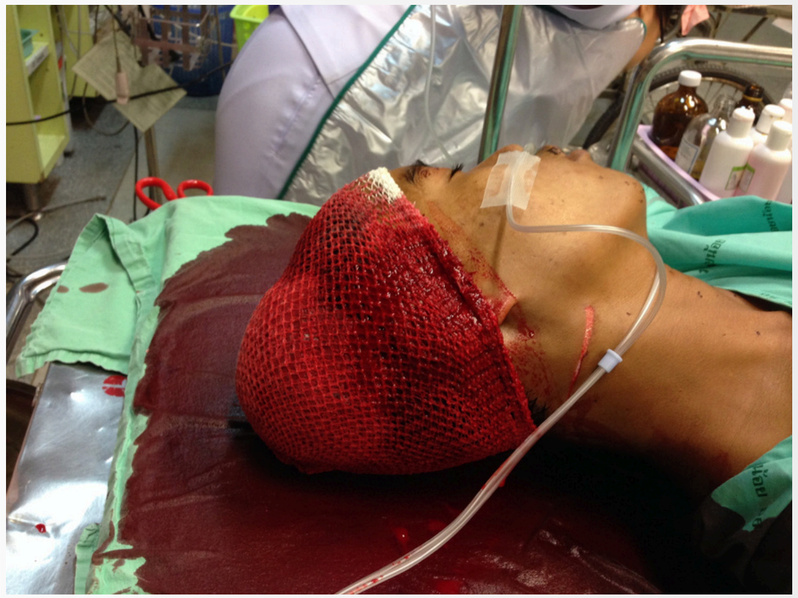
19/08/2025

Panchawirat.W@gmail.com

DISCLOSURE

We have no financial relationships with any commercial interest related to the content of this activity


mA: 0
KVp: 0
DI: -0.56
ETI: ---
EI: 1936



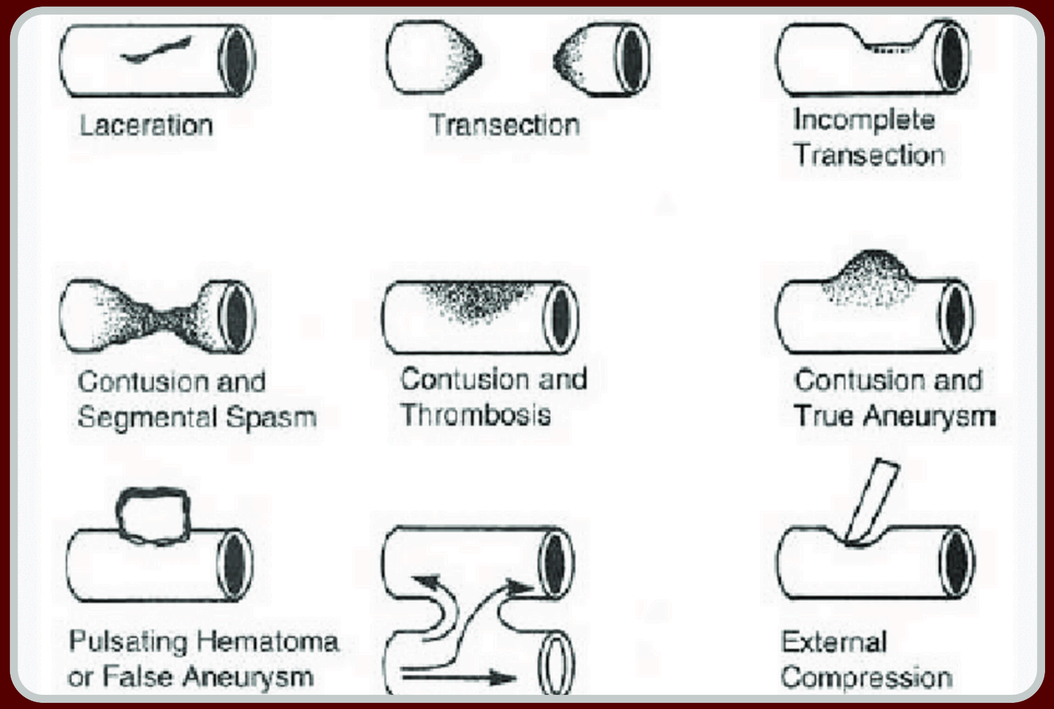
VASCULAR INJURIES BURDEN

Bleeding and its sequele

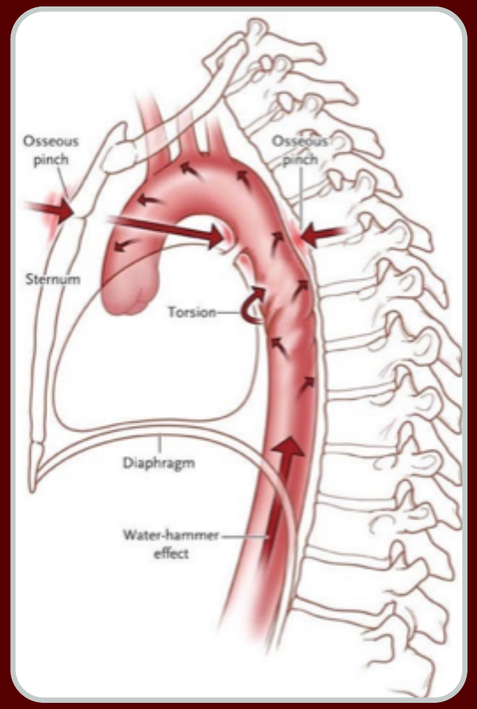
Death

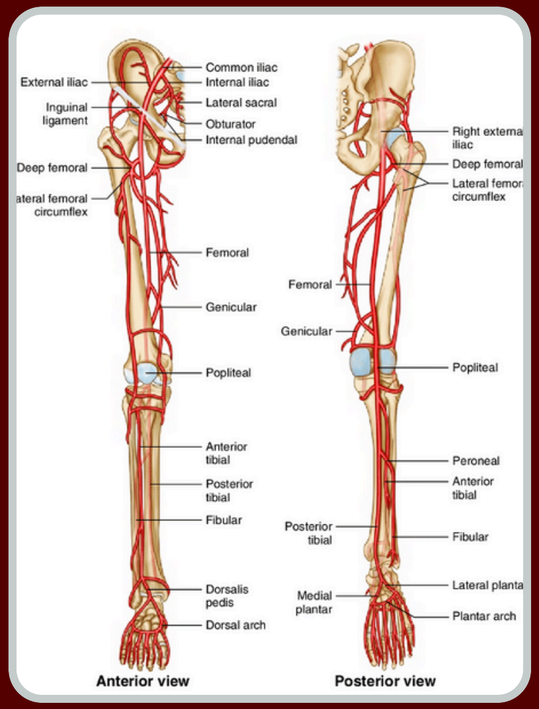
Limb loss

VASCULAR INJURIES CATEGORIES



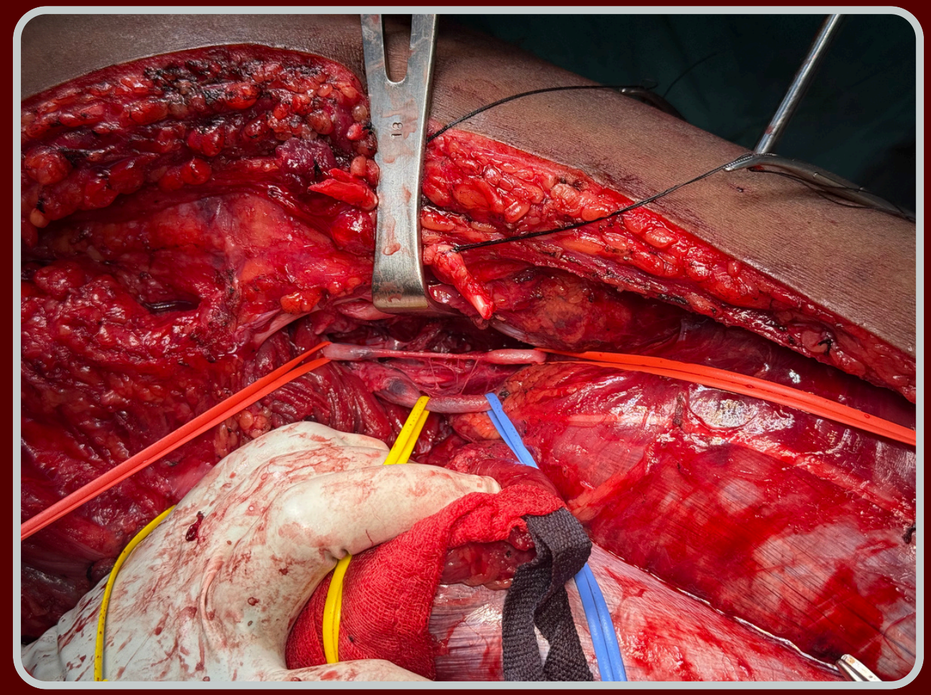
Characteristic





Location

VASCULAR INJURIES CATEGORIES



Mechanism of injuries

WHY MUST WE CONCERN?

- High Mortality and Morbidity rate
- Time sensitive treatment outcome
- Need high Resources
- High risk of misdiagnosis

Sense, Spec 95-100%

MORTALITY RATE
OF VASCULAR INJURY

Blunt thoracic aortic injury

	International	Thailand
Pre-hospital death	70-90%	none
In-hospital mortality	20-25% (Open era) 7.9-9% (TEVAR era)	45.5% (Open era) 0-4.1% (TEVAR era)
Paraplegia rate	9-19% (Open era) 0-3% (TEVAR era)	none

