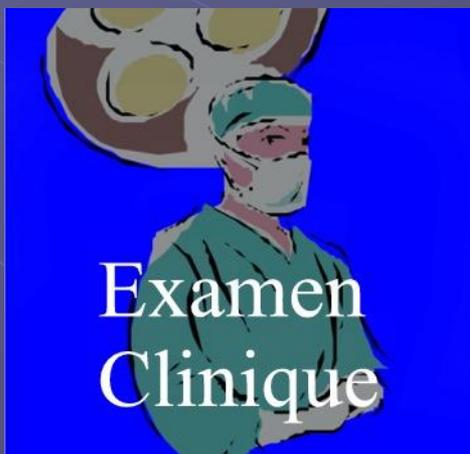




Surgery on vessels and nerves

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Chişinău

Vascular (arterial) injury has two main consequences –
Haemorrhage
Ischaemia.

An Czech surgeon said: "Bloody vascular trauma - it's either bleeding too much or it's not bleeding enough".



Probable arterial/venous/nerve injuries associated with fractures or dislocations

Clavicle fracture	subclavian artery/vein/br. plexus
Shoulder fr./dislocation	axillary artery/vein/br. Plexus
Humerus fracture	deep brachial artery/n.radialis
Supracondylar humerus fr	brachial artery
Elbow dislocation	brachial artery
Pelvic fracture	gluteal arteries
Femoral shaft fracture	femoral artery
Distal femur fracture	popliteal artery
Knee dislocation	popliteal artery
Tibial shaft fracture	tibial arteries

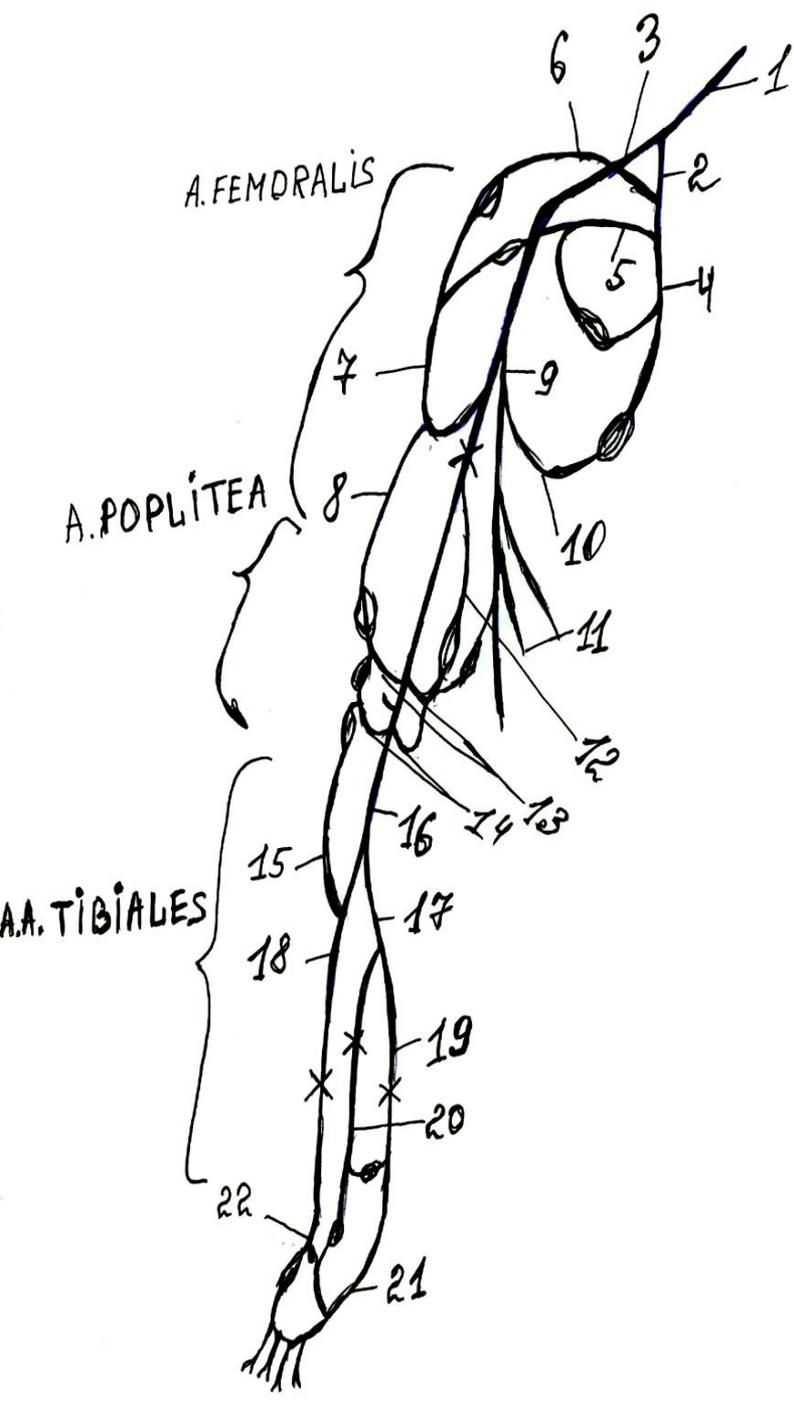
Consequences of vascular injury

- Blood loss
- Ischemia
- Compartment syndrome
- Tissue necrosis
- Amputation
- Death

Prognostic factors depends of:

- Level and type of vascular injury
- Collateral circulation
- Tissue damage
- Ischemia time
- Patient factors
- Medical conditions
(equipment, personnel)





1. A. iliaca communis;
2. A. iliaca interna;
3. A. iliaca externa;
4. A. obturatoria;
5. A. glutea inferior;
6. a. glutea superior;
7. R. ascendens a. circumflexa femoris lateralis;
8. R. descendens a. circumflexa femoris lateralis;
9. A. profunda femoris;
10. A. circumflexa femoris medialis;
11. rr. Perforantes a. profunda femoris;
12. A. genus descendens;
13. Aa. Genus superior medialis et lateralis;
14. Aa. Genus inferior medialis et lateralis;
15. A. recurrens tibialis anterior;
16. A. poplitea;
17. A. tibialis posterior;
18. A. tibialis anterior;
19. A. tibialis posterior;
20. A. tibialis anterior;
21. A. plantaris;
22. A. dorsalis pedis.

● Unrecognised and uncontrolled haemorrhage can rapidly lead to the demise of the trauma patient.

● Unrecognised and untreated ischaemia can lead to limb loss, stroke, bowel necrosis and multiple organ failure.

