Vasular Trauma

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Outline

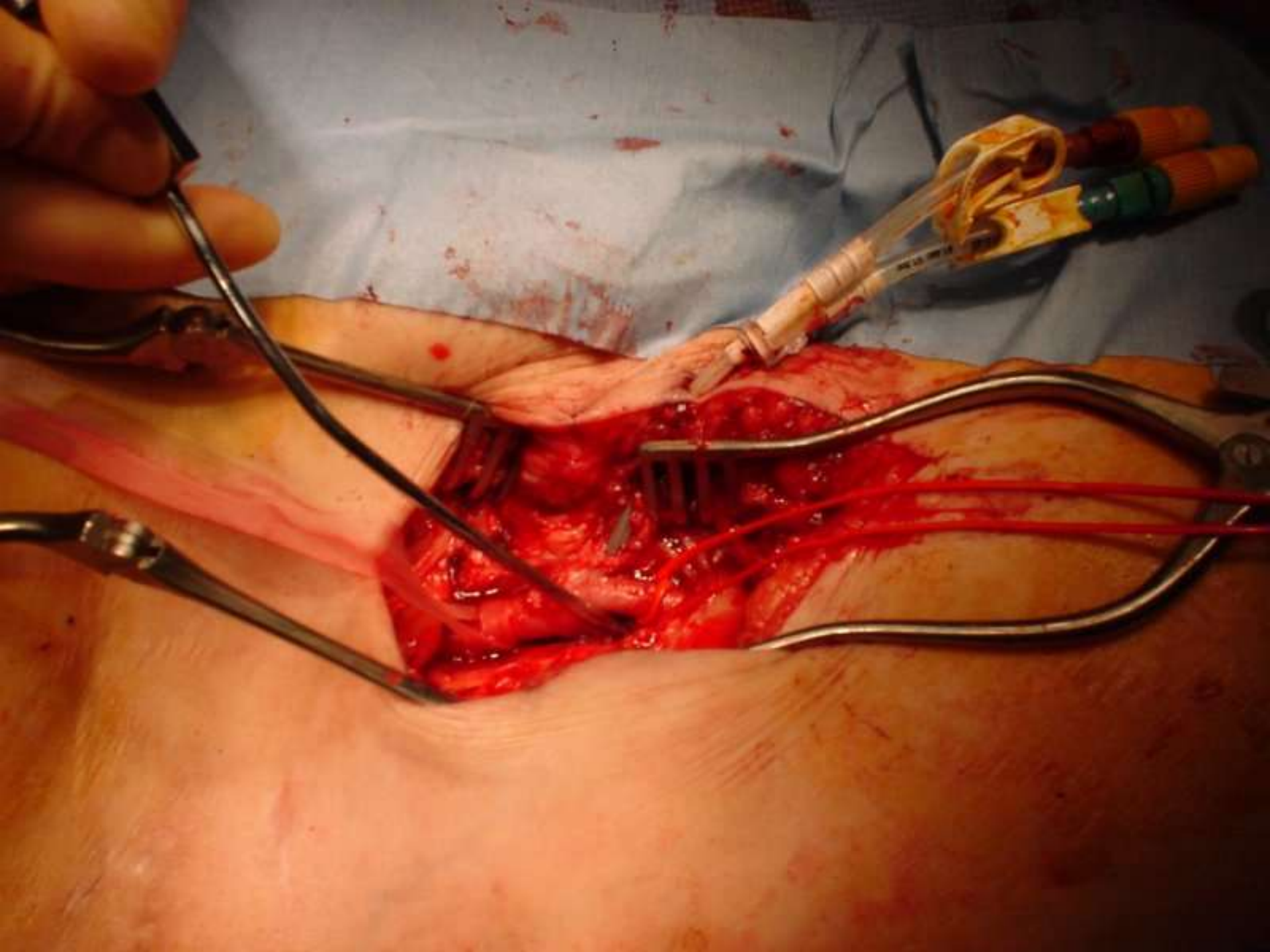
- Types of Vascular Trauma
- Review of the circulation
- Manifestations of ischaemia
- Monitoring the circulation
- Acute Ischaemia/ compartment syndrome
- Examples

Types of Vascular Trauma

- Iatrogenic (physician induced)
  - Post angiography
    - Pseudoaneurysm / Ischaemia / Bleeding
  - Vascular catheters
- Penetrating
  - Guns, knifes, impalement
- Blunt trauma
  - Fractures / dislocations / crushing