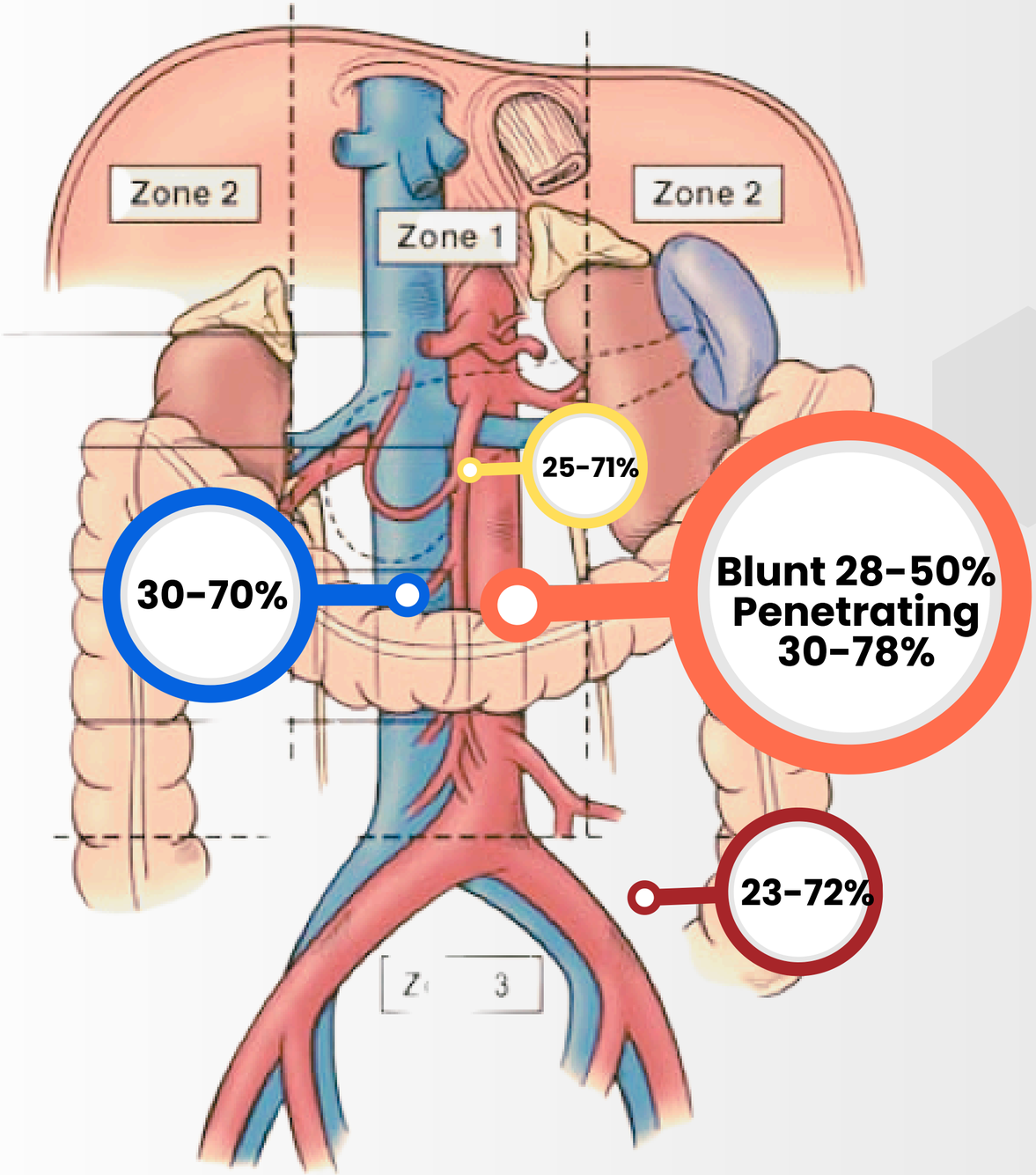
- **High pre-hospital mortality rate**
- **Lower mortality rate in TEVAR era**

1. Leelayana P, Khajarern S, Chernthanomwong P, Kantathut N. Endovascular Intervention in Blunt Traumatic Aortic Injury: Experience in Ramathibodi Hospital. Journal of the Medical Association of Thailand. 2021 Dec;104(12):S103–6.

2. Chittithavorn V, Vasinanukorn P, Rergkliang C, Chetpaophan A. Surgical outcome of traumatic aortic disruption of the thoracic aorta in Songklanagarind Hospital. J Med Assoc Thai. 2004 Sep;87(9):1048–55.

3. Fox N, Schwartz D, Salazar JH, Haut ER, Dahm P, Black JH, et al. Evaluation and management of blunt traumatic aortic injury: A practice management guideline from the Eastern Association for the Surgery of Trauma. Journal of Trauma and Acute Care Surgery. 2015 Jan;78(1):136–46.

4. Harper C, Collier SA, Slesinger TL. Traumatic Aortic Injuries. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Aug 15]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK555980/



MORTALITY RATE
OF VASCULAR INJURY

Abdominal vascular injury

- Cardiac arrest
- Lower limb ischemia
- Multiple organs injuries
- IVC ligation , suprarenal IVC injury

1. Asensio JA, Chahwan S, Hanpeter D, Demetriades D, Forno W, Gambaro E, et al. Operative management and outcome of 302 abdominal vascular injuries. Am J Surg. 2000 Dec;180(6):528–33; discussion 533-534.
41-71%

2. Hospital mortality of blunt abdominal aortic injury (BAAI): a systematic review and meta-analysis | World Journal of Emergency Surgery | Full Text [Internet]. [cited 2025 Aug 15].

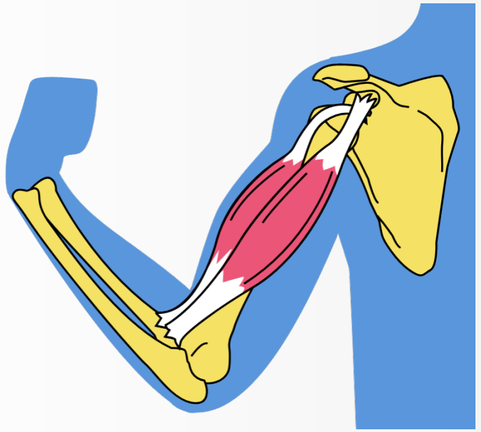
3. Prichayudh S, Rassamee P, Sriussadaporn S, Pak-Art R, Sriussadaporn S, Kritayakirana K, et al. Abdominal vascular injuries: Blunt vs. penetrating. Injury. 2019 Jan;50(1):137–41.

4. Sriussadaporn S. Abdominopelvic vascular injuries. J Med Assoc Thai. 2000 Jan;83(1):13–20.

5. Li M, Wang C, Tu H, Zhu H, Guo Z, Guo L. A systematic review of blunt abdominal aortic injury and analysis of predictors of death. Biomolecules and Biomedicine. 2024 May 2;24(3):486–504.

MORTALITY RATE OF VASCULAR INJURY

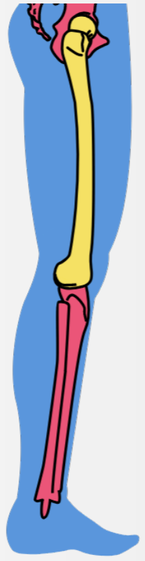
Peripheral vascular injury



Amputation rate

Upper exts 1-2%

Lower exts 5-18%
Popliteal artery 10-15%



Mortality rate

Upper exts 2-3%

Lower exts 1.5-10%

Amputation rate factors

- Ischemic time > 6hour [golden period < 1 hour]
- Major soft tissue inury
- Associated fracture

1. Li M, Wang C, Tu H, Zhu H, Guo Z, Guo L. A systematic review of blunt abdominal aortic injury and analysis of predictors of death. Biomolecules and Biomedicine. 2024 May 2;24(3):486–504.

2. European Society for Vascular Surgery (ESVS) 2025 Clinical Practice Guidelines on the Management of Vascular Trauma

3. Perkins ZB, Yet B, Glasgow S, Cole E, Marsh W, Brohi K, et al. Meta-analysis of prognostic factors for amputation following surgical repair of lower extremity vascular trauma. Br J Surg. 2015 Apr;102(5):436–50.

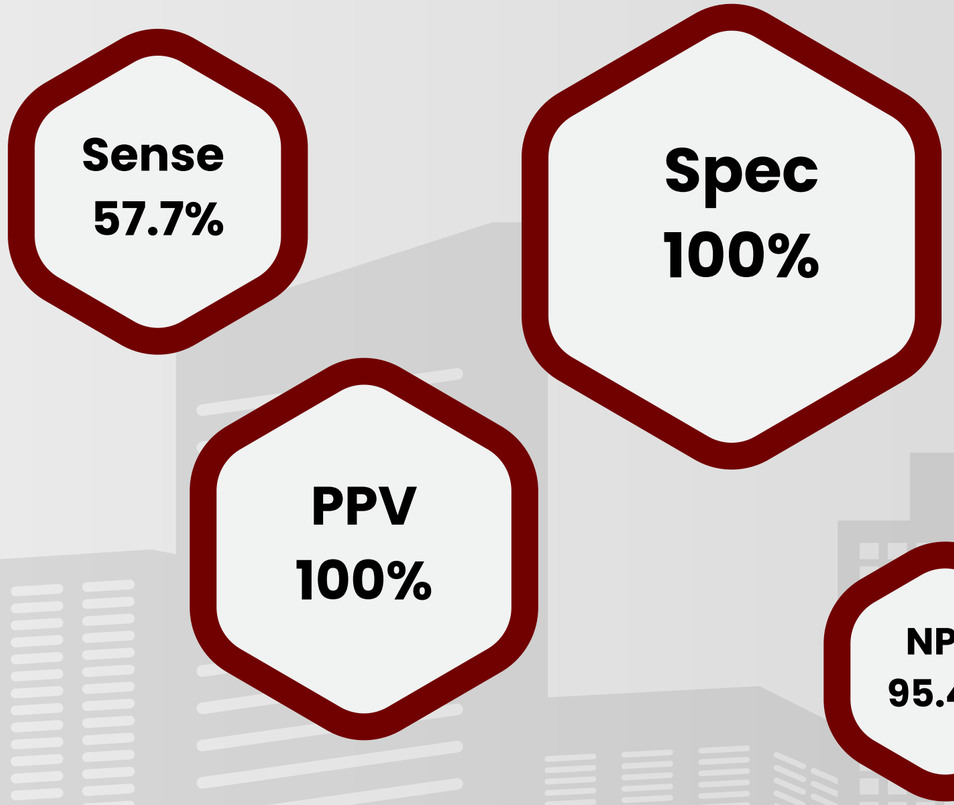
THE KEY PILLARS OF VASCULAR INJURY MANAGEMENT

- Early diagnosis
- Stop bleeding and proper resuscitation
- Refer to Trauma center
- Choose the best operation for “each” patient

CLINICAL DIAGNOSIS

"HARD SIGNS" IN PERIPHERAL VASCULAR INJURY

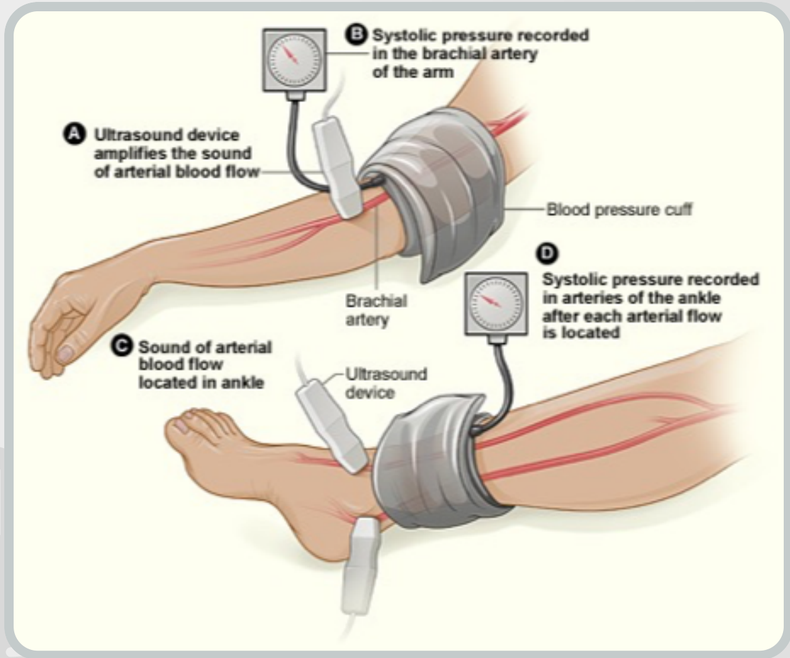
- Pulsatile bleeding
- Expanding hematoma
- Palpable thrill
- Audible bruit
- Presenting of regional ischemia (6 Ps)