Pulse Examination

Lower limb	Upper limb
Femoral A	Subclavian artery
Popliteal A	Axillary artery
Dorsalis pedis A	Brachial artery
Posterior tibial A	Radial artery

Femoral A



Popliteal A



Dorsalis pedis A



Post tibial A



Non-invasive Examination

- Doppler Study

- MRA

- Spiral CT

Invasive Examination angiography

(Sildenger technique)



Types of surgery

- 1. Arterial:
 - Endarterectomy
 - Profundoplasty (an operation to repair an obstructing lesion in a deep blood vessel, for example, of the deep femoral artery)
 - Bypass graft
 - Angioplasty (autogenous, allogenuous, xenogenous, Synthetic implant, patch-Dacron, etc.)
 - Sympathectomy

● **Management**

- The priorities of vascular injury are arrest of haemorrhage and restoration of normal circulation.
- Principles of vascular reconstruction:
never risk life to save a limb.

The bleeding stoppage

- Immediate control is usually achievable by **direct pressure over the site of injury**. It is better one individual to **manually** compress the site of haemorrhage.



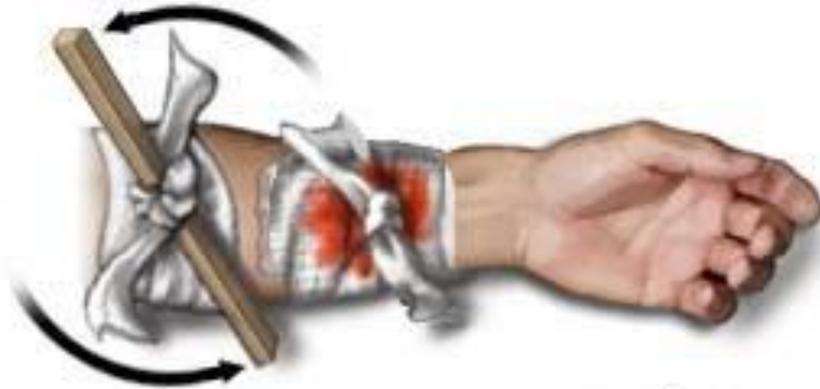
Apply direct pressure on external wounds with sterile cloth or your hand, maintaining pressure until bleeding stops

- The **manually** or **tourniquet** compression higher than the place of injuries:
 - **On upper limb one can press (squeeze) a main artery if necessary :**
 - (manually) **subclavian artery** on first rib;
 - (manually or tourniquet) **brachial artery** the site of the arm at humerus bone just above the elbow and just below the armpit Squeeze the main artery in these areas against the bone
 - **On lower limb one can press :**
 - (manually) **the femoral artery** on superior ramus of pubis bone,
 - (tourniquet) at the **middle site of femoral bone**
 - (manually) **popliteal artery** in the popliteal fossa just behind the knee
- Where haemorrhage is welling up from a deep knife or gunshot track, haemostasis may be temporarily achieved **by passing a urinary catheter into the track as far as possible, inflating the balloon**



If bleeding has not stopped after 15 minutes of direct pressure, apply strong pressure at one of these points between the wound and the heart

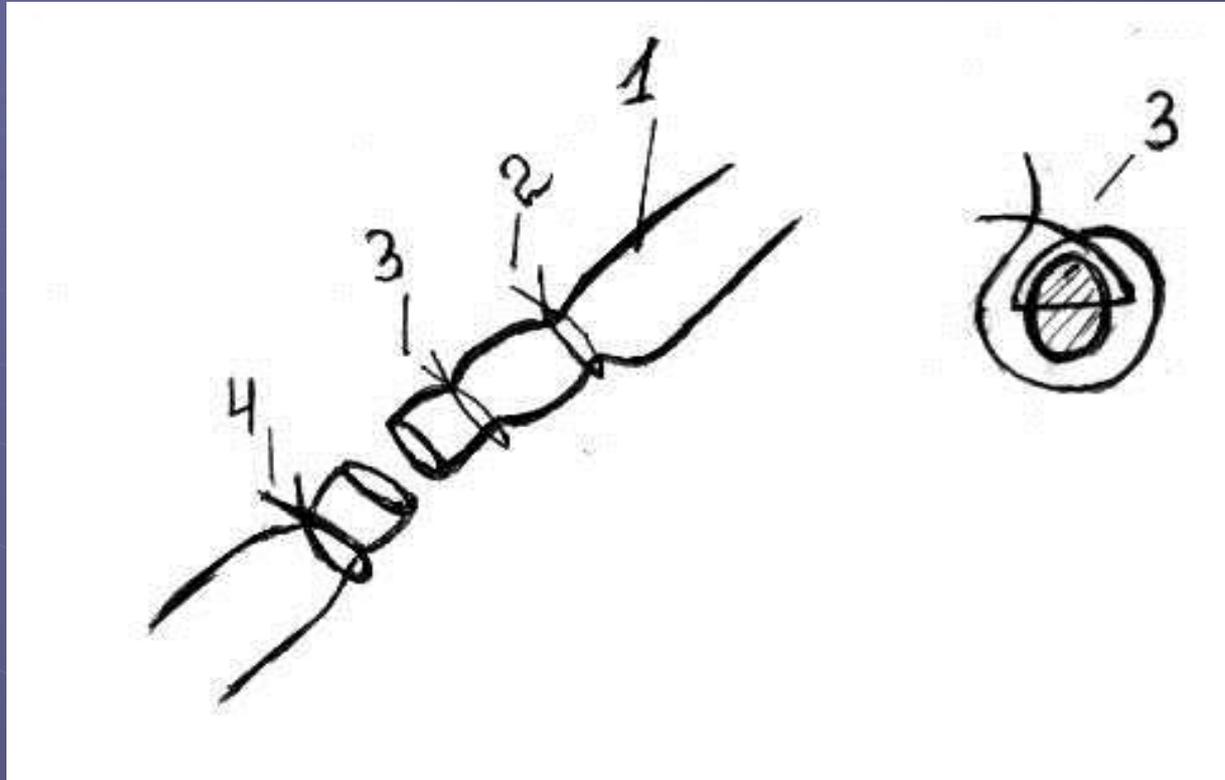
Use a tourniquet **ONLY AS A LAST RESORT**, if bleeding cannot be stopped and the situation is life-threatening



ADAM.