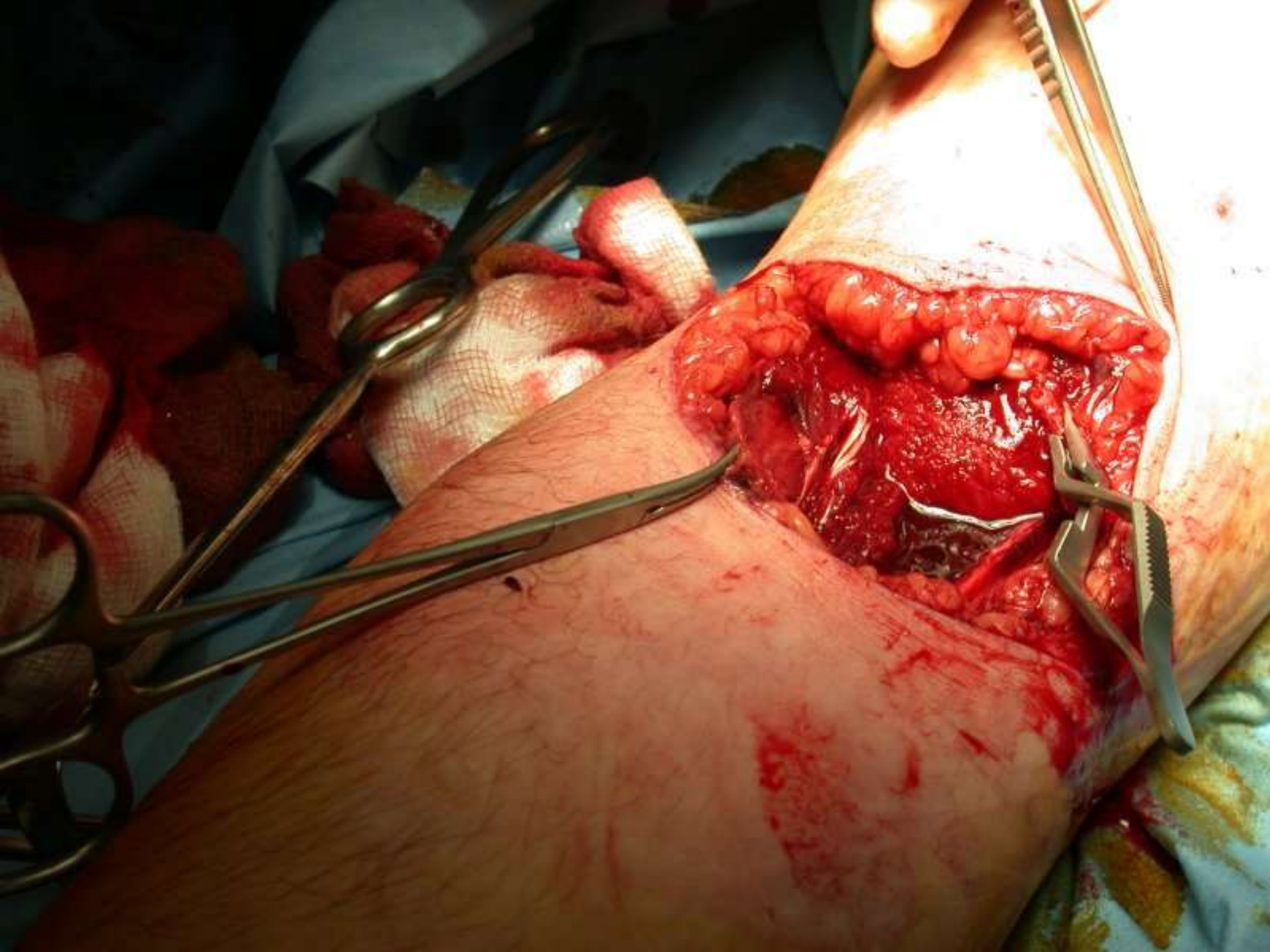
Types of Vascular Trauma

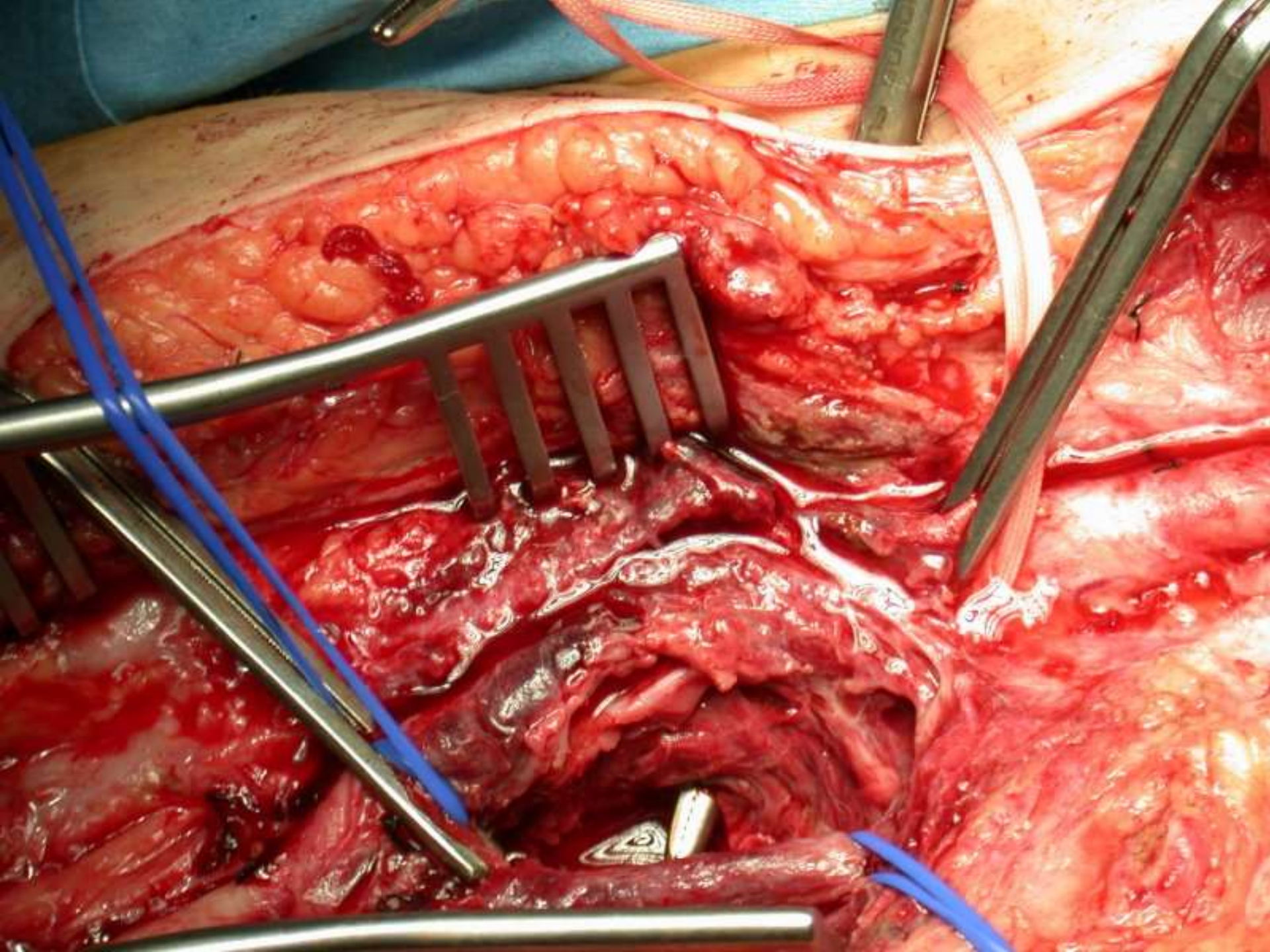
- Iatrogenic (physician induced)



