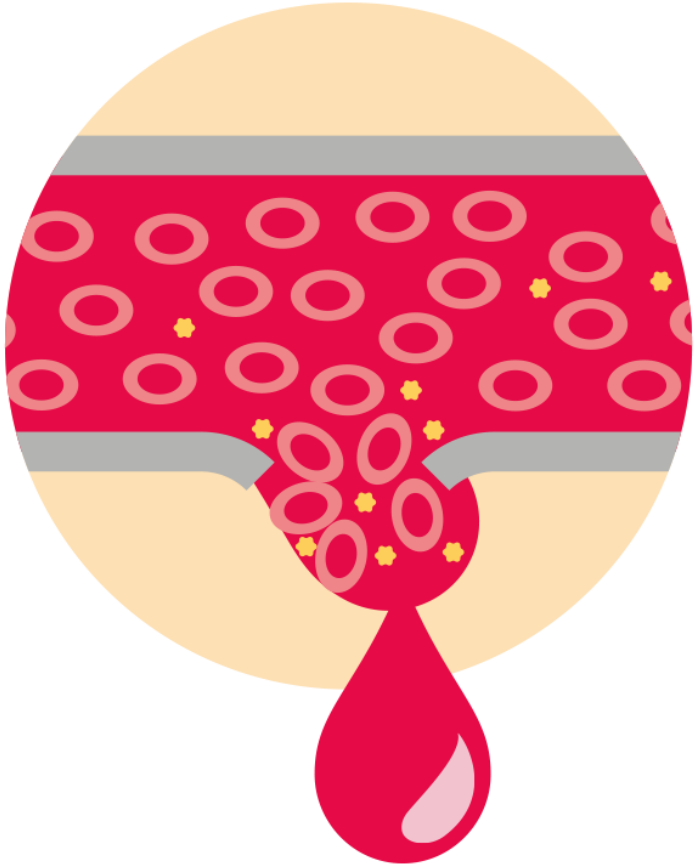
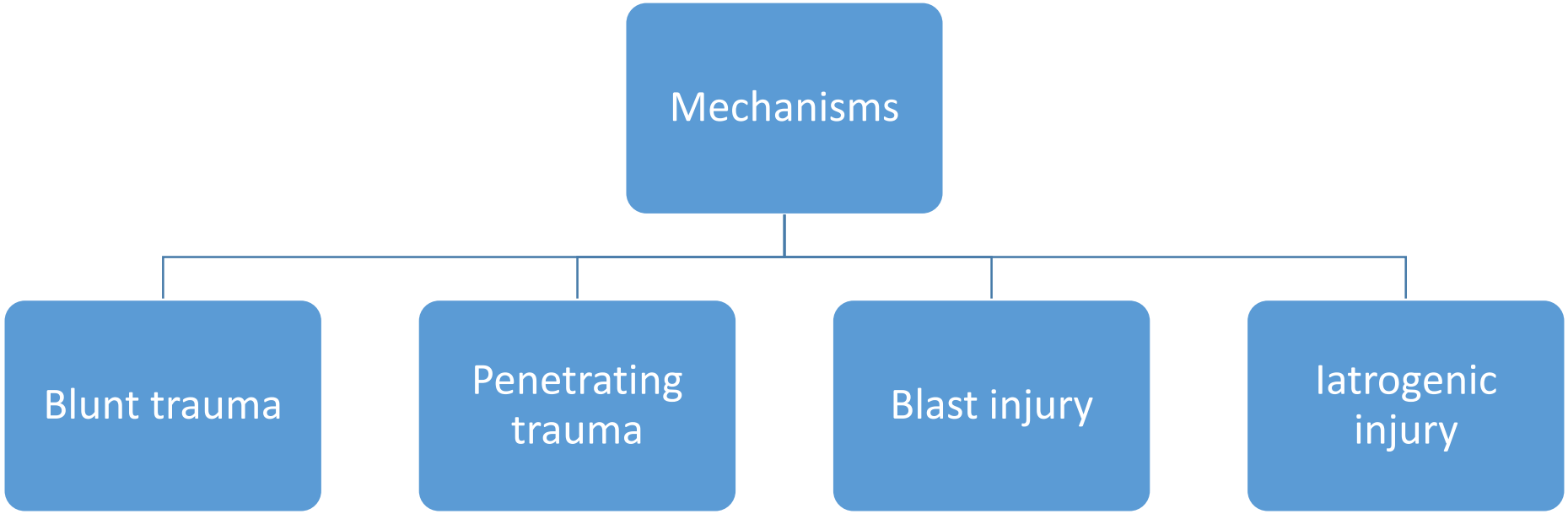
Vascular Injury