Blind clamping with a **haemostatic forceps** in the depths of a wound is dangerous and can be made only in the surgery room

Ligature technique on the arterial big vessel in the wound

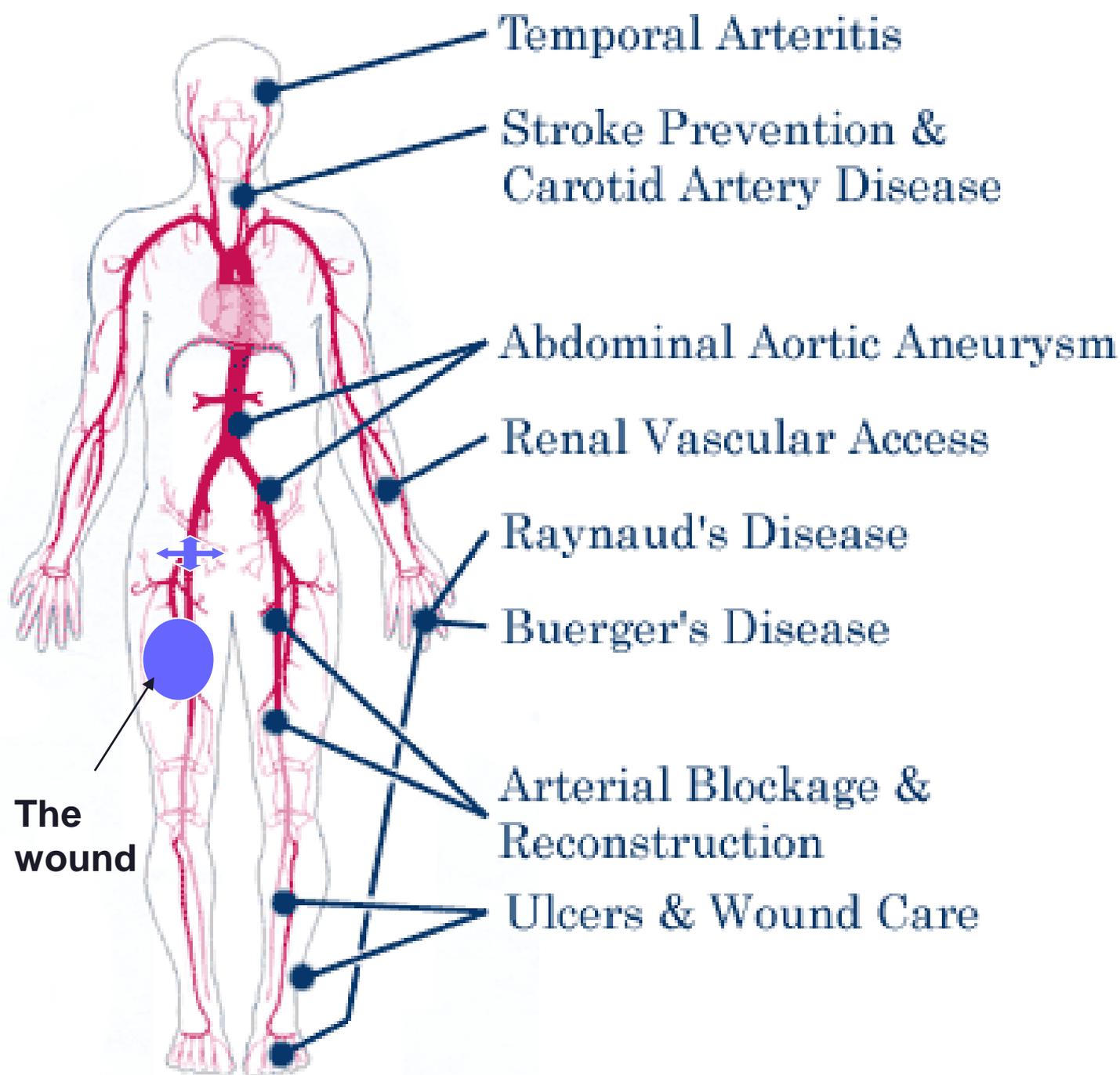


1. Proximal end of blood vessel,
2. Proximale ligature
3. Distale ligature transmurale,
4. ligature on distal end of the vessel

Ligature technique on the arterial big vessel proximally from the injury site

● Indications:

- Purulent wounds, gangrena
- When it's impossible to find the end of the vessel (a. glutea superioris – on ligature on a. iliaca interna; a. lingualis – ligature on external carotid artery.)



**Ligature
technique
on the
arterial
big
vessel
proximall
y from
the injury
site**

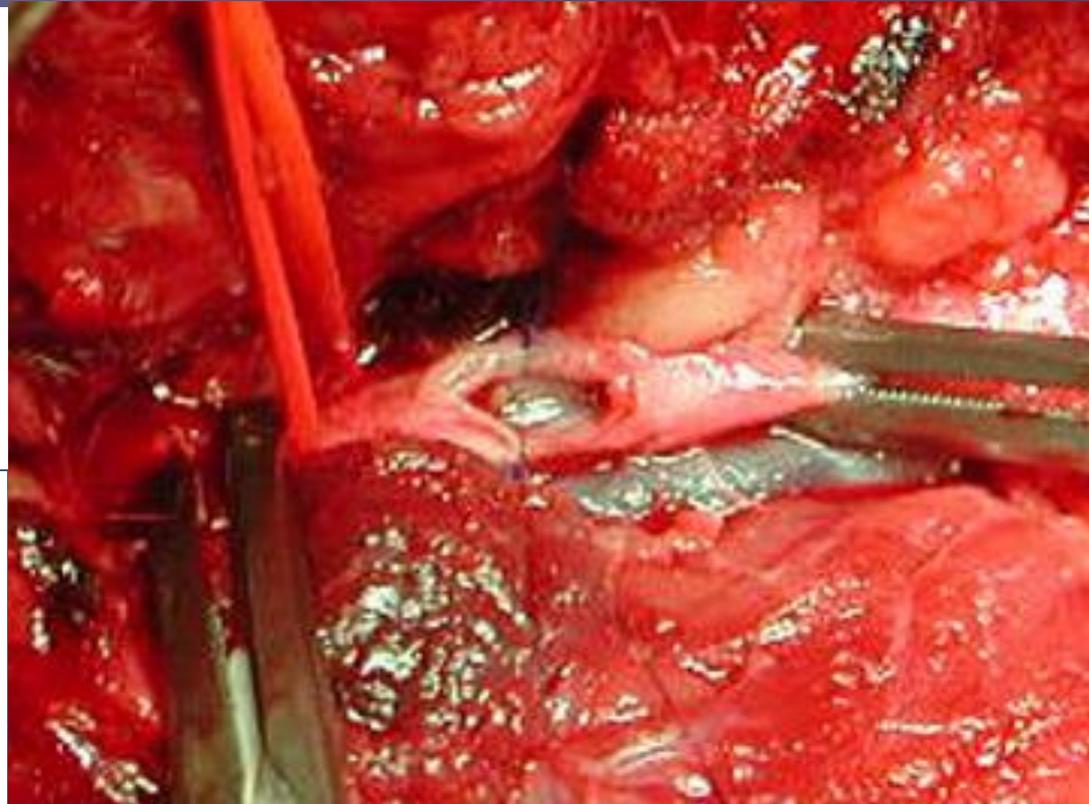
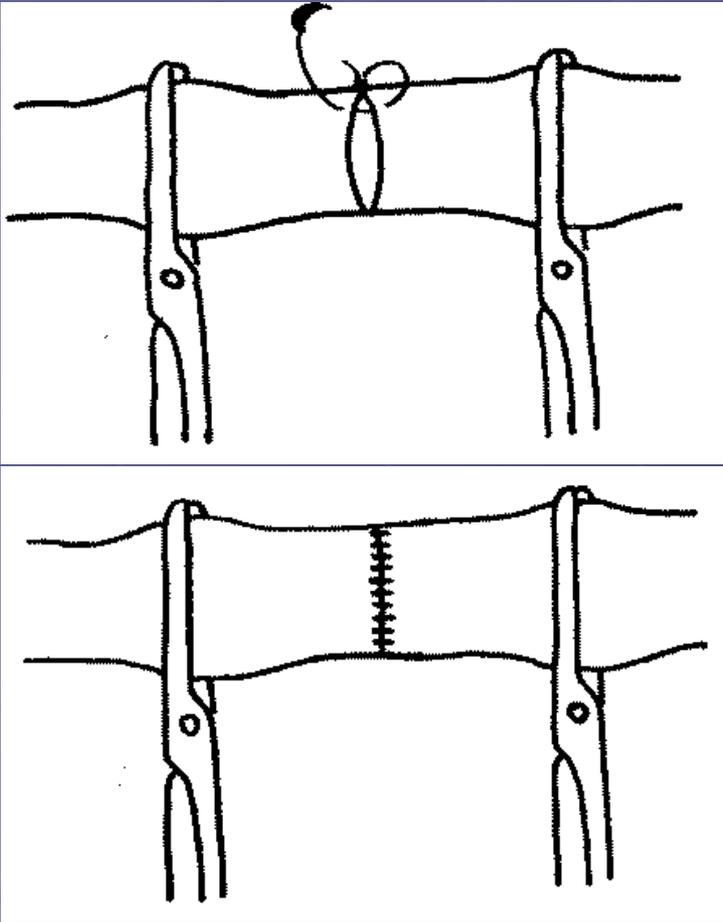
Technical principles on vascular sutures