Types of Vascular Trauma

- Penetrating





Types of Vascular Trauma

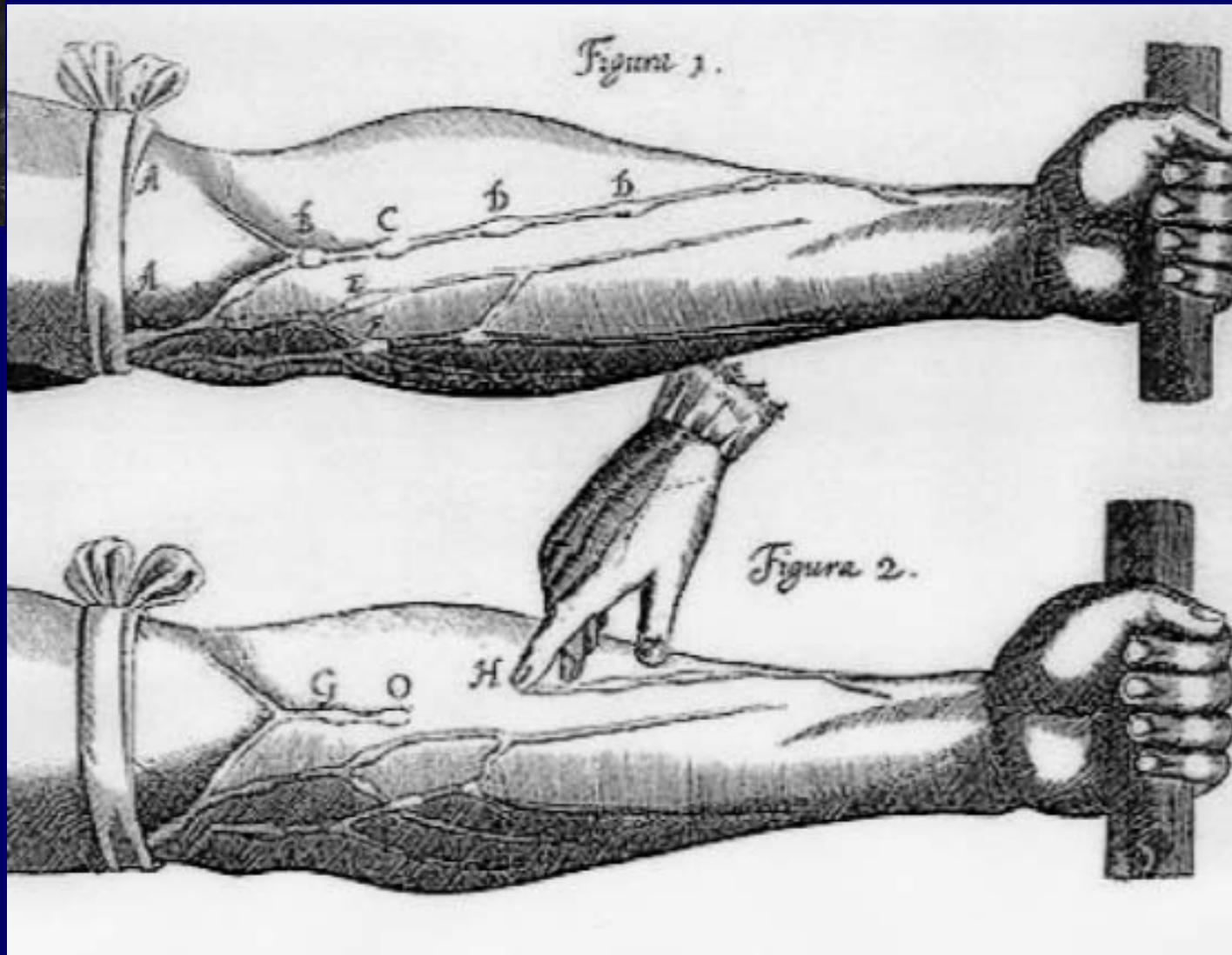
- Blunt

Review Of Circulation

- Cells need supply of nutrients and removal of by products
- In a unicellular organism this may occur via the cell membrane into say a pond or sea
- Multicellular organisms need a circulatory system

William Harvey (1578-1657)

On the Motion of the Heart and Blood in Animals (1628)



Problem With Blocked Circulation

- Tissues lack adequate supply of nutrients
- Tissues suffer build of toxic by products

- May cause symptoms and signs particularly when more blood flow is required;
  - To muscles during exercise
  - To tissues that are injured (more blood needed)