1. Simsek Y, Gur A. Vascular Injury of Penetrating Trauma of the Extremities. Emerg Med Int. 2024 Dec 28;2024:9979585.

CLINICAL DIAGNOSIS
"SOFT SIGNS" IN PERIPHERAL VASCULAR INJURY

- History of moderate hemorrhage
- Proximity injury [fracture, dislocation, penetrating wound]
- Diminished but palpable pulse
- Peripheral nerve deficit



ABI < 0.9

↓

CTA

Intra-op angiogram

1. Simsek Y, Gur A. Vascular Injury of Penetrating Trauma of the Extremities. Emerg Med Int. 2024 Dec 28;2024:9979585.

ROLE OF CT ANGIOGRAPHY

- Soft signs of vascular injury
- Shotgun wound
- Pre-existing of peripheral arterial disease
- Plan for endovascular intervention

Sense, Spec 95-100%

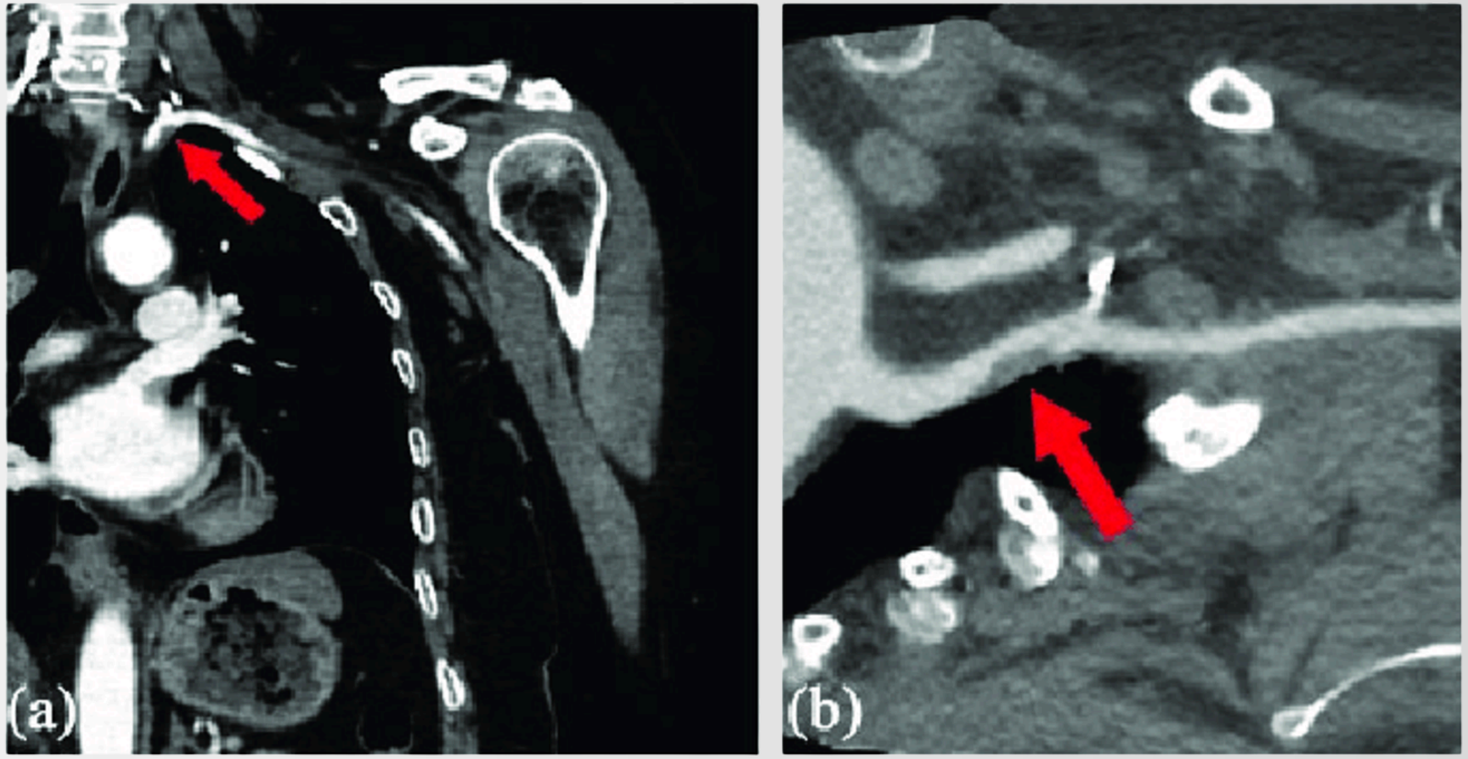
1. European Society for Vascular Surgery (ESVS) 2025 Clinical Practice Guidelines on the Management of Vascular Trauma

.

2. Jens S, Kerstens MK, Legemate DA, Reekers JA, Bipat S, Koelemay MJW. Diagnostic performance of computed tomography angiography in peripheral arterial injury due to trauma: a systematic review and meta-analysis. Eur J Vasc Endovasc Surg. 2013 Sep;46(3):329–37.

ROLE OF CT ANGIOGRAPHY

Popliteal artery (P3) injury



Left subclavian artery injury

“Uncontrolled bleeding is the number one cause of preventable death from trauma.”

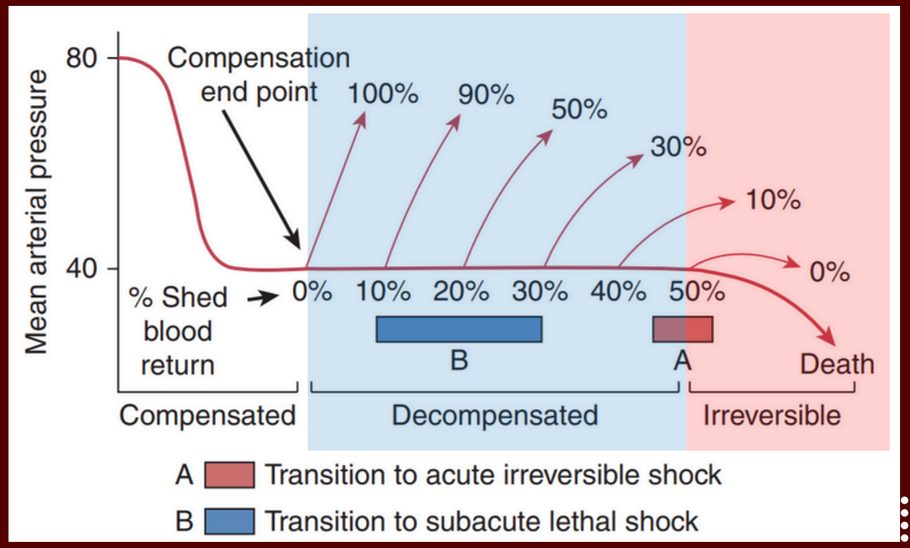
J Trauma. 2002 Mar;52(3):420-5. doi: 10.1097/00005373-200203000-00002.

Time to laparotomy for intra-abdominal bleeding from trauma does affect survival for delays up to 90 minutes

John R Clarke [1], Stanley Z Trooskin, Prashant J Doshi, Lloyd Greenwald, Charles J Mode

Affiliations + expand

PMID: 11901314 DOI: 10.1097/00005373-200203000-00002



TIME INFLUENCED OUTCOME

The probaility of death in hypotensive patients that spent up to 90 min in ED before transfer to OR for laparotomy and hemorrhage control

increased by 0.35% for every minute of delay in ED

Intra-abdominal bleeding

+

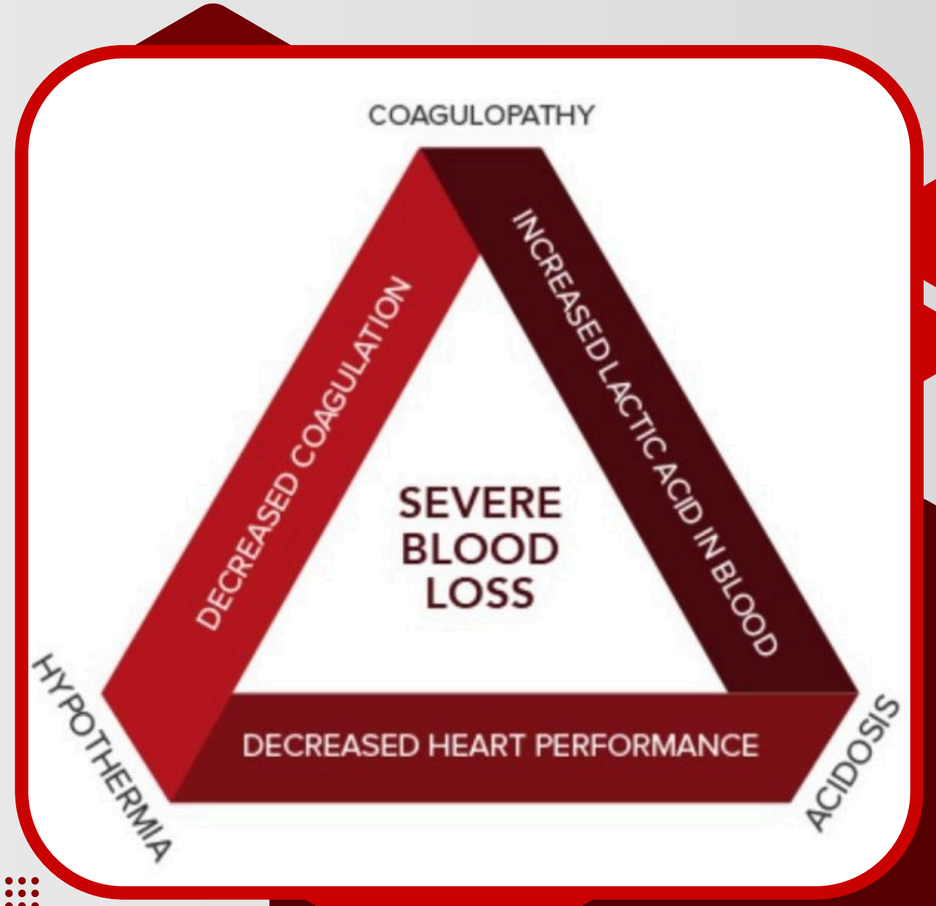
Hypotension

→ **Operating room**

1. Peitzman AB, Harbrecht BG, Udekwu AO, et al. Hemorrhagic shock. Curr Probl Surg. 1995;32:974
2. Clarke JR, et al. "Time to laparotomy for intra-abdominal bleeding from trauma does affect survival for delays up to 90 minutes." J Trauma. 2002;52:420-425.

WHY PATIENTS CAN’T STOP BLEEDING?

HOW TO MANAGE THEM?