1. Aim for a smooth flow by a. Avoiding loose flaps
2. Avoiding both intrinsic and **extrinsic constriction**
3. Avoid narrowing at anastomoses
4. Handle all arteries and grafts with care
5. Strict asepsis
6. Peroperative anticoagulation

Vascular suture

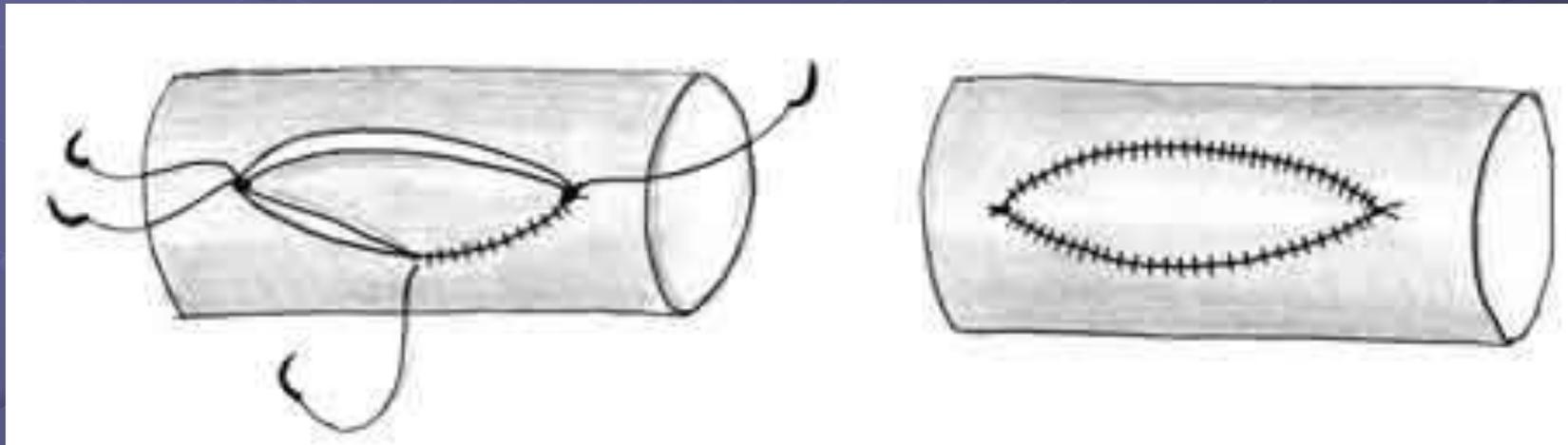
- Manual vascular sutures
- Mechanical vascular sutures

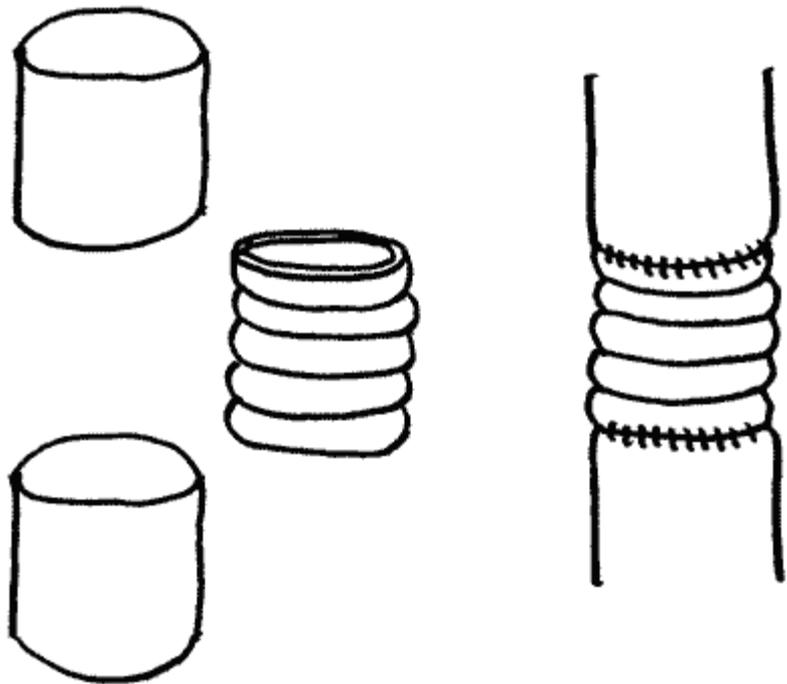
Small, clean, transverse wounds to vessels that involve only part of the circumference can be repaired with a direct suture technique