Manifestations Of Blocked Arteries

- Depends on circulation affected
  - Heart
    - Stable angina, unstable angina, myocardial infarction
  - Brain
    - Transient ischemic attact, stroke
  - Kidney
    - Hypertension, renal failure
  - Legs
    - Claudication, rest pain, necrosis

Manifestations Of Blocked Arteries

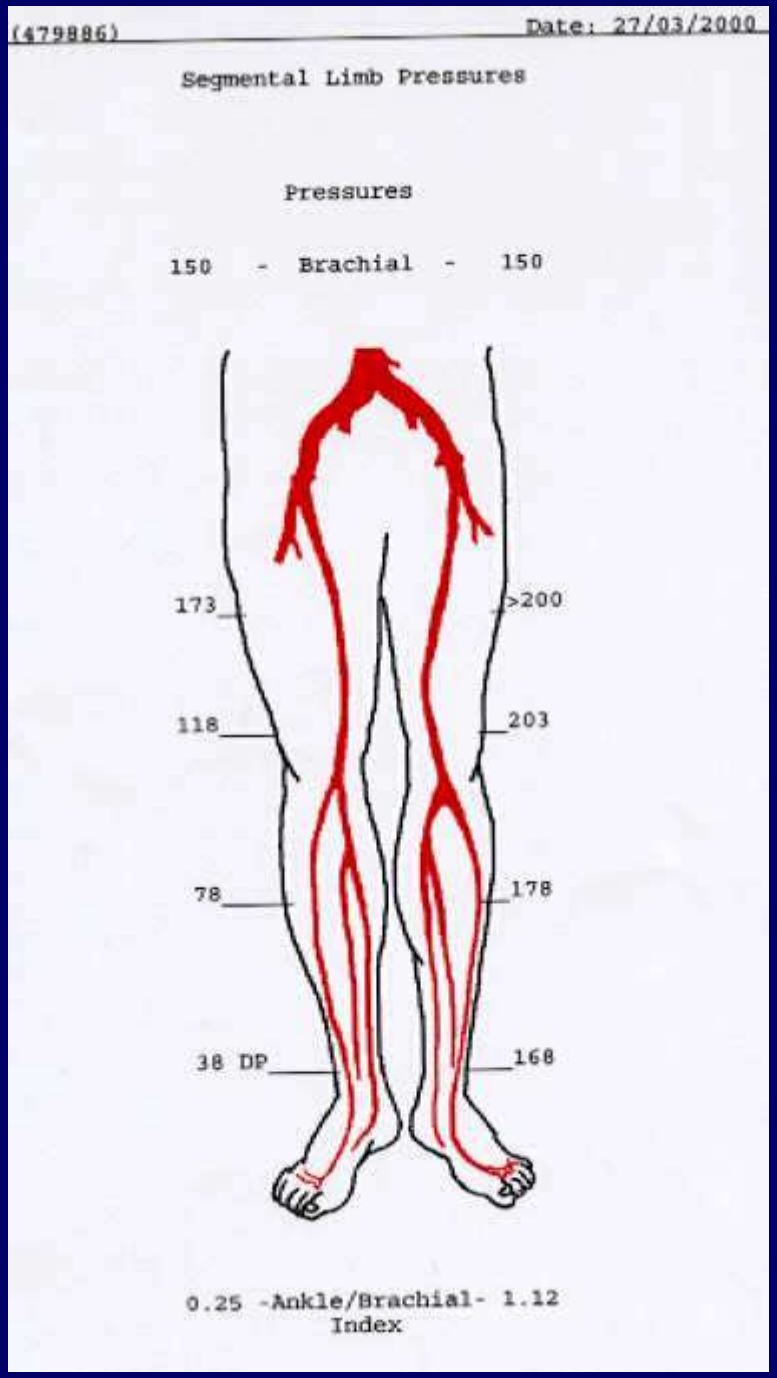
- Depends on speed of development of blockage
  - Slow blockage
    - Permits development of collateral blood supply so that occlusion may be asymptomatic
  - Rapid blockage
    - No time for development of collaterals
      - Symptoms/ signs depend on adequacy of preexisting collaterals

