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Fundamentals of surgical interventions on blood vessels and peripheral nerves

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SURGICAL INTERVENTIONS ON VESSELS

STOPPING BLEEDING (METHODS)

TEMPORARY:

1. Finger pressing against the bone above the injury site- applicable only for a short period of time
- applicable only for a short period of time;
- it is difficult or almost impossible to transport the injured
2. Using a harness

Advantage: quick and easy to use

Disadvantages:
- limited application time (no more than 2 hours);
- the possibility of serious complications:
✓ gangrene of the distal limb;
✓ nerve paralysis as a result of their compression;
✓ turnstile shockoк
3. Applying a hemostatic clamp to a damaged vessel
4. Applying a tight gauze bandage

THE FINAL:

1. Mechanical

applying ligatures – **ligation of the vessel** → In the wound / during

2. Physical

- electro – and thermocoagulation

3. Biological

- hemostatic sponges;
- tamponade with biological tissues, etc.

4. Chemical

- hydrogen peroxide; iron chloride solution, etc..

5. Restoration of the integrity of the damaged main artery using **a vascular suture**

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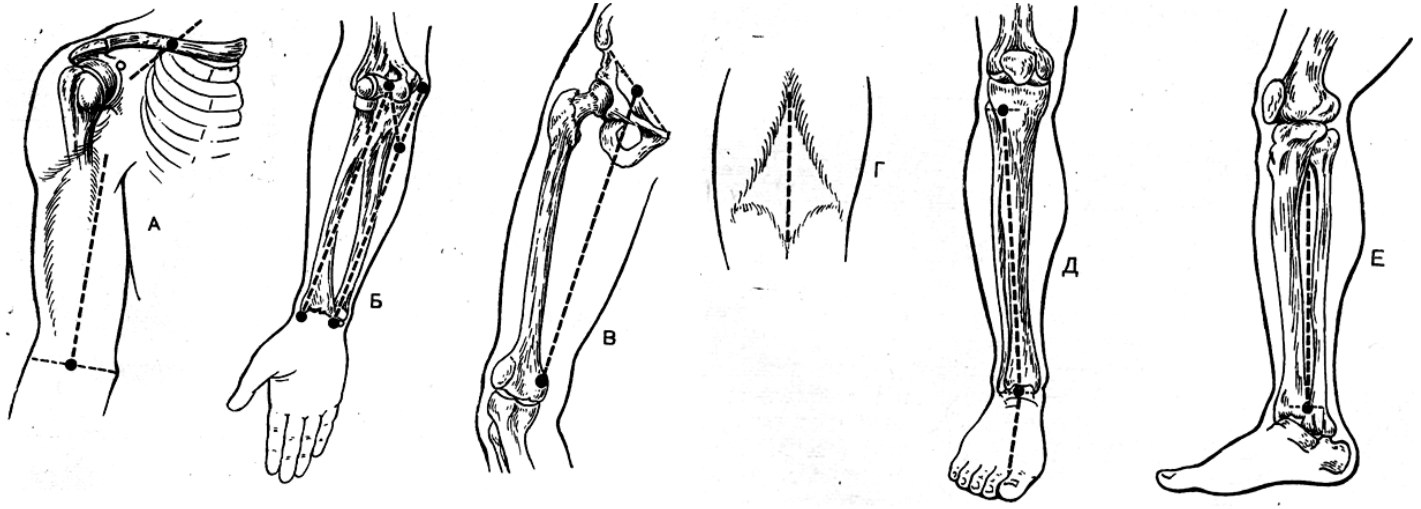
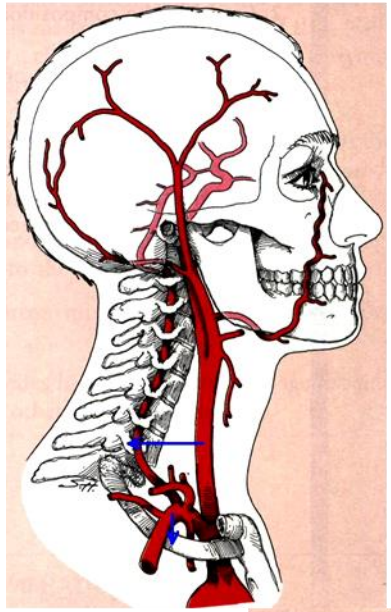
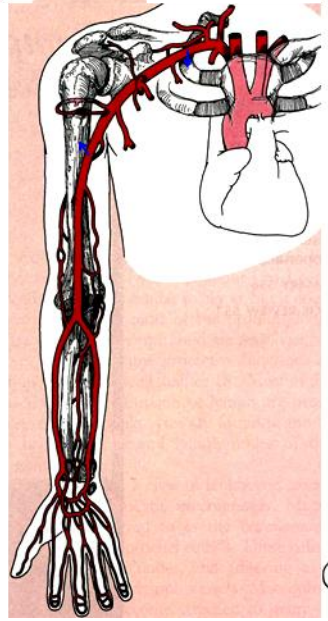
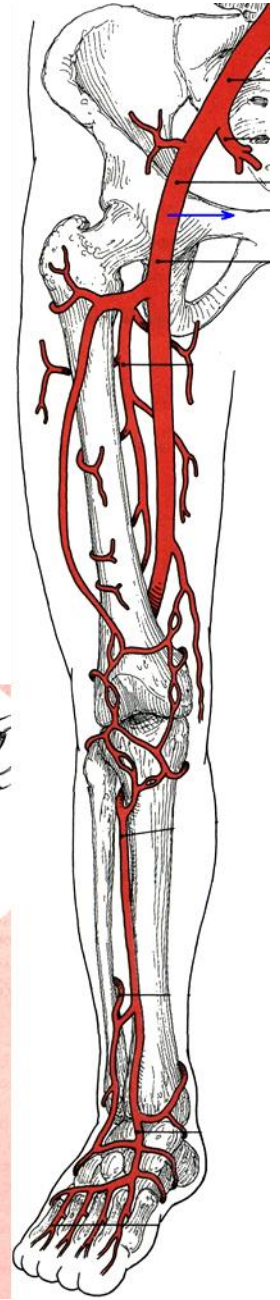
Projections of the main neurovascular bundles of the extremities