To avoid the narrowing of the vessels some times is necessary to use the:
use the:

- Vein patch or Synthetic patch





Synthetic angioplasty with Dacron

- Very good replacement for large vessels (> 10 mm)

Problems

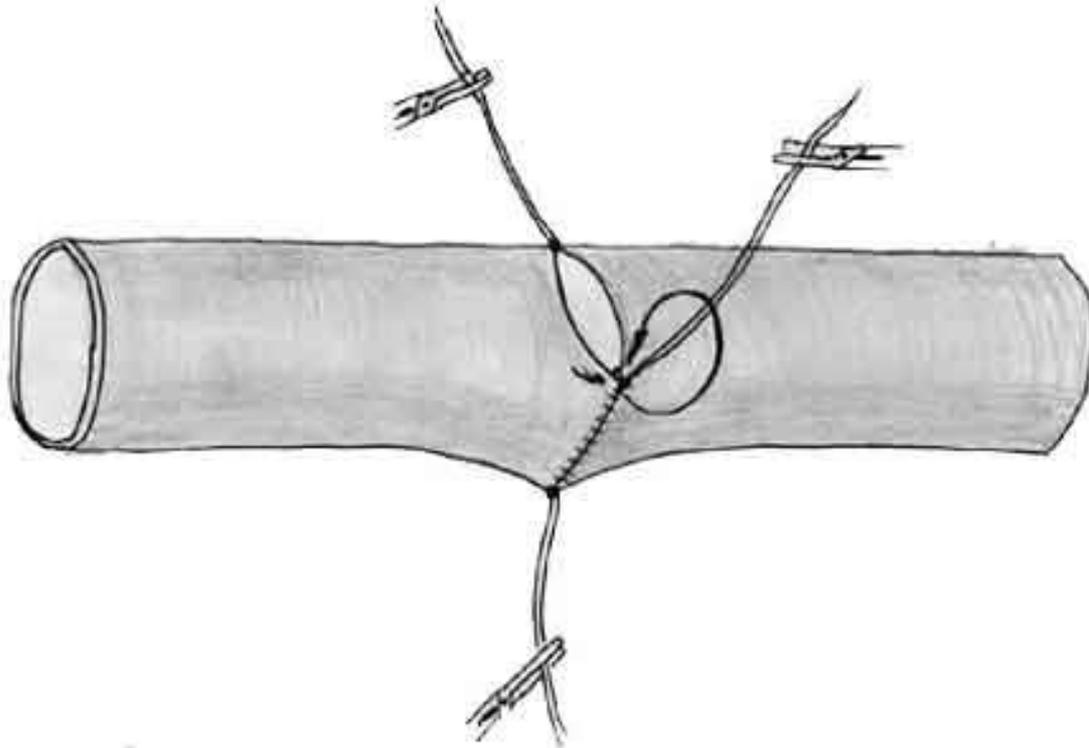
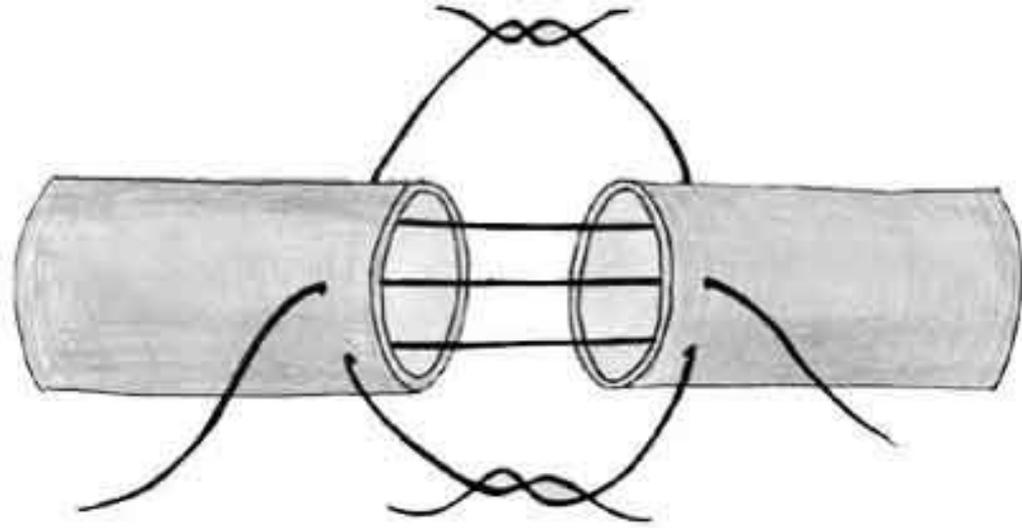
- Tend to buckle across joints
- False aneurysms at anastomoses
- Thick intimal deposition (2-4 mm)
- Infection of implanted foreign material b.

PTFE (Goretex)

- Useful for smaller arteries (e.g. superficial femoral)
- Easy to suture and requires no pre-clotting