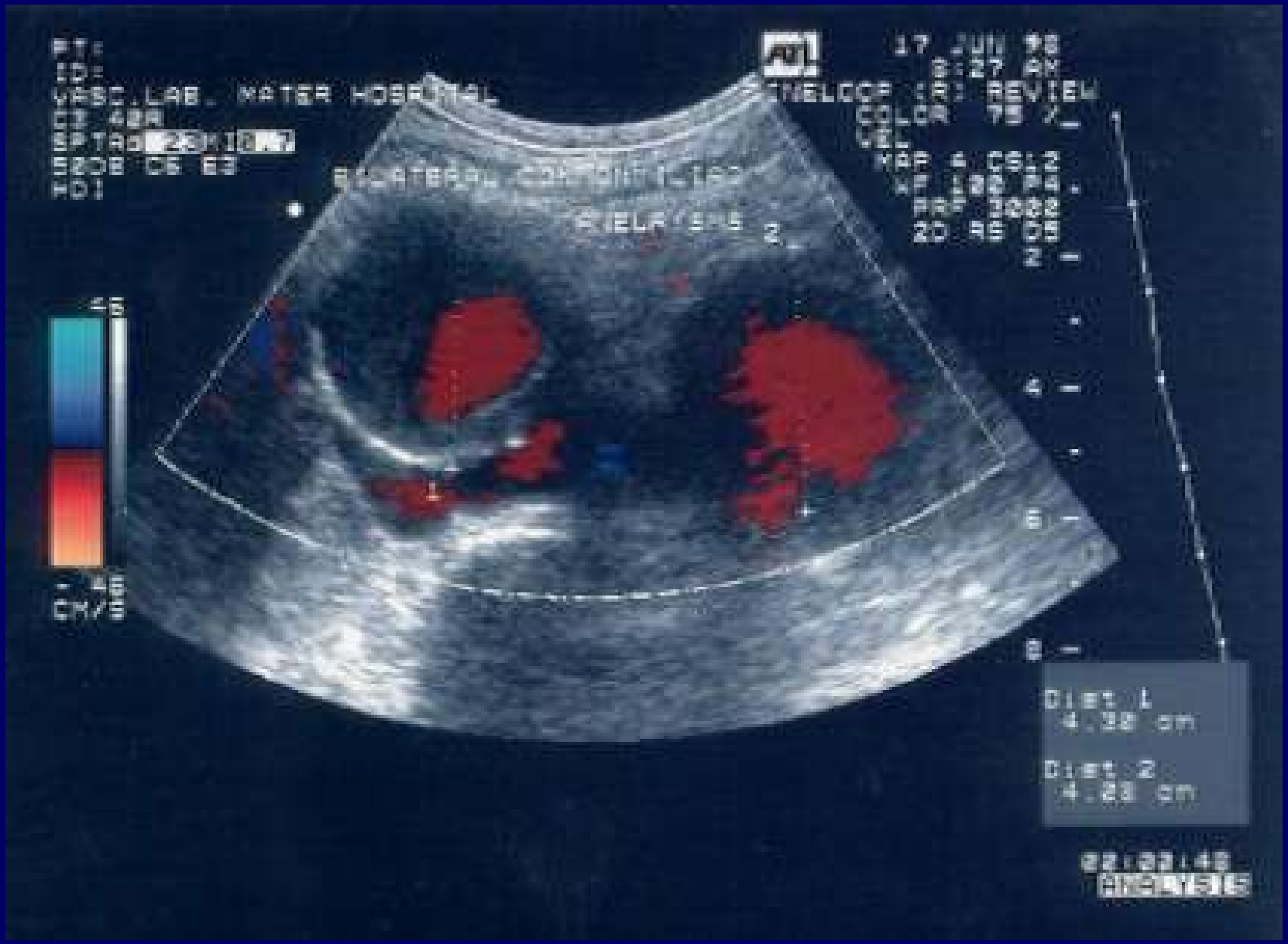
Monitoring Circulation

- Mottling, colour, temperature, movements, sensation
- Palpable pulses, doppler signals

- Non invasive pressure studies (Doppler)
- Duplex imaging
- Angiography (IAA, DSA, MRA)

Non Invasive Pressure Studies (NIPS)




VASC.LAB. MATER HOSPITAL
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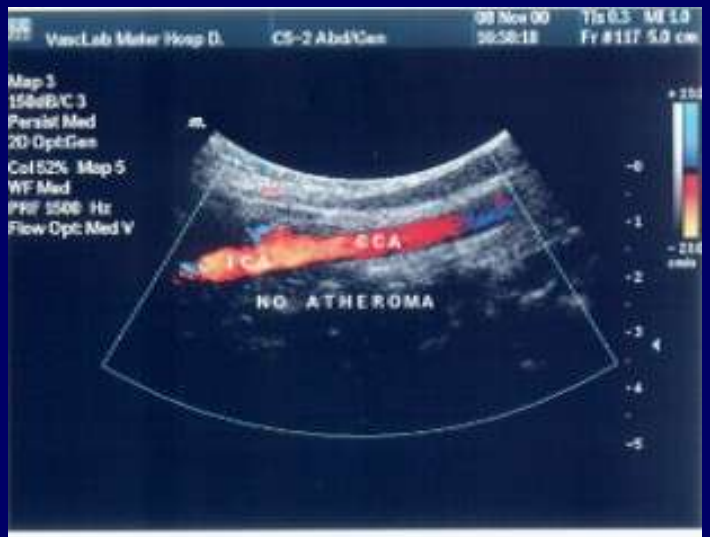
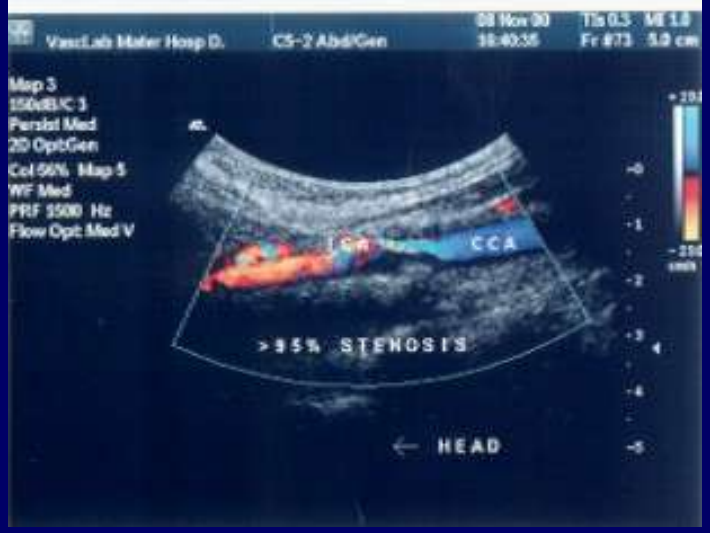
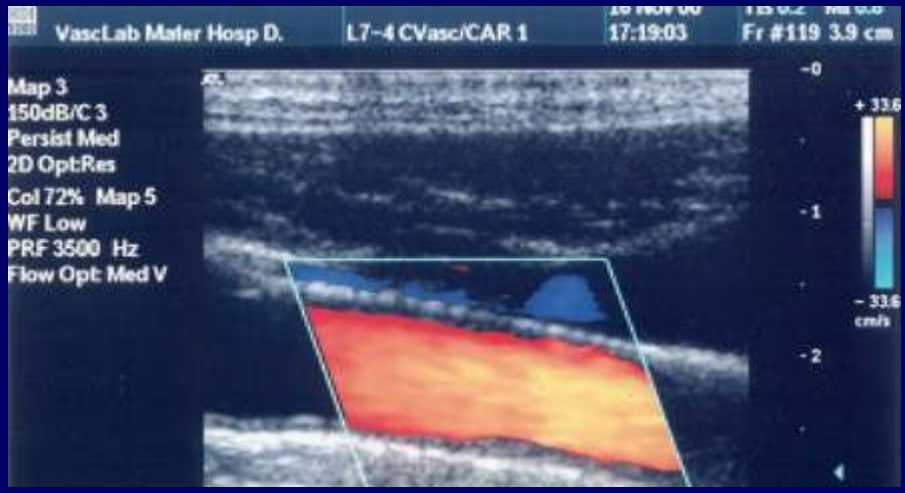
Dist 1
4.38 cm
Dist 2
4.23 cm