OPERATIONAL ACCESS TO VESSELS:

- **STRAIGHT LINES** – are drawn strictly along the projection line (to deep–lying formations)
- **ROUNDABOUT** – are carried out outside the projection line (to surface-lying formations)

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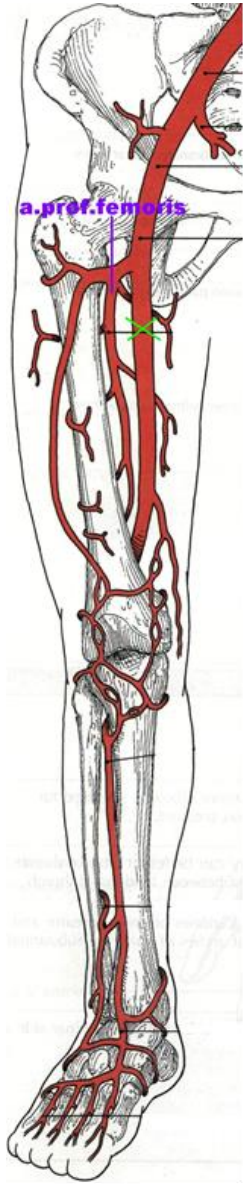
LIGATION OF THE ARTERY IN THE WOUND (stages of surgery)

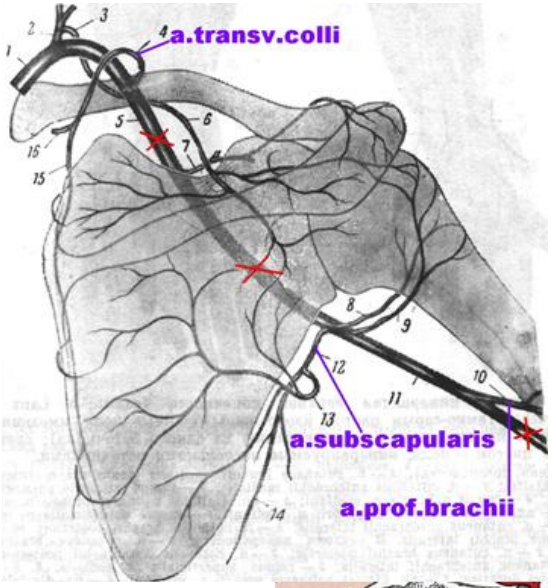
1.Operative access (optimal)
2.Application of hemostatic clamps to the ends of the damaged artery
3.Careful isolation of the ends of the artery from the surrounding tissues (1-2 cm)
4.Application of ligatures to the central and peripheral ends of the artery (even if the peripheral end of the artery does not bleed)
5.Immobilization of the limb