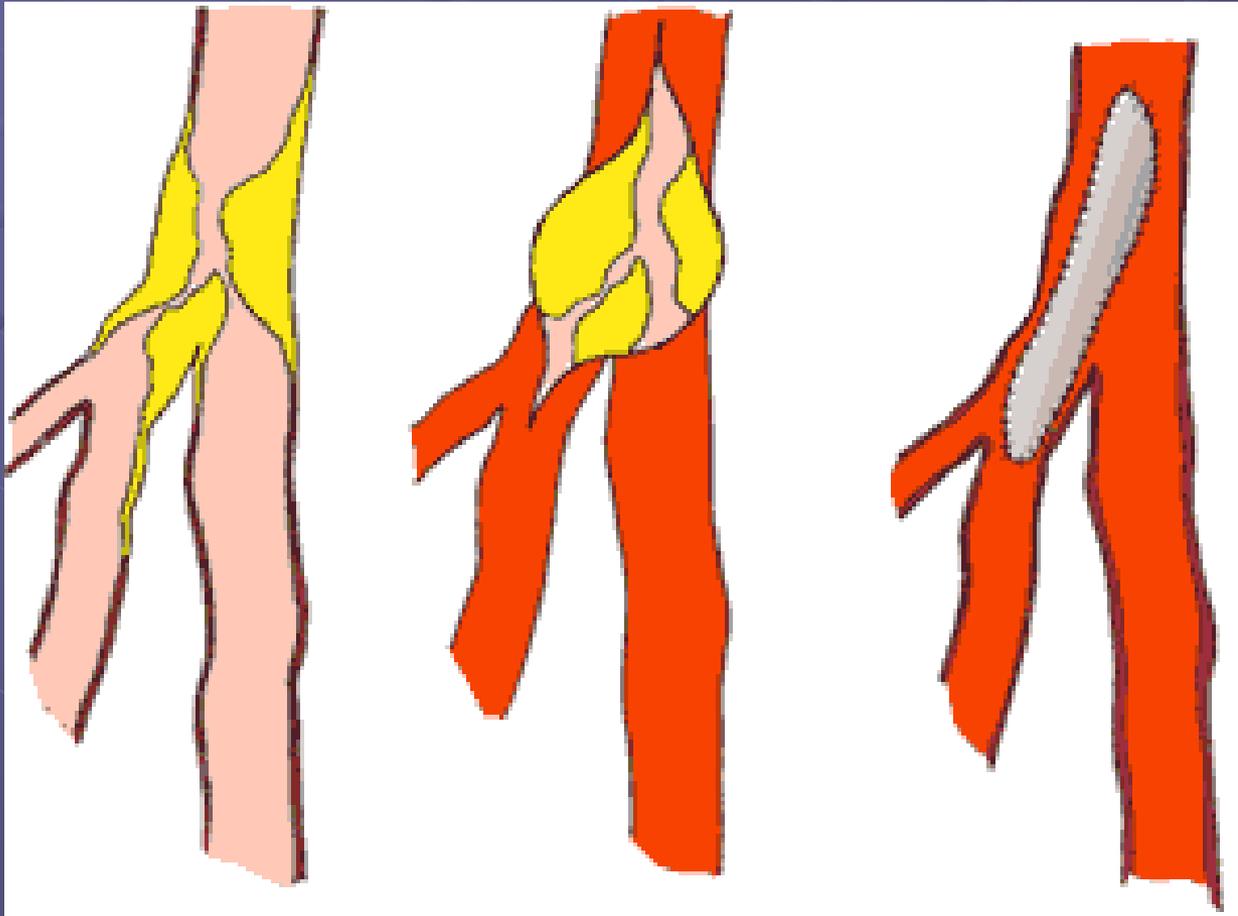
Problems

- High 3-year failure rate ($> 30\%$) compared with vein infection
- Tendency to kink

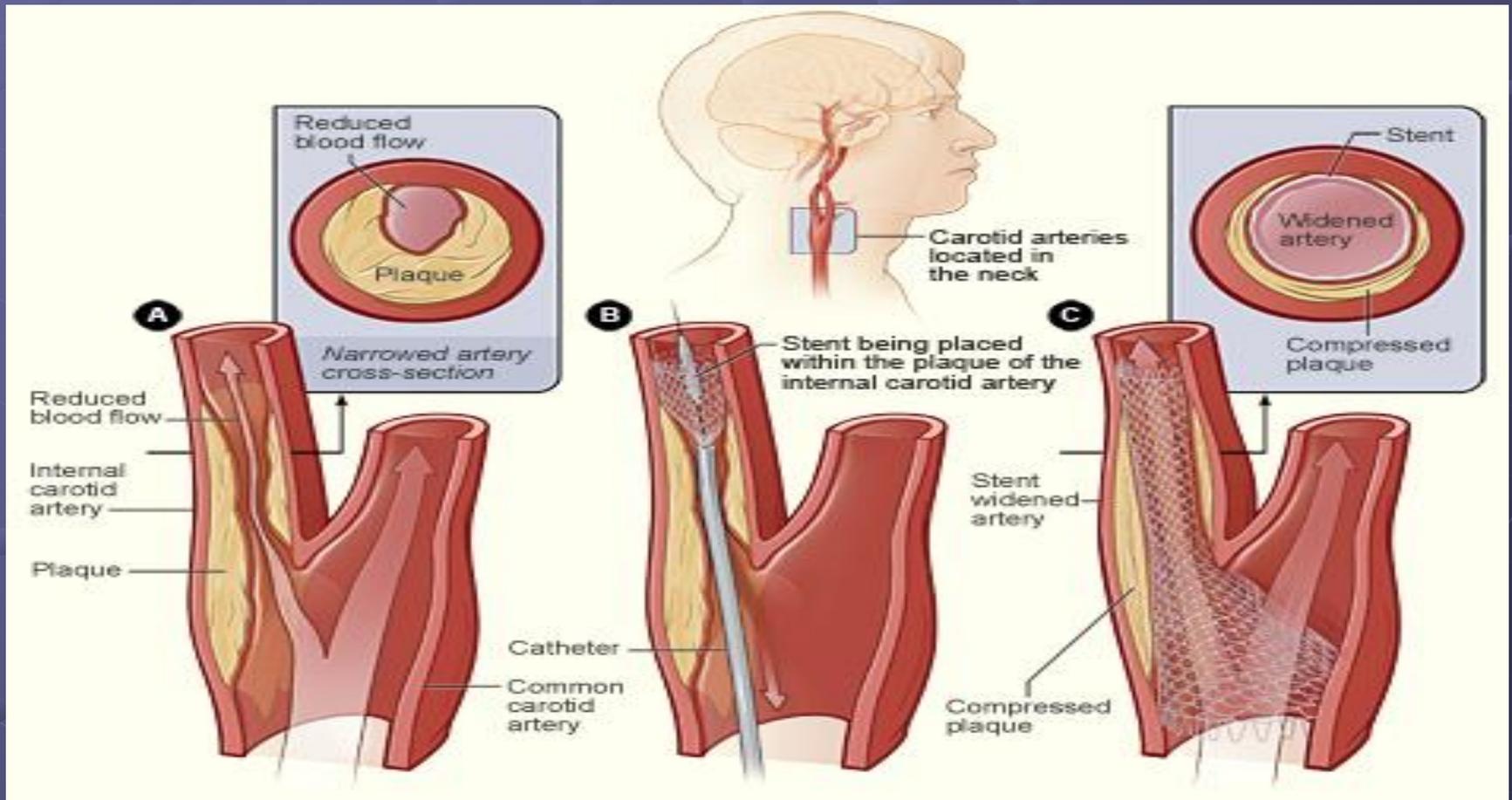


Carrel's vascular suture description: End-to-end anastomosis of severed vessels with triple-threaded sutures.

Endarterectomy (Atherectomy): is a procedure to remove plaque from arteries. Plaque is the buildup of fat, cholesterol and other substances in an artery's inner lining.



