
بسم الله الرحمن الرحیم

Peripheral vascular Trauma

Vascular injury is a major cause of death and disability in society,with trauma being the principal etiology.

trauma is the number **one** cause of death for patients between the ages of 1 and 46, and is the **third** highest overall cause of mortality across all age groups.

Certainly, mortality from trauma is complex,with outcomes predicated on the extent and nature of sustained injuries.

Major vascular trauma commonly manifests with hemorrhage, and, arguably, the initial principles of surgical practice evolved around the control of bleeding.

new medical techniques and principles, such as antisepsis, antibiotics, and improved anesthetics, facilitated a widespread revolution in the management of vascular injury.

Factors Influencing the Natural History of Vascular Injury

For severely injured patients, damage control techniques, including abbreviated surgery, the application of endovascular techniques, balanced resuscitation, and temporary intravascular shunts (both arterial and venous) have been associated with major reductions in both mortality and limb loss.

Natural History of Various Types of Vascular Injuries and Potential Future Complications

Injury Type	Natural History	Complications
Penetrating or Iatrogenic		
Laceration	Pseudoaneurysm or thrombosis	Ischemia, rupture, embolization
Contusion	Stenosis, thrombosis	Ischemia, embolization
Arteriovenous fistula	Increase in size and flow	"Steal" syndromes, heart failure
Blunt		
Intimal dissection or thrombosis (<25%)	Spontaneous resolution	None unless progression
Intimal dissection or thrombosis (>25%)	Pseudoaneurysm, thrombosis	Rupture, ischemia
Pseudoaneurysm	Increase in size	Rupture, embolization
Thrombosis	Occlusion, recanalization	Ischemia, stenosis
Arteriovenous fistula	Increase in size and flow	"Steal" syndromes, pseudoaneurysm
Transection	Thrombosis, pseudoaneurysm	Ischemia, compartment syndrome

Extremity trauma is extremely common in all settings fromboth blunt and penetrating mechanisms, accounting for approximately 1% to 2% of all civilian trauma.

Extremity vascular trauma

Vascular injuryis more common in the lower extremities (66%) versus upper (34%).

In modern series,vascular injuries to the extremities occur in 0.5% to 1% of injured patients but account for 20% to 50% of all vascular Injuries.

Mortality in Extremity vascular trauma

Extremity vascular injuries result from blunt and penetrating mechanisms with nearly equal frequency.

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Patients with blunt injuries experience mortality rates between 2% and 5%, whereas penetrating injuries generally result in fewer deaths.

Amputation in Extremity vascular trauma

Amputation rates in patients with extremity vascular injury . range from 7% to 30%, with most amputations performed in patients with blunt mechanisms.

Associated Tissue Injuries

The incidence of named **venous injury** concomitant with extremity arterial trauma ranges between 15% and 35%.

Long-term limb edema in particular appears to be unrelated to whether a venous injury was repaired or not.peripheral **nerve injury** the incidence appears to be higher in the upper extremity, reported as 40% to 70%,than in the lower extremity, for which rates are typically reported to be 30%. The presence of a significant soft tissue deficit does appear to correlate with amputation in lower extremity arterial

trauma

Clinical Signs of Extremity Arterial Injury

Hard Signs

- Absent distal pulse
- Palpable thrill or audible bruit
- Actively expanding hematoma
- Active pulsatile bleeding

Soft Signs

- Diminished distal pulse
- History of significant hemorrhage
- Neurologic deficit
- Proximity of wound to named vessel

DIAGNOSIS AND WORKUP

All patients presenting with trauma to the extremities and **hard signs** of arterial injury should have those injuries surgically explored in an expeditious manner.

Patients presenting with **soft signs** should undergo a complete pulse examination and a measurement of Doppler pressures in the injured limb distal to the suspected injury for the calculation of a pressure index. If the index is less than 1.0, a further diagnostic and localization study should be performed.

DIAGNOSIS AND WORKUP

Computed Tomographic Angiography

Computed tomographic angiography (**CTA**) is the diagnostic modality most frequently used to identify and localize extremity arterial injuries,having largely supplanted catheter-based Angiography.

DIAGNOSIS AND WORKUP

Duplex Ultrasonography

The use of duplex ultrasonography (**DUS**) in the diagnosis of

extremity vascular trauma has been limited, especially with

the increasing use of CTA. DUS can be time-consuming and

operator specific.

TREATMENT PRINCIPLES

Nonoperative Management

Injuries identified on imaging that may be considered for observation include those that produce no active hemorrhage or distal ischemia, such as **small intimal tears** or **flaps**,**pseudoaneurysms**,and **arteriovenous fistulas**. Serial surveillance with an appropriate imaging modality such as CTA or DUS is recommended; early repair might be more appropriate if prospects for follow-up are uncertain.

TREATMENT PRINCIPLES

Endovascular Therapy

Endovascular treatment is most appropriate when the **morbidity** difference between the open and endovascular procedures is greatest. This is most often the case in the setting of injuries to **junctional vessels** (such as the subclavian and iliac).

the use of endovascular balloon occlusion for proximal

vascular control may obviate the need for opening a body cavity.

TREATMENT PRINCIPLES

Open Surgical Management

* Open surgical control and repair remain the mainstays of the management of most extremity vascular injuries.
* Wide debridement
* In general, provided the patient's physiologic status will tolerate it, arterial injuries should undergo urgent surgical repair with the goal of restoring inline distal flow.

Mangled Extremity Severity Score

Skeletal/Soft Tissue Injury	
Low energy (stab; simple fracture; pistol gunshot wound)	1
Medium energy (open or multiple fractures, dislocation)	2
High energy (high-speed motor vehicle accident or rifle gunshot wound)	3
Very high energy (high-speed trauma + gross contamination)	4
Limb Ischemia	
Pulse reduced or absent but perfusion normal	1[a]
Pulseless; paresthesias, diminished capillary refill	2
Cool, paralyzed, insensate, numb	3[a]
Shock	
Systolic blood pressure always >90 mm Hg	0
Hypotensive transiently	1
Persistent hypotension	2
Age	
<30 years	0
30-50 years	1
>50 years	2

[a]Score doubled for ischemia >6 h.

Modified from Helfet DL, Howey T, Sanders R, Johansen K. Limb salvage versus amputation. Preliminary results of the Mangled Extremity Severity Score. *Clin Orthop Relat*. 1990; Res 256:80-86.

Vascular Injury in the Mangled Extremity

A MESS of **7** or higher correlates well with primary amputation of the upper or lower extremity. Ischemia is a component of the MESS, but the degree of bone loss and soft tissue disruption has greater bearing on the decision to perform primary amputation.

Neither the MESS nor any of the numerous other extremity injury scores accurately predict **functional outcomes** in severe limb trauma.