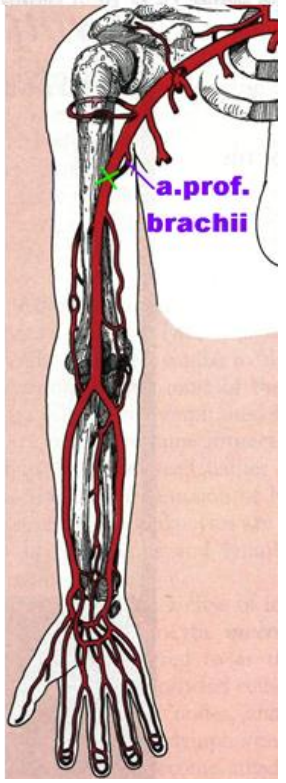
Ligation of the blood vessel (artery) in the wound is not possible:

- When localized in areas with complex relationships of anatomical formations (gluteal region, scapular region, deep facial region)
- When bleeding in a purulent wound
- When bleeding in a crushed wound

In these cases, it is advisable - **ligation of the artery throughout**
- a way to stop bleeding
- a method of preventing bleeding before performing complex operations (amputation of a limb, resection of the upper jaw, etc.)







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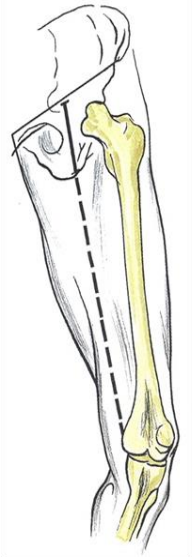
Ligation of the artery throughout

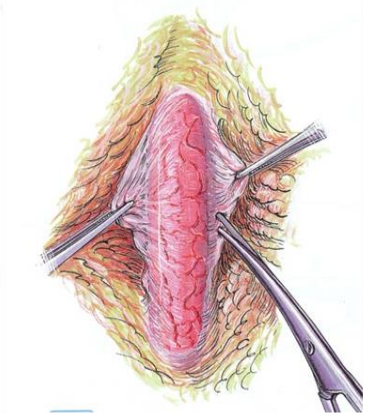
Operative access during artery ligation throughout:

- direct (projection)
- indirect (roundabout, non-projection)

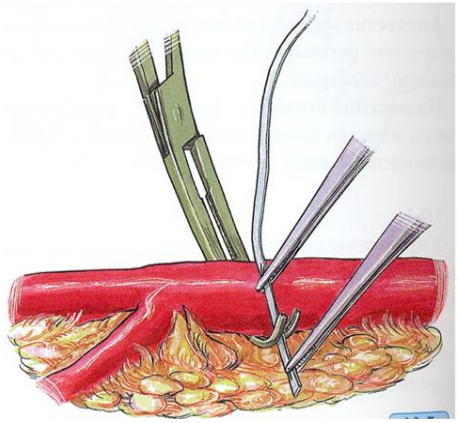
Operational reception



Проекция бедренной артерии



Выделение артерии из сосудистого влагалища



Подведение лигатуры под артерию

Complications of artery ligation:

- The possibility of necrosis (gangrene) of the distal limb in the immediate period after surgery;
- While maintaining the viability of the limb, the possibility of developing "disease of the ligated vessel" (rapid fatigue of the limb, periodic pain, muscle atrophy) due to insufficient blood supply to tissues in the long term after surgery.

Collateral circulation

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Collateral circulation is the flow of blood to the peripheral parts of the limb, bypassing the main pathways, along anatomical collaterals.