COURSE MANUAL | 11th Edition

Advanced Trauma Life Support® (ATLS®)

Standardized Trauma Care
When Seconds Count

xABCDE

- Trauma with shock patient [SBP <90mmHg]
- CAB decreased 24 hours and 30 days mortality rate

Ferrada *et al. World Journal of Emergency Surgery* (2024) 19:15
https://doi.org/10.1186/s13017-024-00545-8

World Journal of Emergency Surgery

RESEARCH Open Access

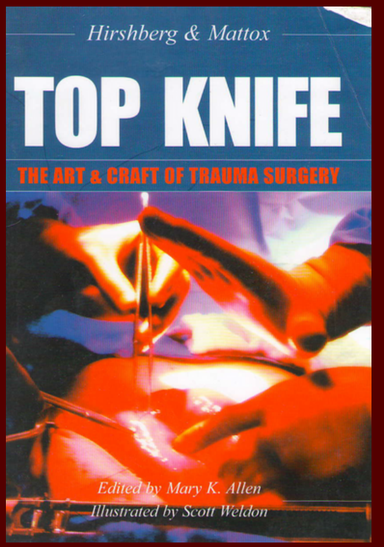
Comparing outcomes in patients with exsanguinating injuries: an Eastern Association for the Surgery of Trauma (EAST), multicenter, international trial evaluating prioritization of circulation over intubation (CAB over ABC)

Paula Ferrada[1,8*], Alberto García[2], Juan Duchesne[3], Megan Brenner[4], Chang Liu[1], Carlos Ordóñez[2], Carlos Menegozzo[5], Juan Carlos Salamea[6] and David Feliciano[7]

Whenever you encounter massive bleeding, the first thing to remember is: it's not your blood.

~ Raphael Adar, MD, FACS

Control compressible and extremity bleeding



Hirshberg & Mattox, Top Knife the art & craft of trauma surgery

CLINICAL PRACTICE GUIDELINE DOCUMENT

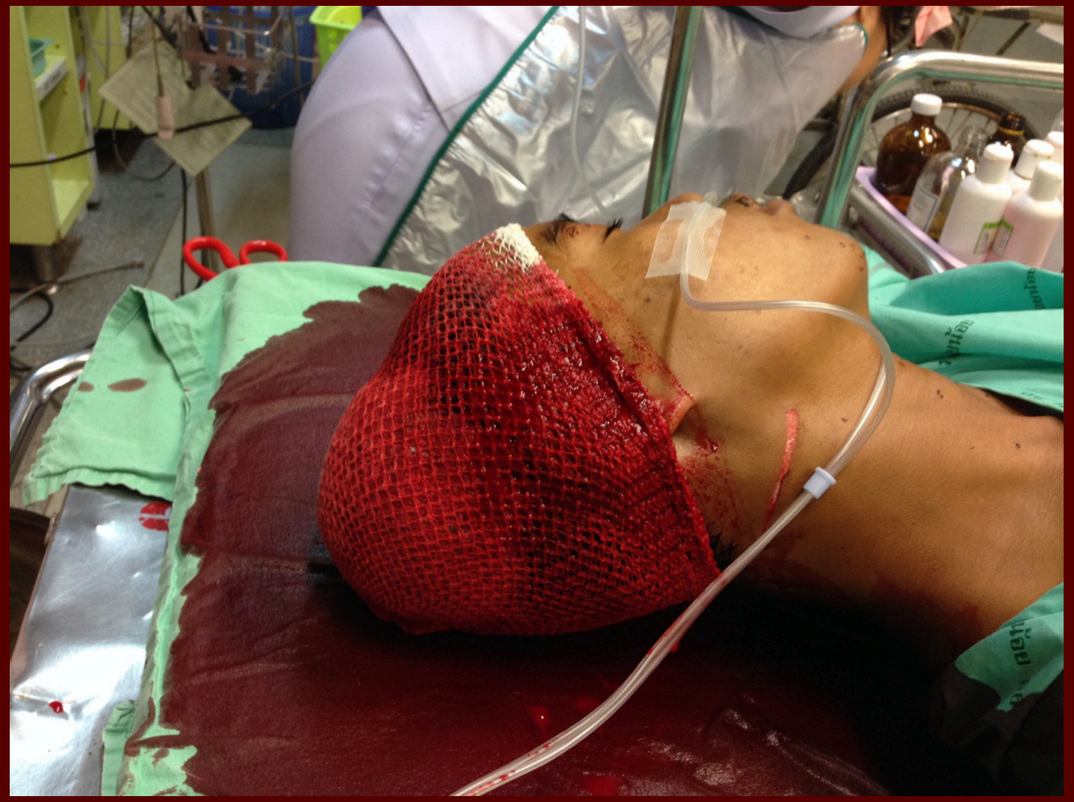
European Society for Vascular Surgery (ESVS) 2025 Clinical Practice Guidelines on the Management of Vascular Trauma☆

Recommendation 6

A pre-hospital tourniquet, applied as distally as possible, is recommended for patients with uncontrolled bleeding from extremity vascular trauma when local compression and or packing are not sufficient.

Class	Level	References	ToE
I	C	Scerbo *et al.* (2017),[69] Beekley *et al.* (2008),[70] Covey *et al.* (2022),[71] Benítez *et al.* (2021),[72] Henry *et al.* (2021),[74] Teixera *et al.* (2018)[73]	

EXTERNAL BLEEDING



EXTERNAL BLEEDING

Courtesy of Dr. Banpot Wattakawanich

Immediate

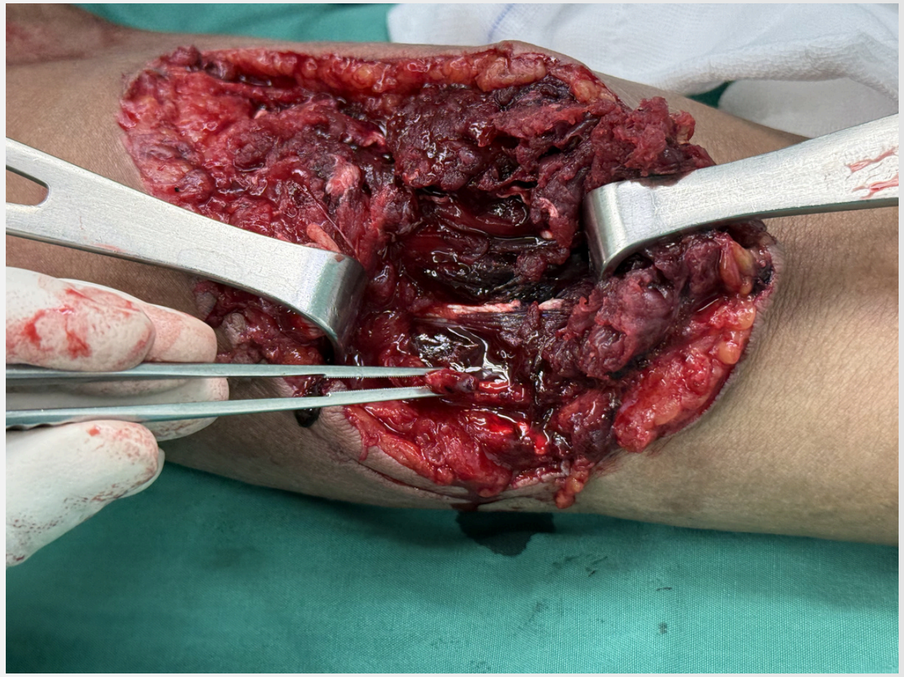
15 min

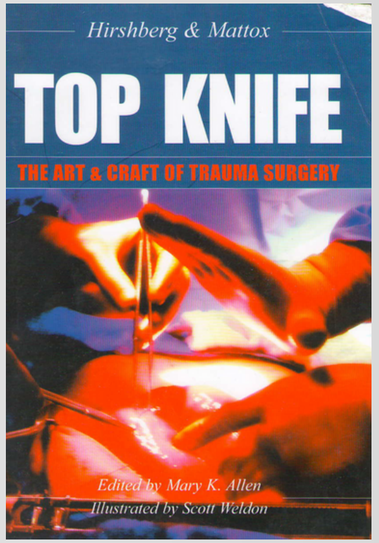
30 min

Courtesy of Dr. Banpot Wattakawanich

Courtesy of Dr. Banpot Wattakawanich

“Ligation is not an admission of defeat; it can be sign of good judgment.”