Duplex of carotid stenosis







Angiography (DSA)

MRA

Acute Ischemia

Effects Of Acute Ischemia

- Reduced blood flow
  - Pulseless, pallor, perishing cold
- Nerve ischemia
  - Pain, paralysis, Paresthesia
- Muscle ischemia
  - Rhabdomyolysis
- Compartment syndrome
- Ischemia reperfusion syndrome

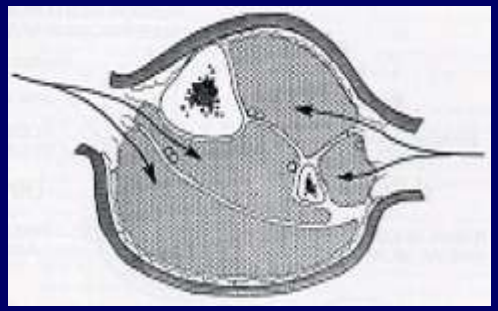
The **P**'s

- No flow in artery
  - **P**allor
  - **P**ulse absent
  - **P**erishing cold
- Nerve becomes ischemic
  - **P**ain
  - **P**aresthesia / anesthesia
  - **P**aralysis

Compartment Syndrome

- Pathophysiology
- Diagnosis
- Management

Compartment Syndrome Pathophysiology



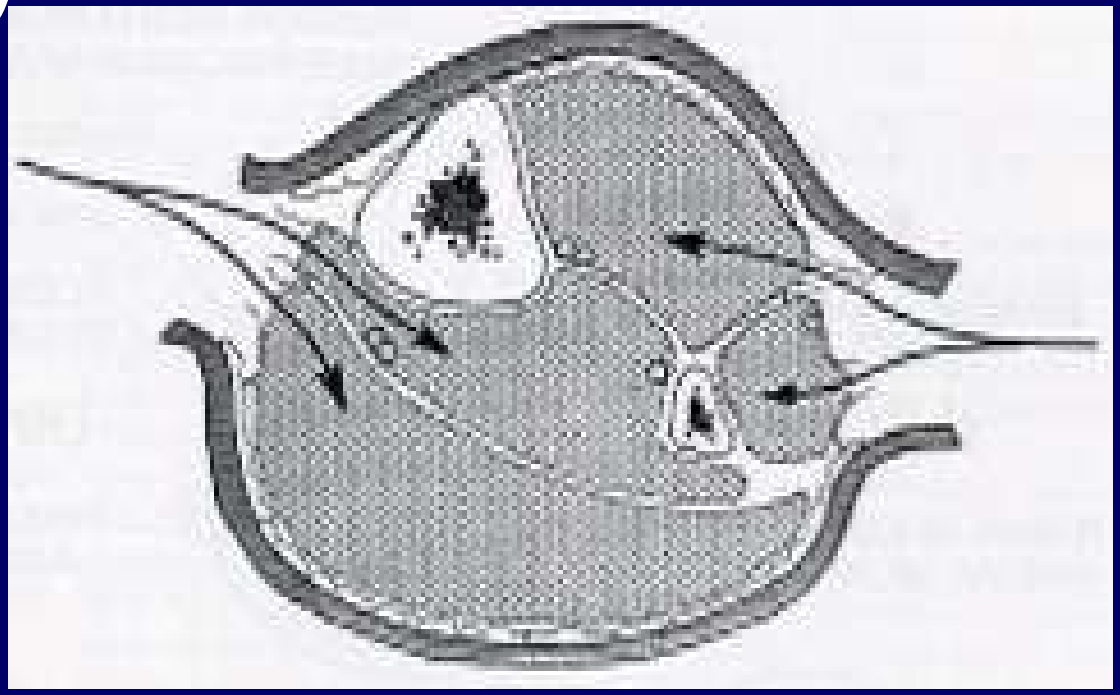
- Strong fascia encases the limb to aid muscle function and return of venous blood
- Injury results in swelling
- Swelling raises pressure
- Pressure occludes lymphatic return, then venous return, then arterial inflow
  - Result is dead or severly damaged tissues due to pressure and ischemia

Compartment Syndrome Diagnosis

- Strong index of suspicion
  - Nature of injury and duration of ischemia
- Clinical manifestations
  - Nerve and muscle dysfunction
  - Decreased perfusion
  - Tense compartment
- May measure compartment pressure as adjunct to treatment > 40 mm hg