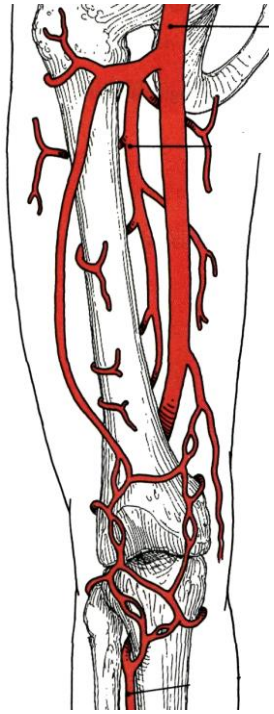
Anatomical collaterals or anastomoses are divided into:

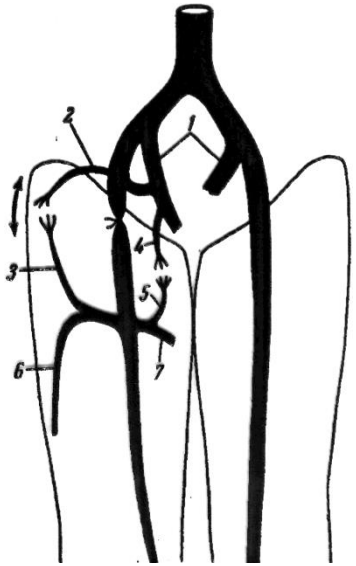
- intersystem – connecting vessels belonging to the basin of one artery (for example, anastomoses between branches of the deep artery of the thigh and the descending artery of the knee);
- intersystem – connecting pools of different vessels located in different areas (for example, anastomoses between branches of the femoral artery and the internal iliac artery).

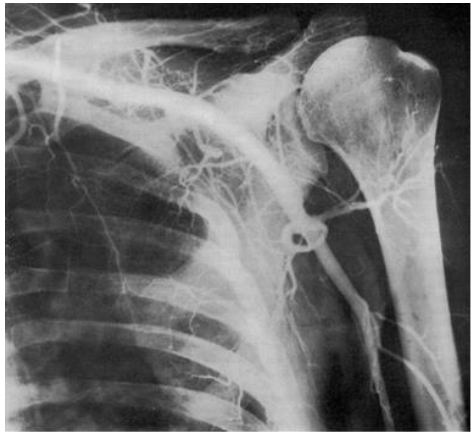
The intensity of collateral circulation depends on:

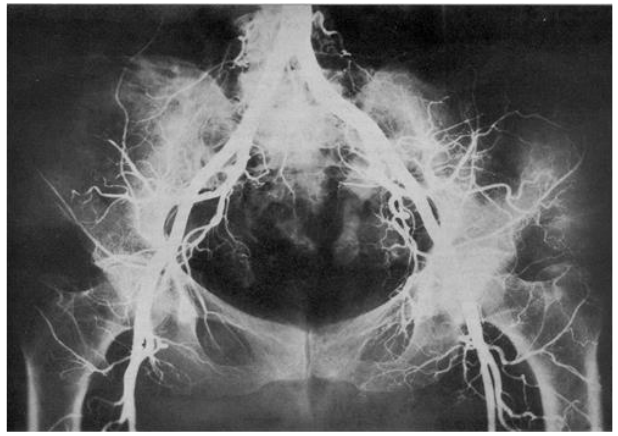
- anatomical (diameter, number, angle of departure of the collateral branches and the level of ligature application),
- functional (spasm or dilation of collateral branches).

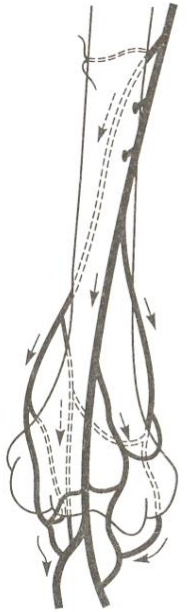
Reduced blood circulation (according to Oppel) – in order to improve blood supply to tissues to reduce blood outflow, when ligating the main artery, the accompanying vein is ligated.