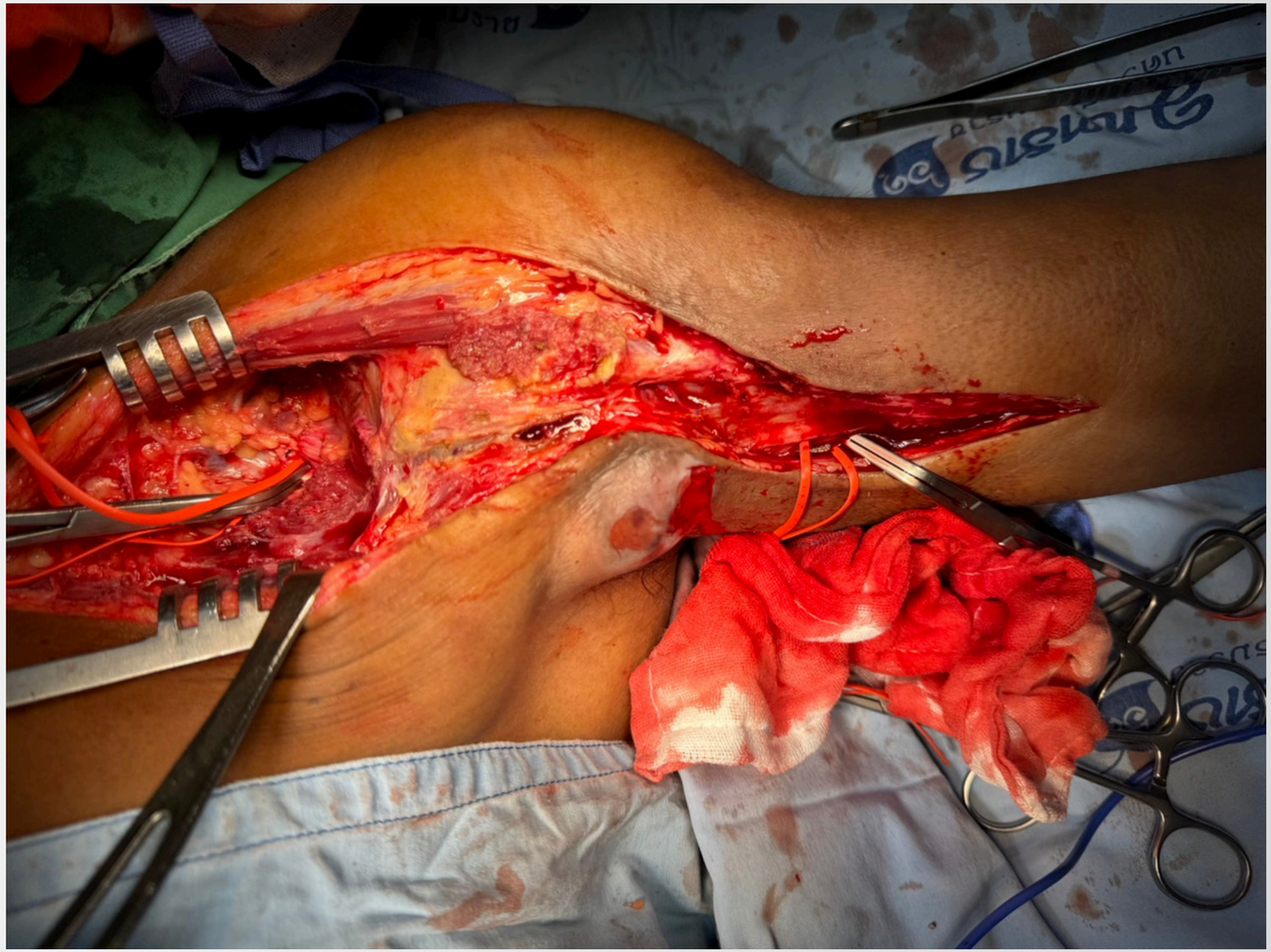




Hirshberg & Mattox, Top Knife the art & craft of trauma surgery

EXPOSURE AND CONTROLL

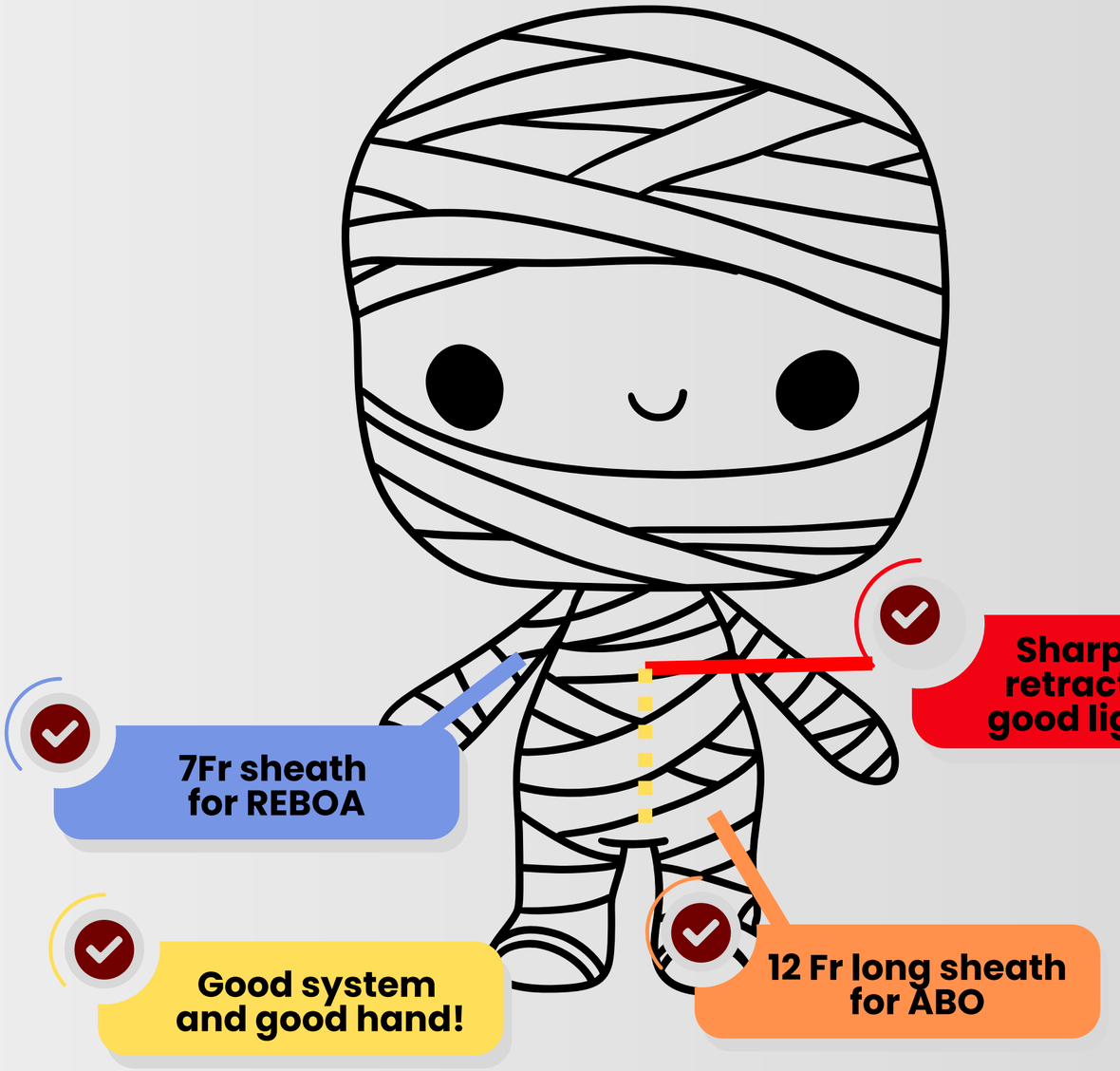
Proximal brachial artery injury



Axillary artery clamping

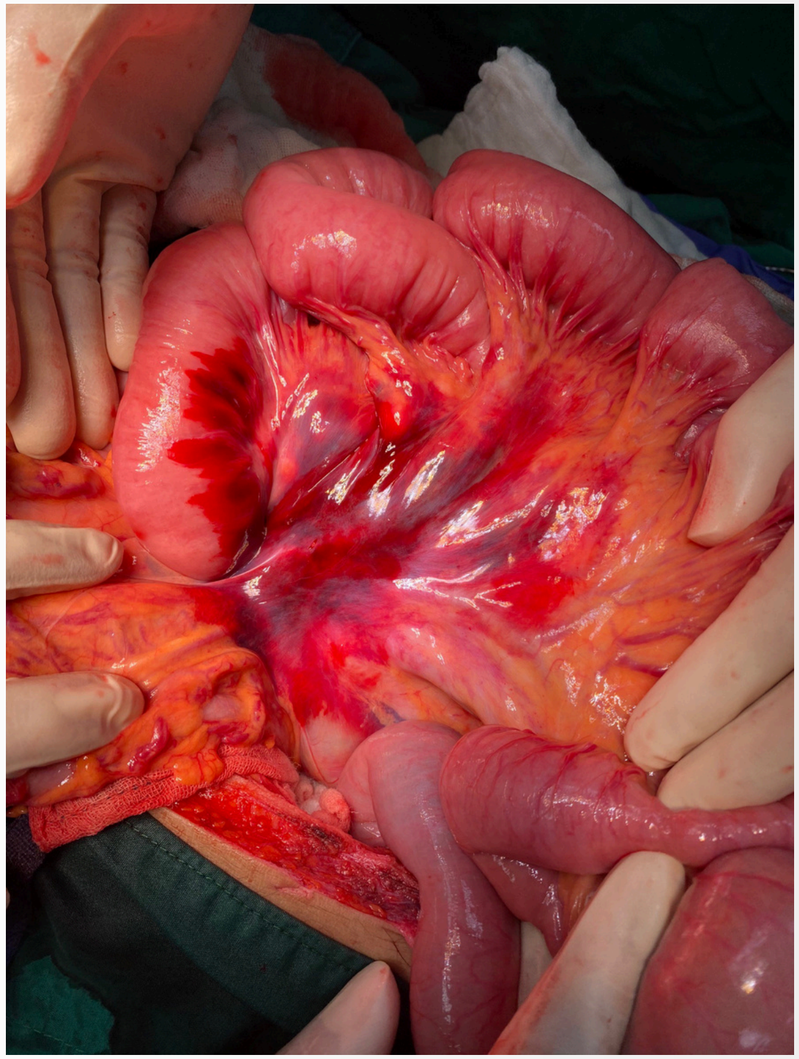
EXPOSURE AND CONTROLL

- Direct control
- REBOA
- Aortic balloon occlusion
- Thoracotomy

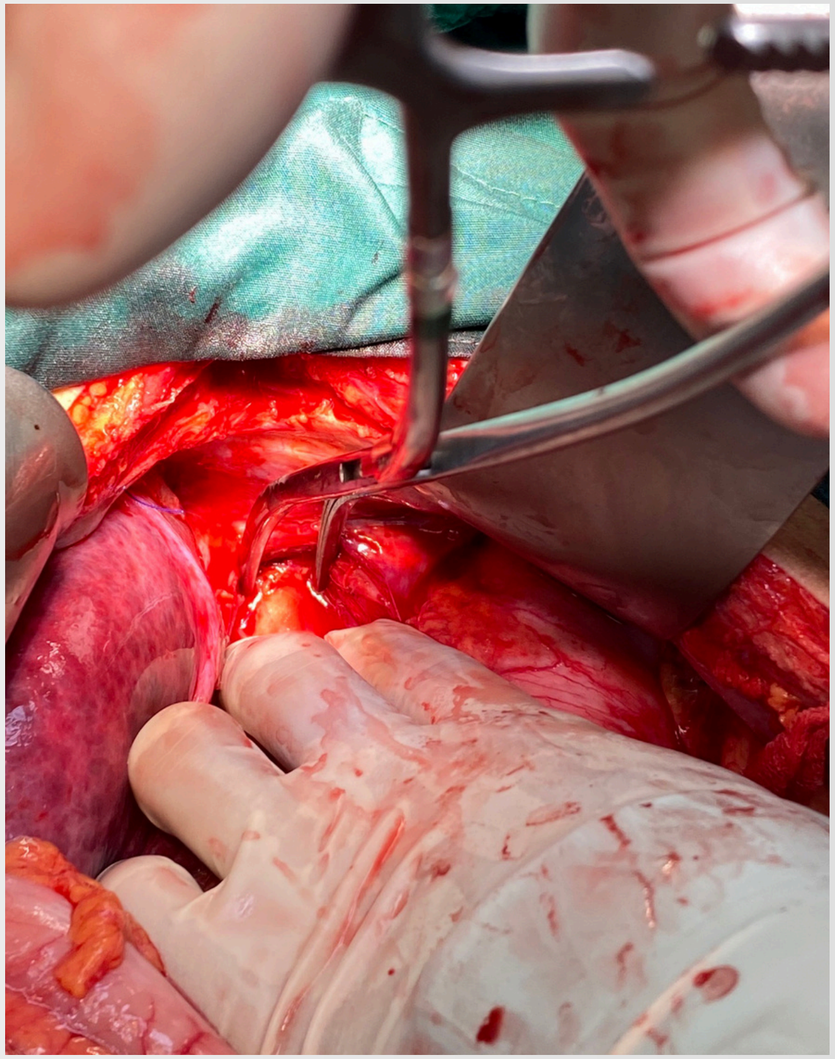


CHOOSE THE BEST
IN YOUR PLACE

EXPOSURE AND CONTROLL

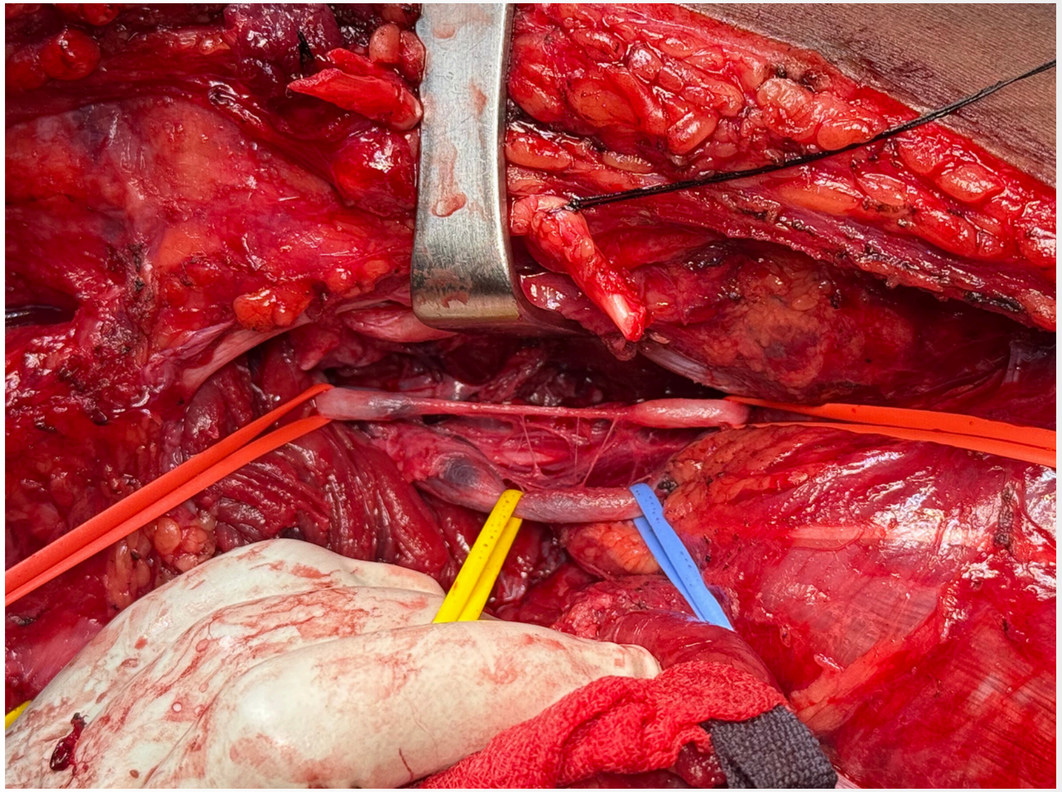


Expanding hematoma zone I

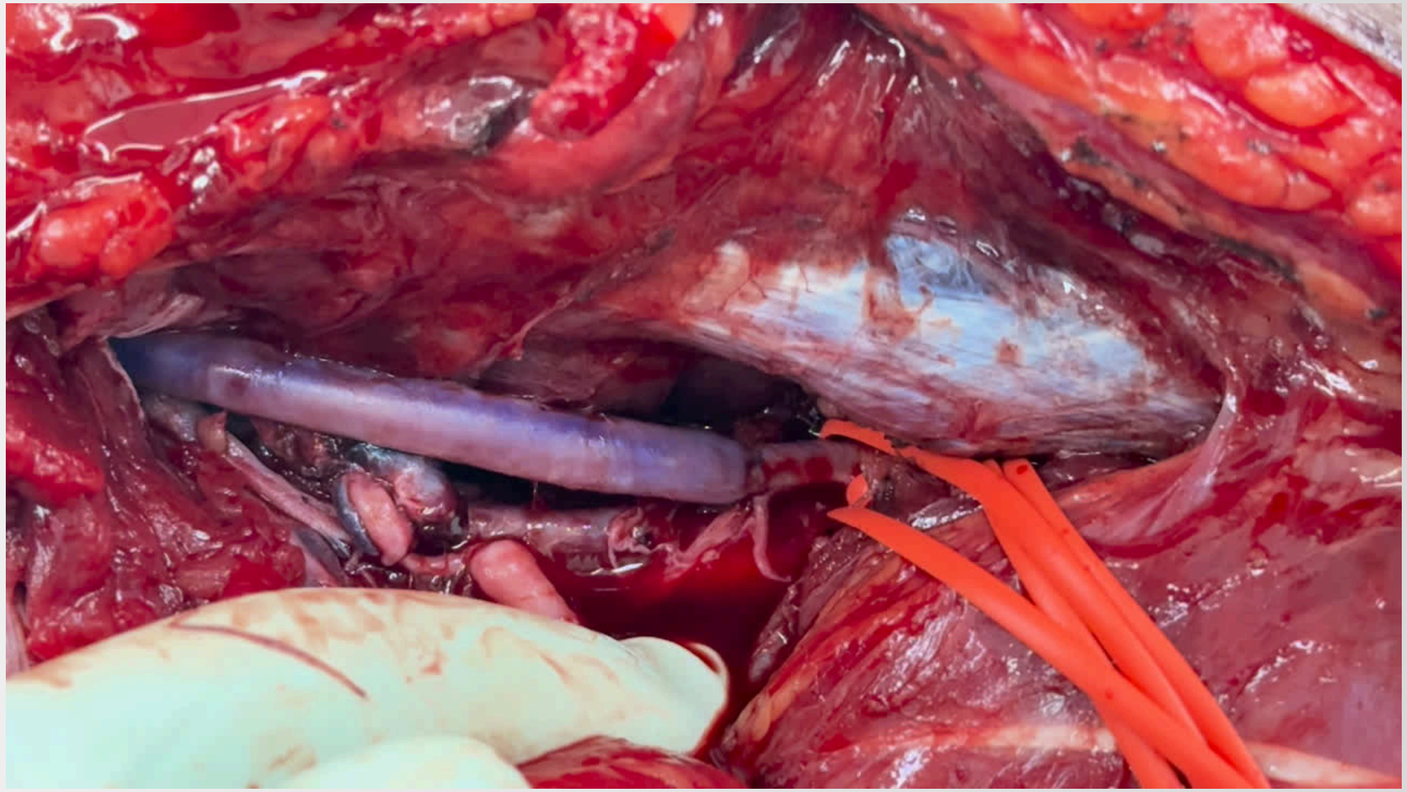


Supraceliac cross clamp