Mechanisms of vascular injury



Penetrating trauma

- Vessel may be partially or completely transected.
- Can cause major vascular damage.
- e.g. Gunshot injury.

Blunt trauma

- Vessels can be injured directly by crush injury or indirectly by distraction.
- e.g. fractures and dislocations.

Iatrogenic trauma

- May occur during surgery, angiography and angioplasty.
- Also, can occur while obtaining access to the circulation.
  - ❑e.g. Arterial lines and CVP lines.
- It may also occur with accidental intra-arterial injection.
  - ❑e.g. Intravenous drug abusers.

Blast injury

- Shock wave from a blast can be severe enough to disrupt blood vessels without external evidence of trauma.

Patterns of vascular injury

Incomplete or partial disruption

Pulsatile haematoma with increased risk of delayed rupture.

Can lead to false aneurysm

Complete transection

Intense vasospasm with distal pulse deficit and ischaemia.

Intimal flap and thrombosis

Vessels may look normal and intact from outside and exploration is mandatory for correct diagnosis and treatment.

Vascular spasm and stretch

Should only be diagnosed after excluding the vascular injury by either computed tomography (CT) or digital subtraction angiography

Clinical features

Hard signs

- Shock with continued blood loss
- Pale, pulseless, and cold limb
- Pulsatile haematoma
- Thrill or bruit
- Pulsatile bleeding

Soft signs

- History of massive bleeding at the time of injury
- Penetrating trauma near the major vessels
- Non pulsatile haematoma
- Reduced volume of distal pulse
- Distal neurological impairment