Carotid Artery Stenting



Sympathectomy

- Surgical
- Chemical



Grafting

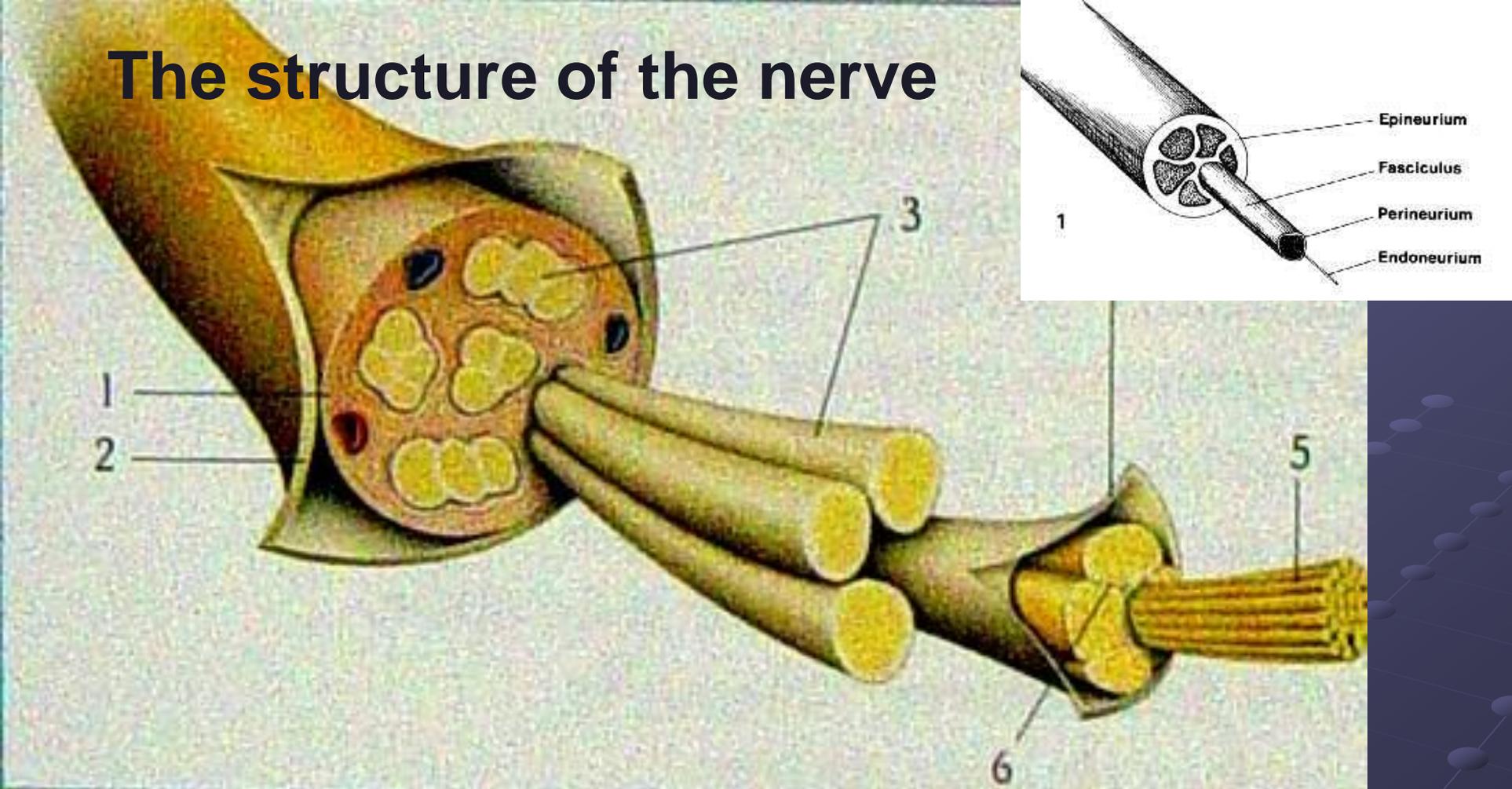
- By vein (best material, available from long saphenous or cephalic veins)
- Synthetic dacron (very good replacement for large vessels ($> 10\text{mm}$))
- RTFE

Principles of management of nerve injury

● Exploration needs:

- Avascular field (tourniquet)
- Available facilities for microsurgery
- Good light
- Adequate anesthesia
- Preserve all viable skin and all tissue around.

The structure of the nerve



- 1 and 2) Epineurium;
- 3) Group of Fascicules;
- 4) perineurium;
- 5) Nervous fibers;
- 6) Endoneurium

Peripheral nerves contain sensory or motor axons most of which are myelinated. Each axon is surrounded by fine collagen fibers, the endoneurium.

Groups of axons called fascicles are bound together by the perineurium, which consists of thin layers of specialized perineurial cells and fine collagen fibrils.

The epineurium, made of thicker collagen fibrils, surrounds the fasciculi. This layer is thought to elaborate the fibroblastic reaction that is the primary cause of fibrosis subsequent to nerve injury.

If removal of scarred ends leaves a gap between the nerve ends, length can be gained **by nerve transposition** by limitation on flexion or by bone shortening to close the nerve gap.

The ulnar nerve length can be gained by anterior **transposition** at the elbow.

Indications: dislocation of the nerve; defect of the nerve.

Procedure:

10cm incision following the ulnar nerve and centered on the medial epicondyle.

Expose and mobilize the nerve, carefully preserving its blood supply

Cut m. flexor carpe ulnaris, divide intermuscular septum to expose the nerve

Separate the flexors from the medial epicondyle and place the nerve anterior to the medial epicondyle