Compartment Syndrome Management

- Fasciotomy



Clinical Assessment of Severity

- Viable — no immediate threat
- Threatened
  - Marginally — ok if treated promptly
  - Immediately — ok if treated immediately
- Irreversible — dead leg

Irreversible Ischemia

- Sensory loss — Profound, anaesthetic
- Muscle weakness — Profound, paralysis
- Arterial doppler — Inaudible
- Venous doppler — Inaudible

Amputation

Viable no immediate threat

- Sensory loss None
- Muscle weakness None
- Arterial doppler Audible
- Venous doppler Audible

Restore perfusion

Clinical Assessment of Severity

- *Viable* — *No immediate threat*
- Threatened
  - marginally — Ok if treated promptly
  - immediately — Ok if treated immediately
- *Irreversible* — *Dead leg*

Threatened Marginally

- Sensory loss Minimal (toes) to none
- Muscle weakness None
- Arterial doppler Inaudible
- Venous doppler Audible

Restore perfusion

Threatened Immediately

- Sensory loss — More than toes, Pain
- Muscle weakness — Mild to moderate
- Arterial doppler — Inaudible
- Venous doppler — Audible

Restore perfusion

Practical Questions

- Is this ischemia? (DDx stroke, TIA, cord)
- Is the limb viable, threatened or lost?
- If threatened how long can reperfusion be delayed?
- Is there a need for duplex or angiography?
- Should the patient be immediately heparinised?

Examples of Vascular trauma

- Iatrogenic
  - Pseudoaneurysm and ischaemia post catheterisation
- Blunt injury
  - Multiple trauma with ischaemic limb

Iatrogenic injury post catheterisation/angiography

- Groin main site
  - Bleeding / pseudoaneurysm
  - Acute ischaemia
    - Intimal flap, malposition of occluded device
  - Difficulty with surgery
    - Patients underlying condition (Myocardial infarction)
    - Drug treatment of underlying condition (Clopidrogel)

Pseudoaneurysm

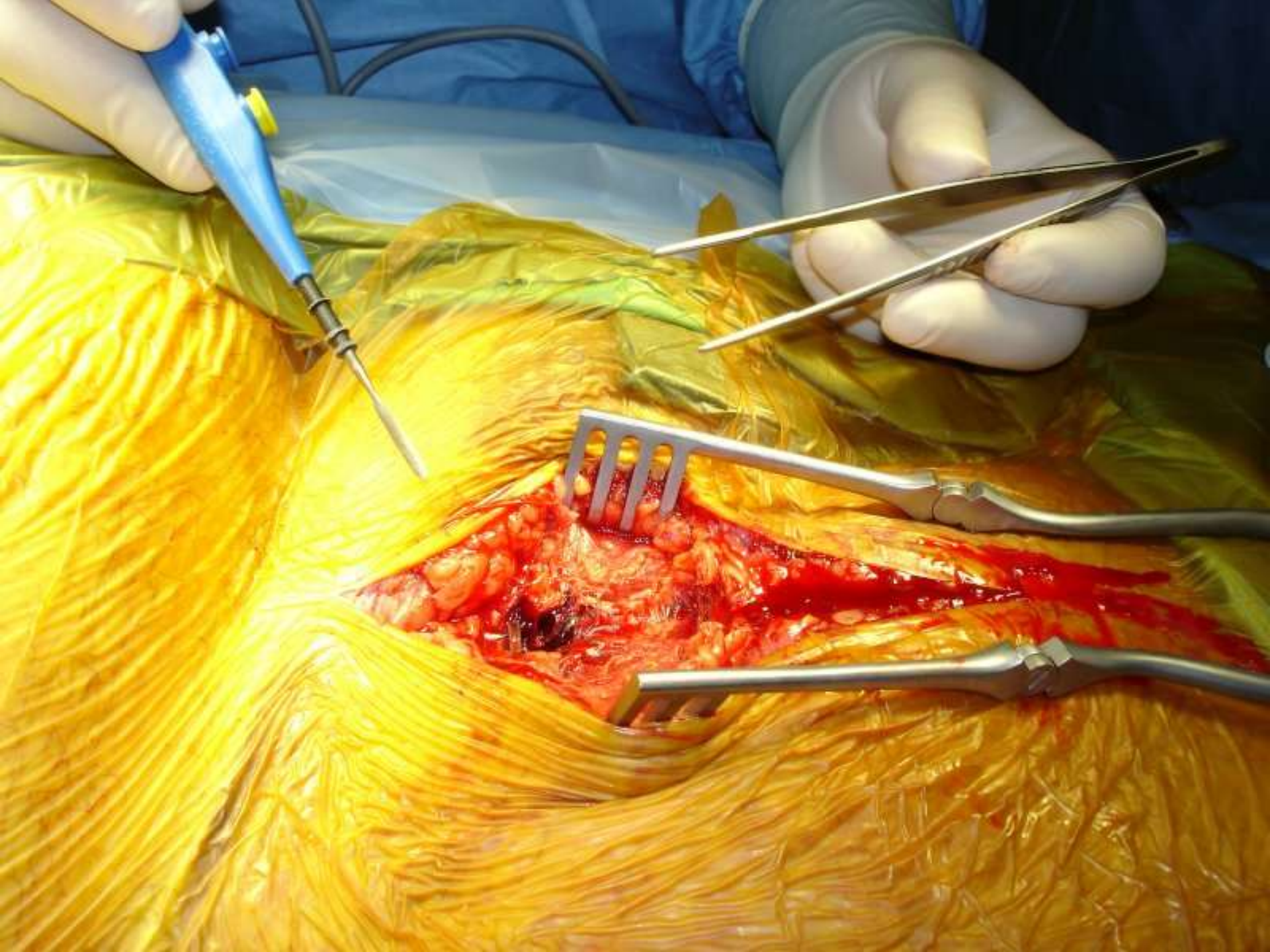
- The hole in the artery is not closed
- Blood is leaking in and out of the hole into the surrounding tissues
- The collection of blood expands
  - Pain in groin (flexion of hip and knee)
  - Compression of nerves (sensory loss)
  - Compression of veins (Deep venous thrombosis)
  - May rupture through the skin