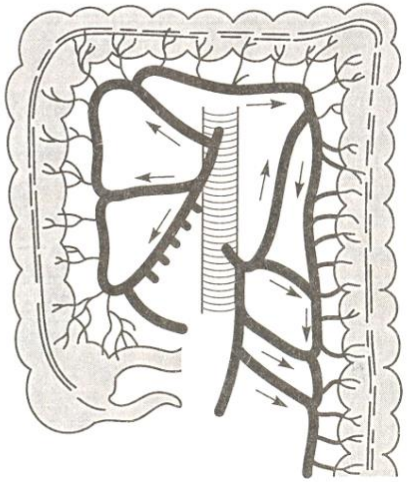












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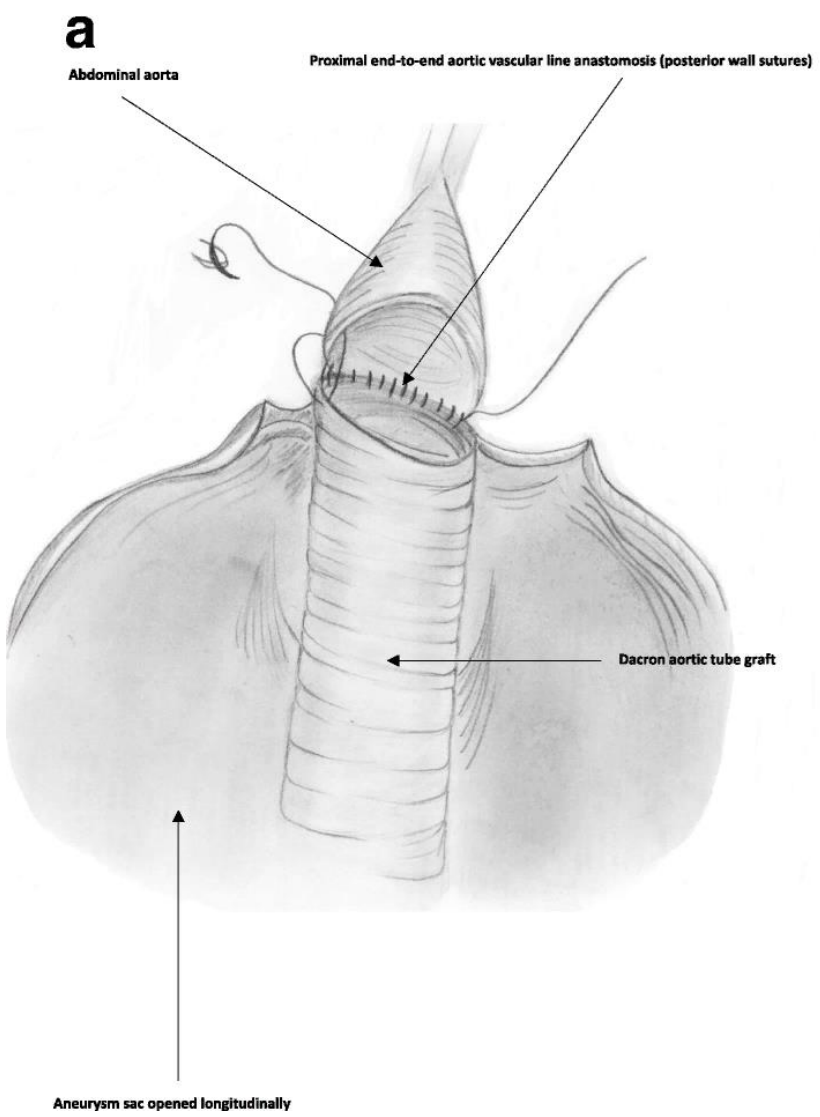
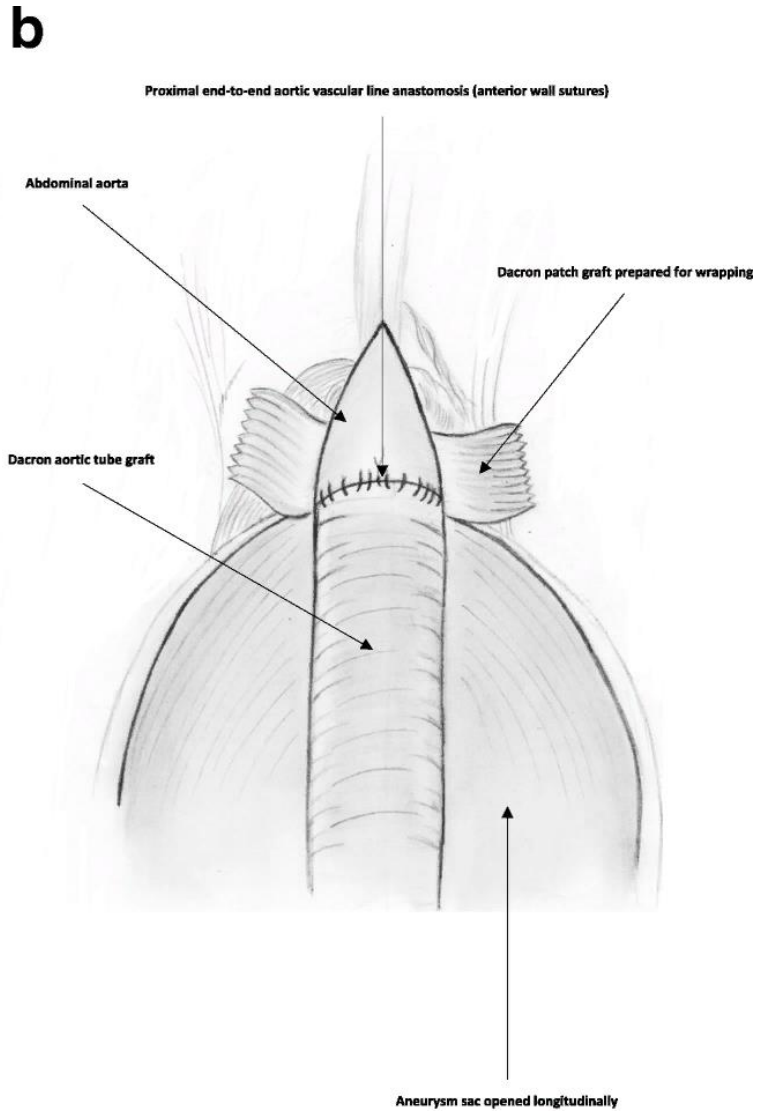
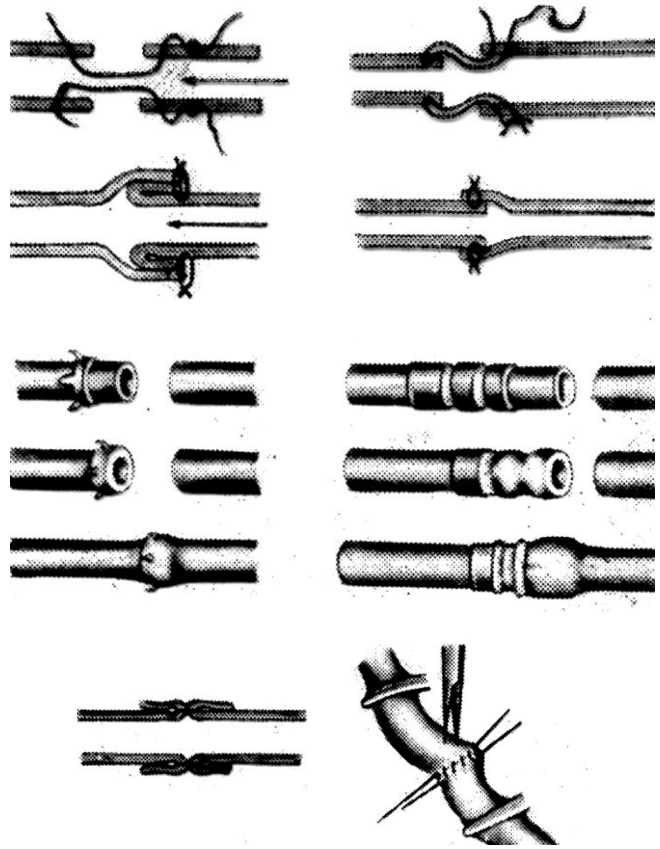