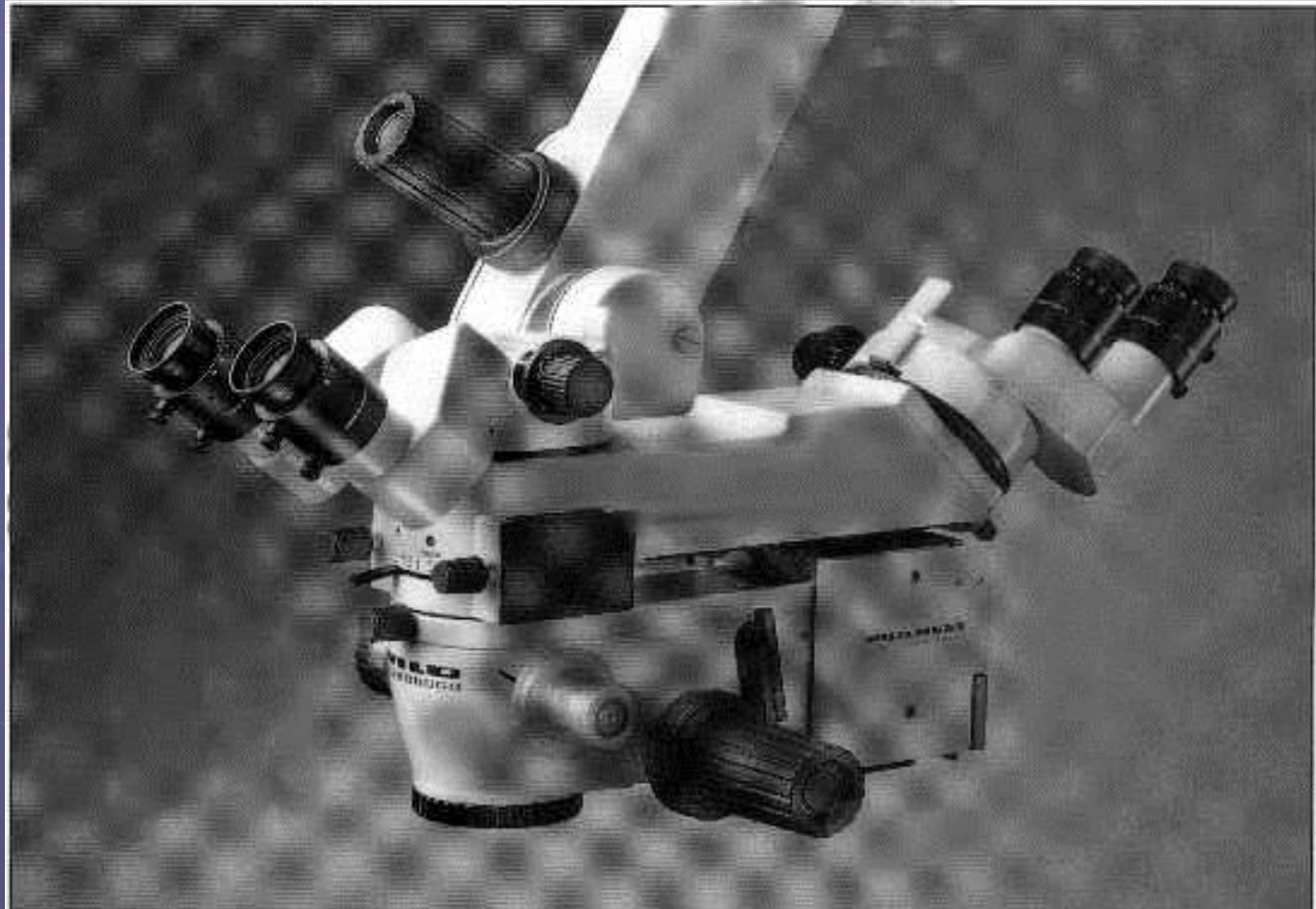
Some lesions resulting from contusion or compression are improved by **neurolysis**.

The procedure consists in separation of the neural structure from fibrous cicatrices.

Carpal tunnel syndrome (CTS) is a medical condition due to compression of the median nerve as it travels through the wrist at the carpal tunnel.

The main symptoms are pain, numbness, and tingling, in the thumb, index finger, middle finger, and the thumb side of the ring finger.

Microsurgical sutures on the small vessels and nerves in procedures of replantation



Varicose Veins

- Varicose veins result from an enlargement and dilatation of veins just beneath the skin and occur mainly in the legs.
- This enlargement of the veins results from a weakening in the vein wall, and a dysfunction of vein valves which regulate blood flow through the vein.
- The condition can be aggravated by pregnancy, obesity, and occupations requiring long periods of **standing**. Varicose veins range in severity from spider veins (telangiectasia) to severe, ropy, twisted veins accompanied with skin sores (venous ulcerations).

Varicose Veins Treatment

- **Stocking** (Some of the symptoms of varicose veins can be treated without intervention by wearing support stockings during the day)
- **Sclerotherapy** is often used to treat spider veins, smaller varicose veins, hemorrhoids and hydroceles.- Sclerosing agents typically used include: polidocanol; sodium tetradecyl sulfate; hypertonic saline solutions to obliterate the vein.
- **Foam sclerotherapy** - the solutions that are injected are exactly the same as those which are already used to treat varicose veins. These are mixed with a gas to create a mousse or foam consisting of very small bubbles
- **Surgery**

VENOUS CATHETERISATION

Is provided by percutaneous insertion of one or two intravenous plastic catheters.

Indications:

- operations or traumas associated with marked blood loss for rapid administration of blood, fluids or medications.

Insert the needle until it contacts the superior edge of the clavicle.

Lower the needle tip below the clavicle and direct the needle parallel to the floor.

Aspirate the syringe as the needle is inserted.

When blood appears in the syringe, thread the catheter into the vein.

If no blood returns is obtained or if resistance is met, redirect the needle toward the patient's opposite shoulder. (do not, at any time, direct the needle toward the patient's feet.)

Regional anesthesia

Brachial plexus block is a regional anesthesia technique that is sometimes employed as an alternative or as an adjunct to general anesthesia for surgery of the upper extremity.

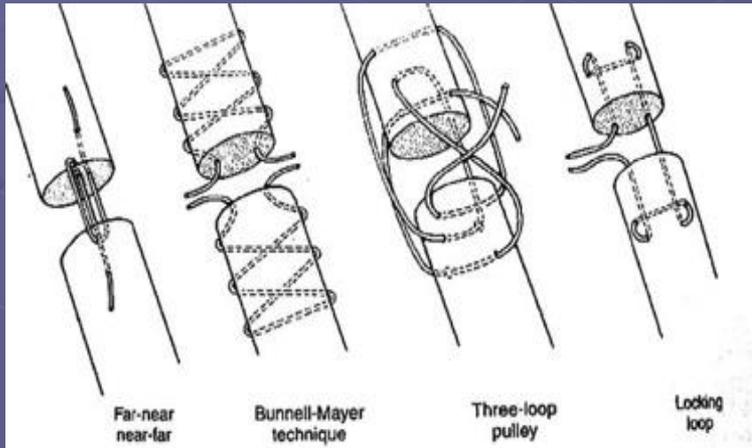
These techniques are classified by the level of injecting the local anesthetic — **interscalene block** on the neck, **supraclavicular block** immediately above the clavicle, **infraclavicular block** below the clavicle and **axillary block** in the axilla (armpit)

Sciatic nerve blockade is useful for postoperative pain, for lower extremity surgery, and lower extremity chronic pain syndromes such as sciatic neuropathy.

Tenorrhaphy, [teno- + G. *rhapḗ*, suture]

Suture of the divided ends of a tendon.

Synonyms **tendinosuture, tendon suture, tenosuture**



**THANKS FOR
YOUR
ATTENTION !!!**