SEGMENTAL RESECTION

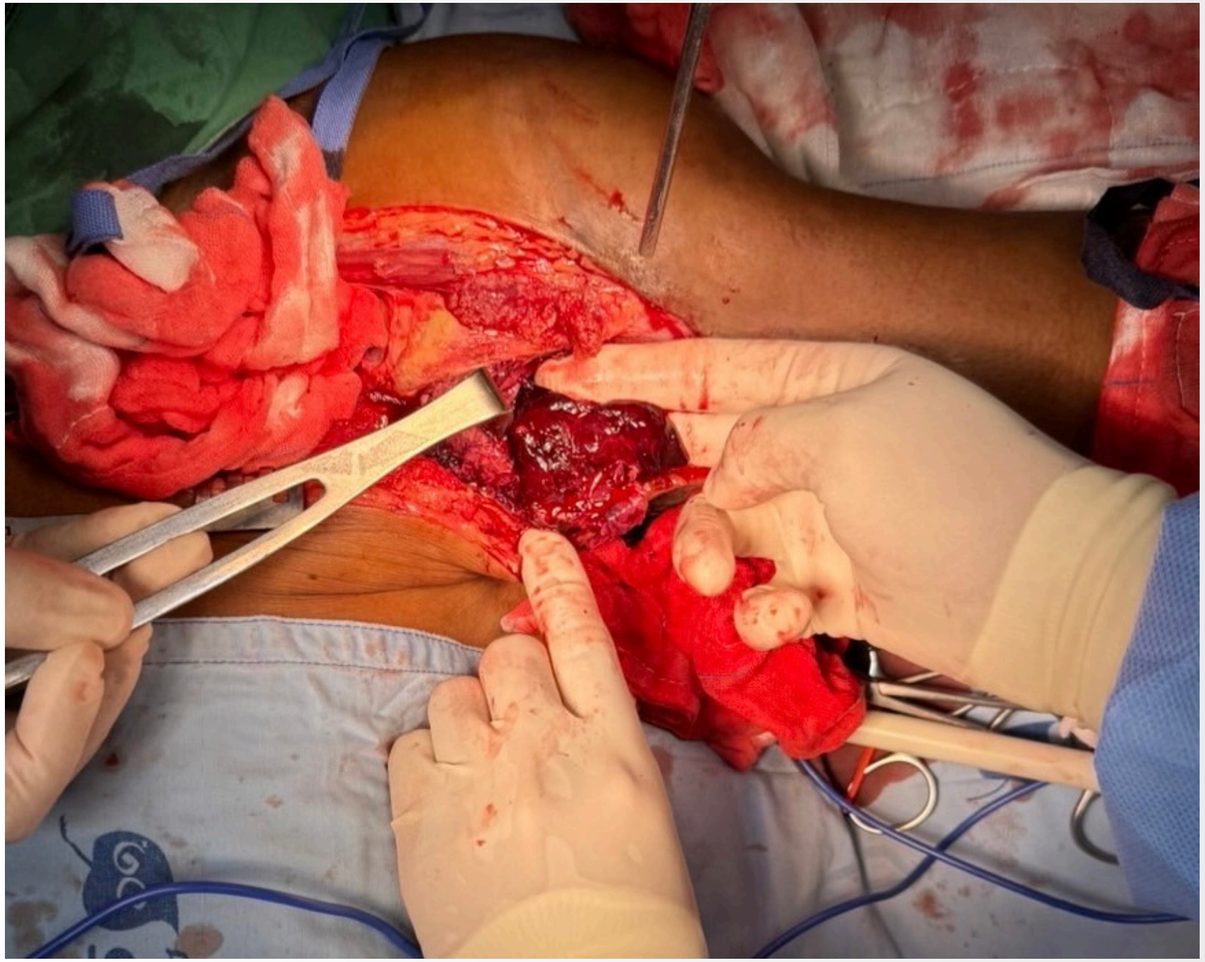


Popliteal artery (P3) injury

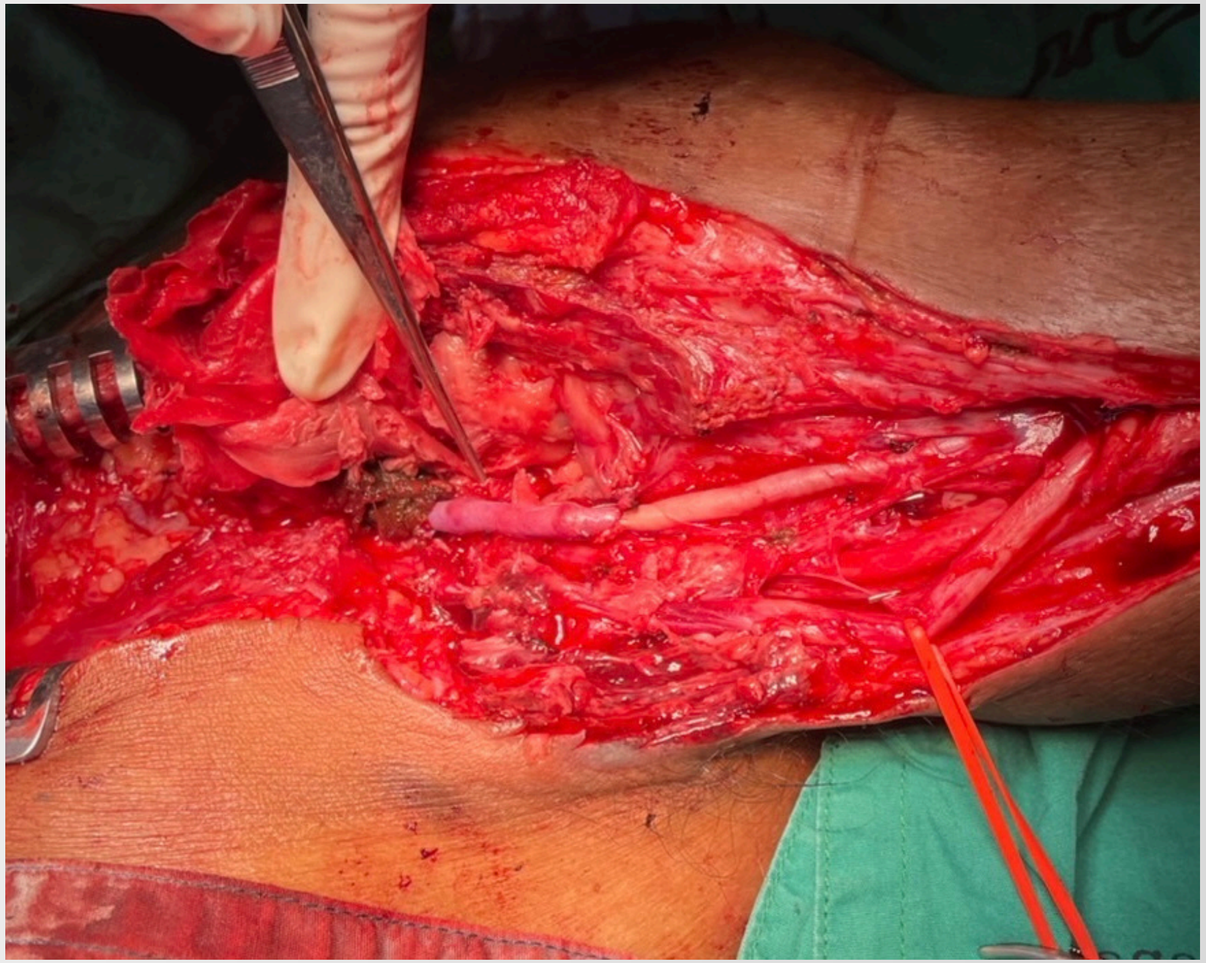


Segmental resection
Interposition graft with reverse GSV graft

SEGMENTAL RESECTION



Proximal brachial artery injury



Segmental resection
Interposition graft with basilic vein graft

SURGICAL BYPASS

Femoro-popliteal artery bypass with reverse GSV graft

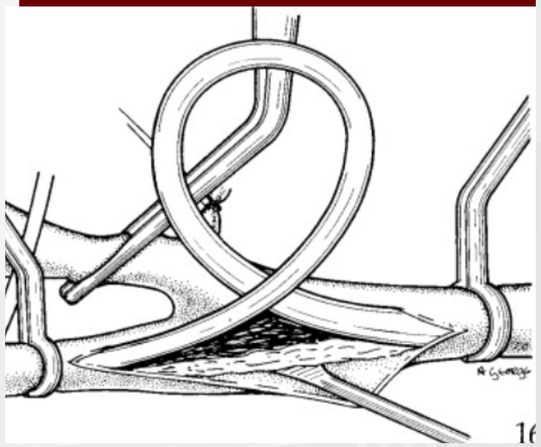
Femoro-femoral artery bypass with ePTFE graft

TEMPORARY SHUNT

The use of temporary vascular shunts to rapidly restore blood flow is recommended when timely