Pseudoaneurysm

- Diagnosis
  - Clinical suspicion
  - Tender swelling near puncture site
  - May be pulsatile
  - Duplex ultrasound confirms the problem

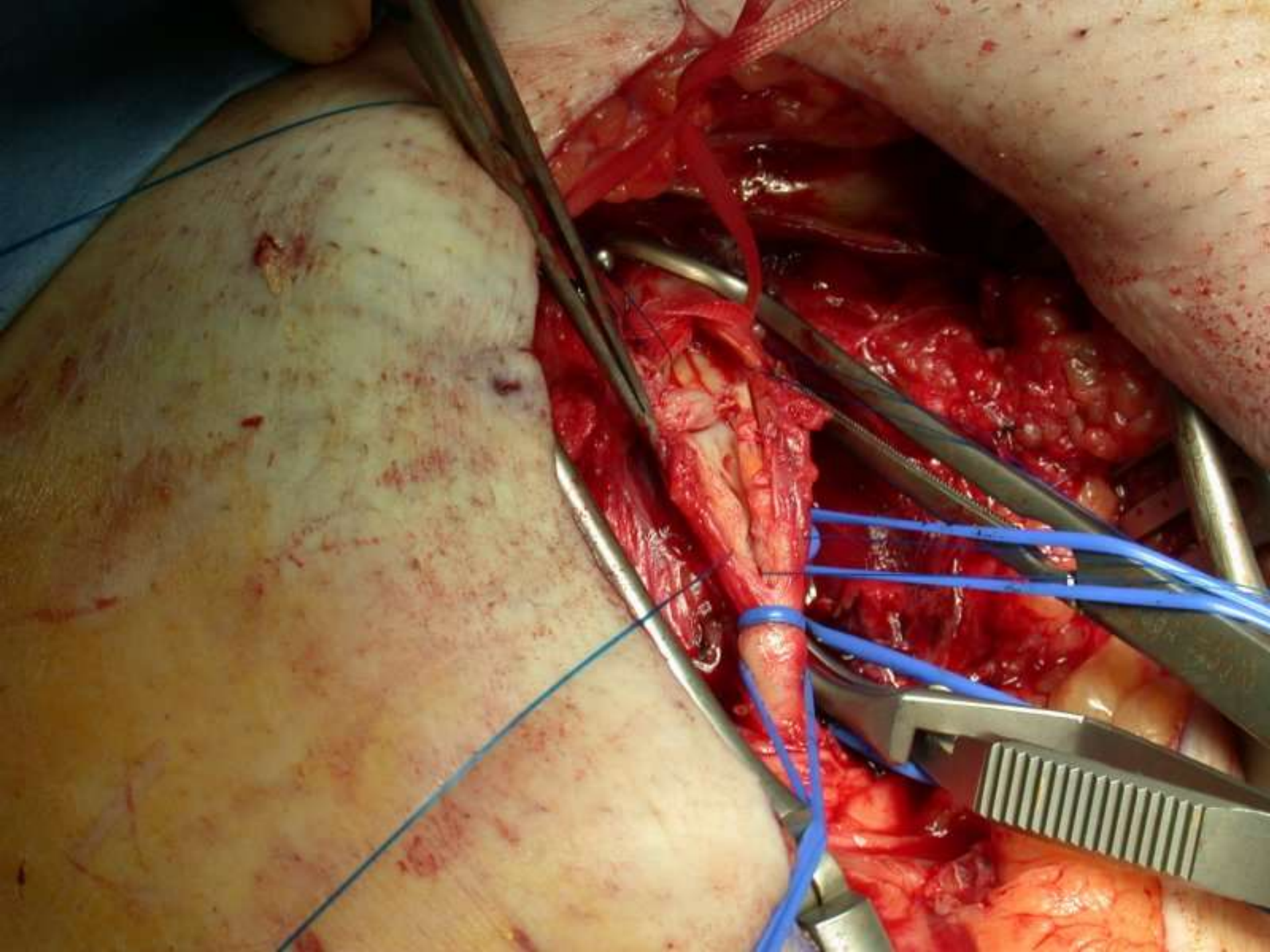
Pseudoaneurysm - treatment

- Small with narrow neck/ low flow
  - Leave alone an option
- Medium with narrow neck /low flow
  - Ultrasonographic compression
  - Thrombin injection
- Larger with large neck / high flow
  - Surgical repair
  - ? role of covered stent occasionally



Ischaemia post catheterisation

- Causes
  - Intimal flap
  - Malposition of occluder device
- Difficult in surgery
  - Patient arteriopath/ distal circulation poor
  - Myocardial infarction
  - Drugs (Warfarin, Aspirin, Heparin, Clopidrogel)



Blunt vascular trauma

- Most often part of multiple trauma
- Multidisiplinary ++
  - A/E, Ortho, Vascular, Plastics, General, Neuro
  - Theatre, ICU, HDU, Ward, Physio, OT, Clinical nutritionist

Blunt vascular trauma

- This 22 year old man caught his arms in the power take off (PTO) shaft on the back of a tractor
- Main injuries were both upper limbs
- Paralysed, insensate, ischaemic left upper limb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Priority in Repair

- Bone
- Vessels
- Nerves
- Soft tissues