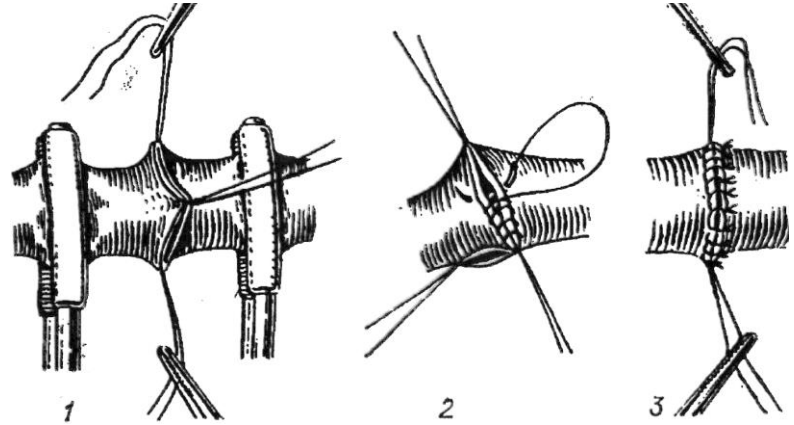
Vascular suture – is an operation that restores the integrity of the vessel, hence the normal blood circulation and nutrition of the limb.