primary definitive vascular repair is not feasible due to patient physiology or injury pattern.

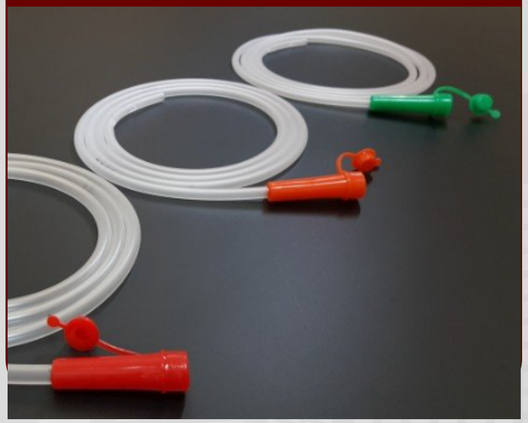
Argyle shunt

Javid shunt



Pruitt-Inahara shunt

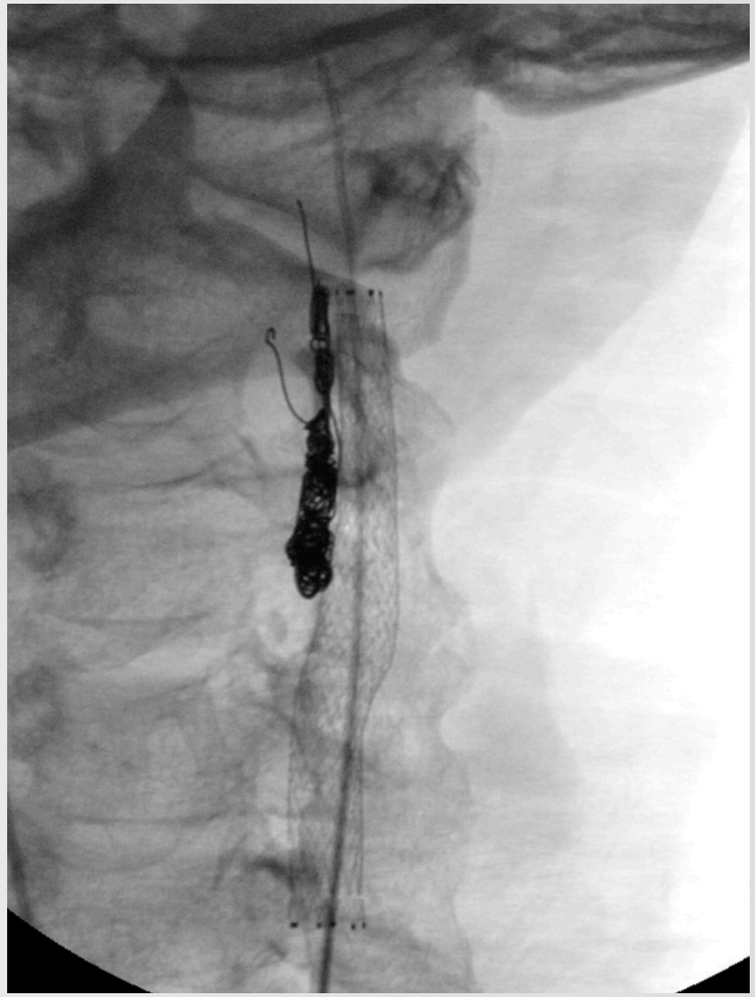
Improvised shunt



(ESVS) 2025 Clinical Practice Guidelines on the Management of Vascular Trauma

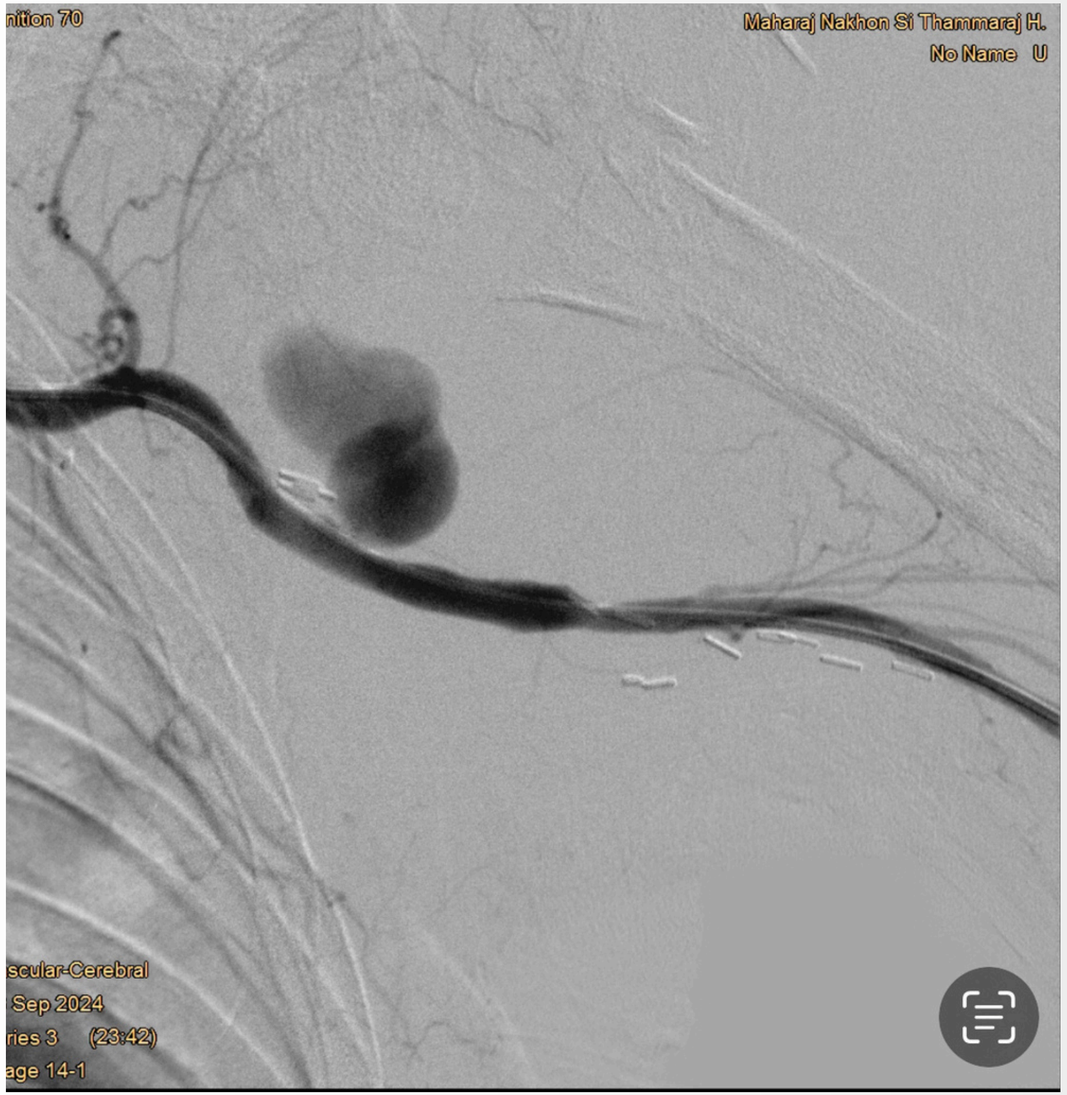
ENDOVASCULAR INTERVENTION

- Embolization in bleeding branch
- Covered stent for pseudoaneurysm or fistula
- First line treatment in thoracic aortic injury
- Subclavian artery injury
- Pelvic injury with ongoing bleeding