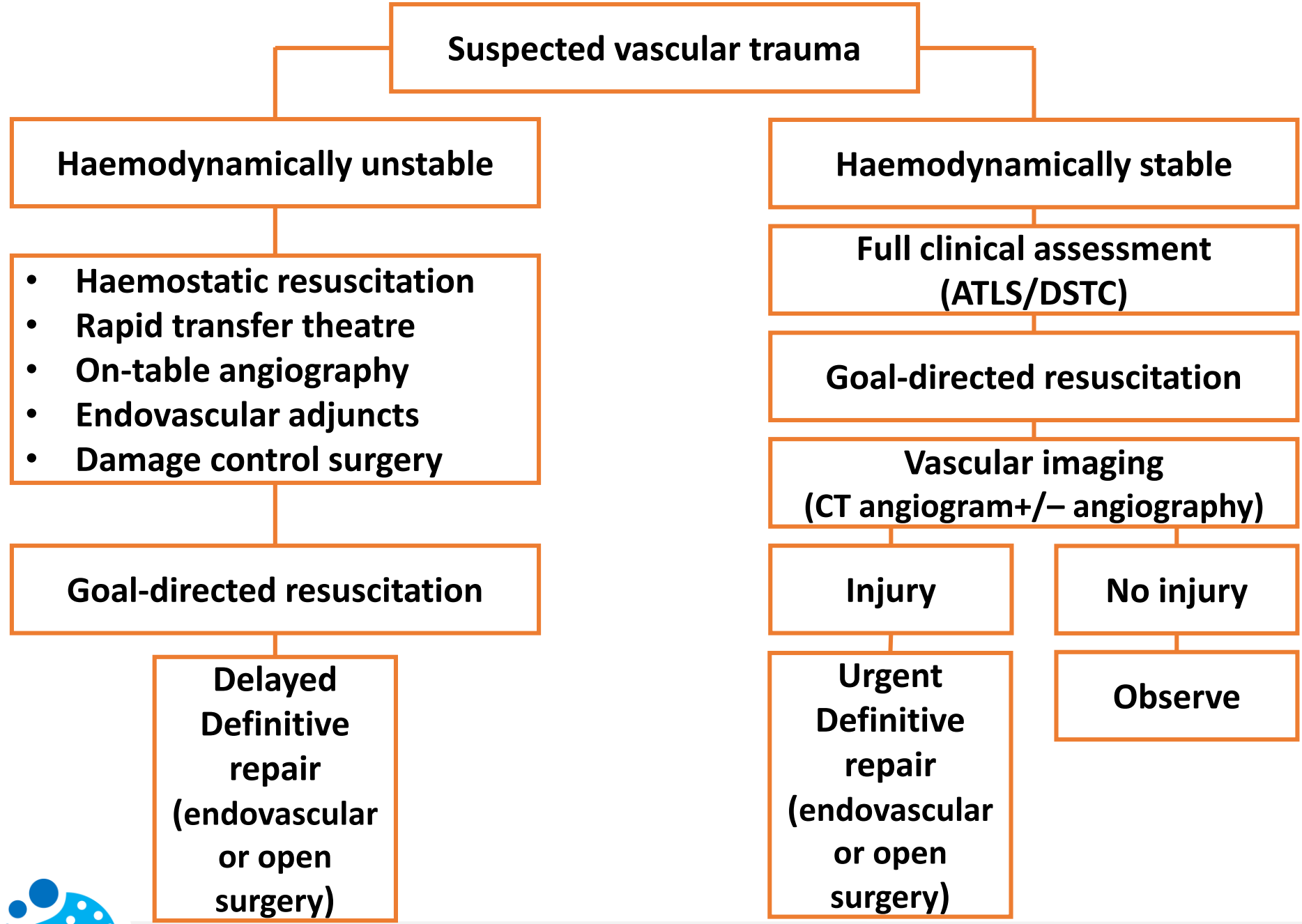
Investigations

- There may be no time for investigations, as urgent transfer to theatre may be required.
  - ❑**Plain radiographs** - Fractures, position of bullets or foreign bodies
  - ❑**Pulse oximetry** - Assess oxygen saturation in both limbs.
  - ❑**ABPI** – Compare injured to uninjured limb.
  - ❑**Duplex ultrasound**
  - ❑**CT angiogram**
  - ❑**Angiography** – Diagnostic and therapeutic.

Management

Principals of management

- Arrest of haemorrhage
- Management of airway
- Correction of hypovolaemia
- Diagnosis of type and degree of injury
- Repair of vessels
- Management of associated injuries
- Rehabilitation



Management—primary survey

- Initial management should be guided by ATLS principles.
- Apply direct pressure to open haemorrhaging wound.
- Carry out aggressive fluid resuscitation.
- Realign and splint any associated fracture.
- Immobilize dislocated joint.

Management—secondary survey

- Begin only after primary survey is complete and resuscitation is continuing successfully.
- Identify limb-threatening injuries.
- Look for hard or soft signs of vascular injury.
- Measure distal systolic Doppler pressures of the injured arm or leg and compare with uninjured brachial systolic pressure.
  - ❑An index of <1.0 is a predictor of arterial injury.
- Presence of hard signs requires immediate operative intervention or arteriography when limb is viable and active bleeding is absent.
- Some minimal arterial injuries can be managed non-operatively.
- Embolization can be used to manage selected arterial injuries.

Principles of surgical management

- Fractures should be stabilized before vascular repair.
- Simple lacerations may be closed by direct suture.
- Lacerations in smaller arteries can be closed by a vein patch.
- In vessels that are transected, end-to-end anastomosis can be performed, If the ends are far apart, then an interposition graft using either reversed autologous vein or PTFE may be used.

Principles of surgical management

- In complex injuries, bypass procedures may be required after ligation of major arteries.
- In unstable patients, vessels may be simply ligated.
- Packing can be used for venous bleeding, but it is unlikely to stop arterial bleeding.
- Fasciotomy should be performed in prolonged ischaemia to prevent compartment syndrome.
- Amputation may be required for the unsalvageable limb.

Complications

- Thrombosis.
- Secondary haemorrhage.
- False aneurysm.
- AV fistulae.
- Compartment syndrome.
- Lymphatic leaks or lymphocele.
- Distal vascular insufficiency.
- Ischaemic muscular contractures.