Embolization and Covered stent insertion

ENDOVASCULAR INTERVENTION

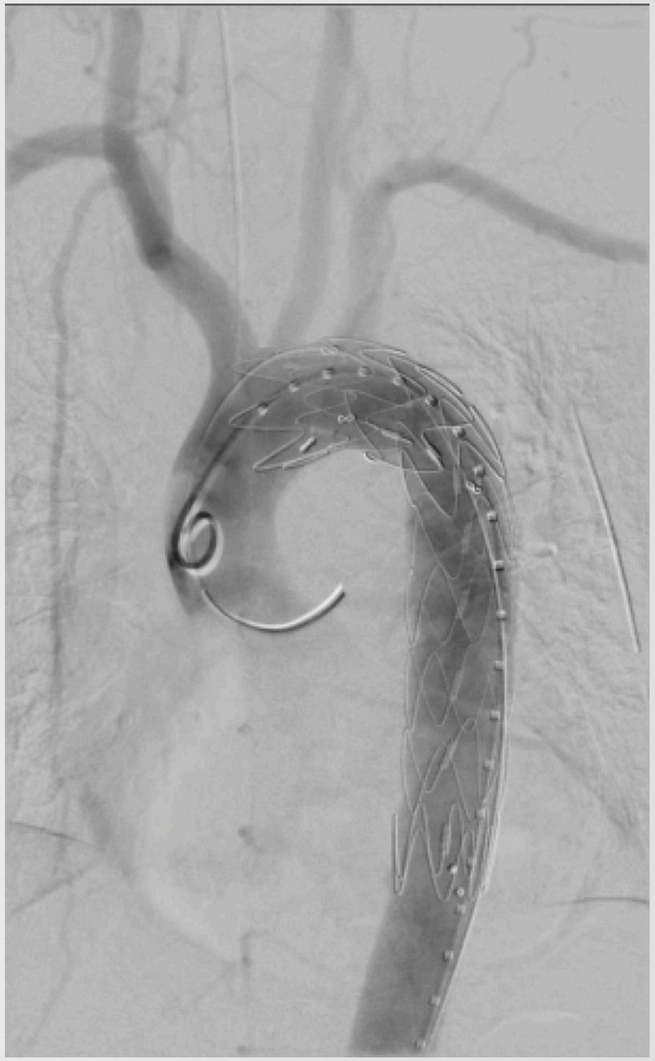


Pseudoaneurysm at axillary artery

Covered stent insertion

ENDOVASCULAR INTERVENTION

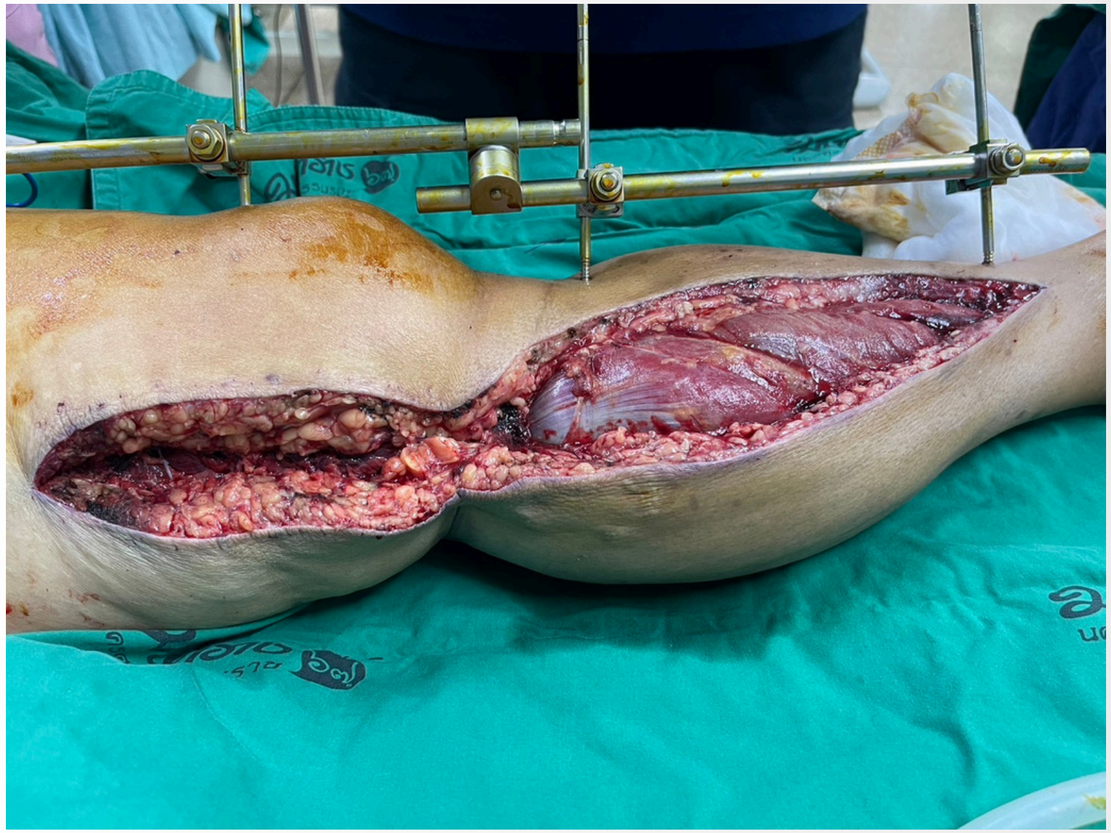
Pseudoaneurysm at distal aortic arch

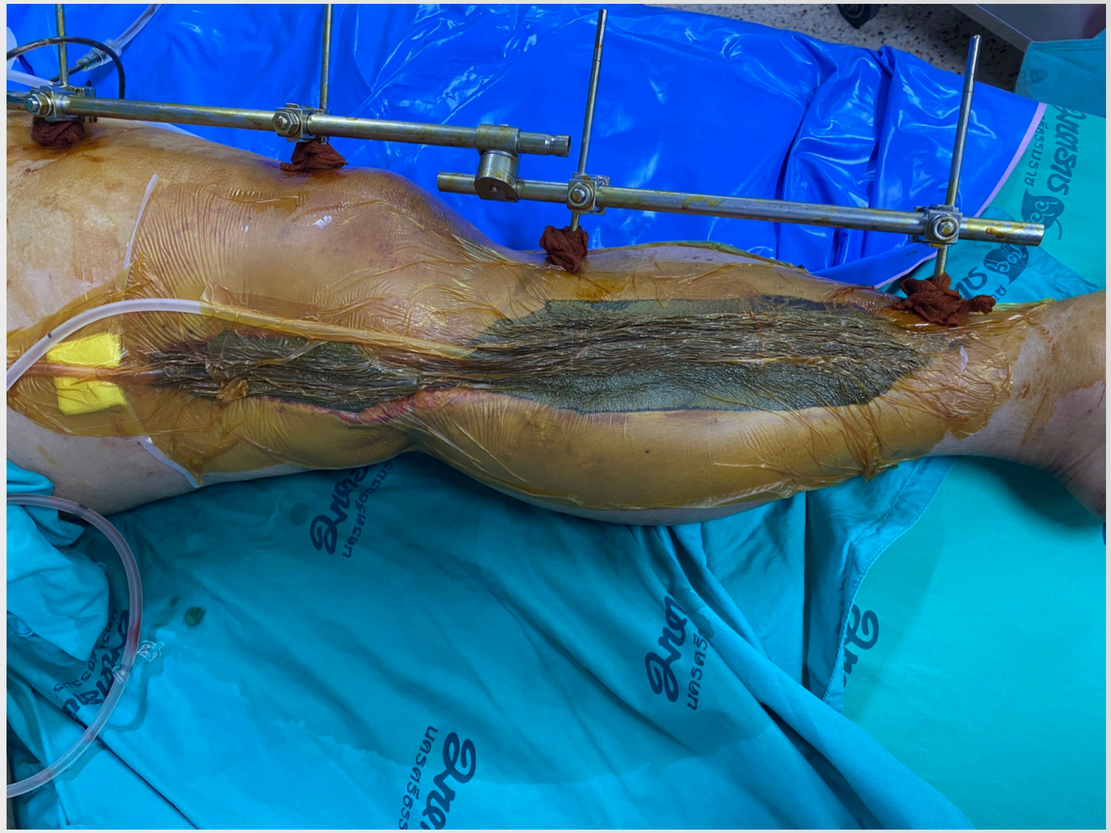


Courtesy of Dr. Supong Worathanmanon

FASCIOTOMY

FASCIOTOMY

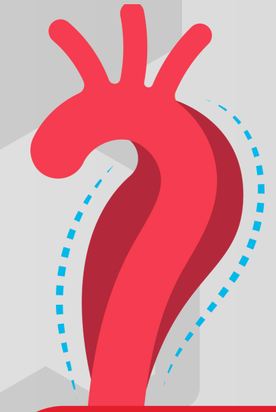




Carotid and vertebral artery
→ Endovascular

Subclavian artery
→ Endovascular

Renal artery
→ Endovascular, Open

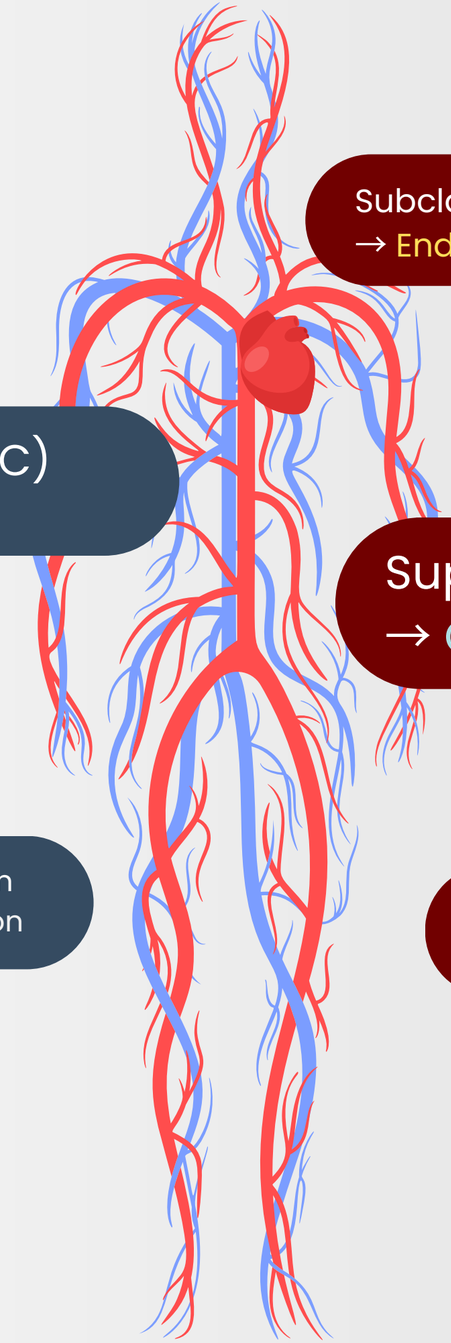


Thoracic aorta
→ Endovascular

Inferior vena cava (IVC)
→ Open

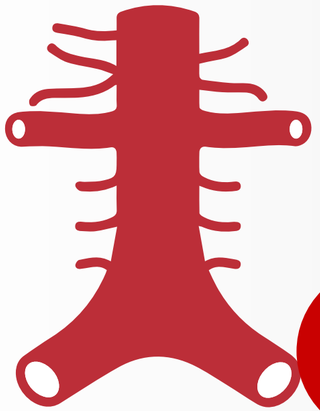
Superior mesenteric artery
→ Open , endovascular

Inferior mesenteric artery
→ Ligation



Abdominal vein
→ Open, ligation

Iliac artery
→ Endovascular



Abdominal aorta
→ Open

ATA, PTA, Radial, Ulnar a
→ Open, ligate

(ESVS) 2025 Clinical Practice Guidelines on the Management of Vascular Trauma

Department of Surgery

THANK YOU FOR YOUR ATTENTION