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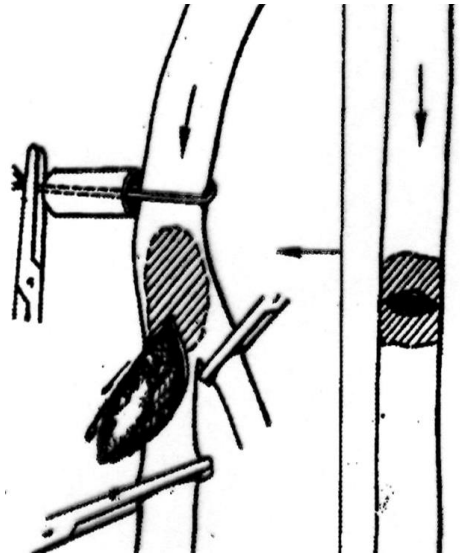
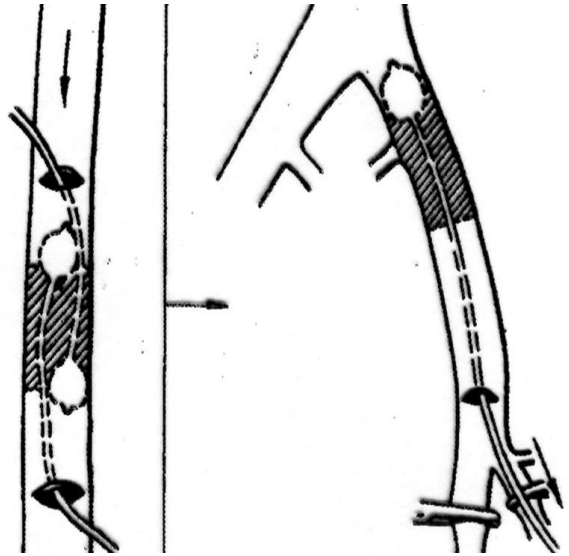
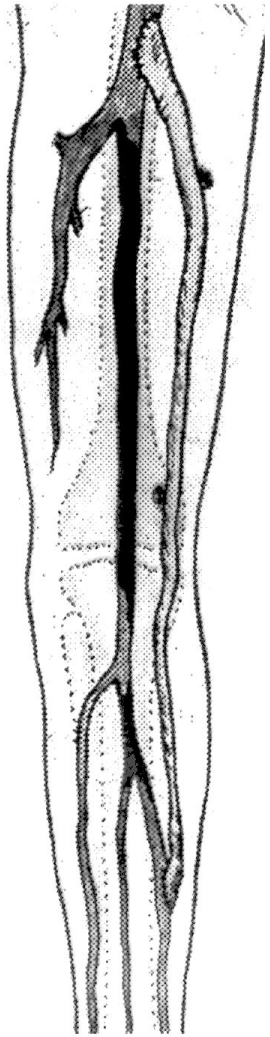
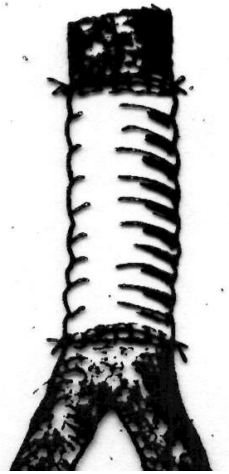
Reconstructive surgery is performed in order to restore the main blood flow in case of vascular patency.

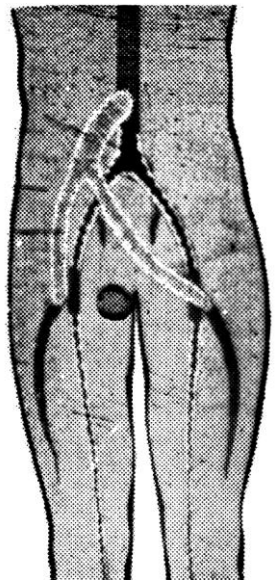
- **Deobliterating operations** are aimed at restoring the patency of the occluded segment of the vessel
- **Plastic surgery** is aimed at replacing the affected segment of the vessel with an auto-, allo-, xenograft or vascular prosthesis.
- **Bypass surgery** - with the help of vascular prostheses or an autograft, an additional pathway for blood flow is created bypassing the occluded segment of the vessel.

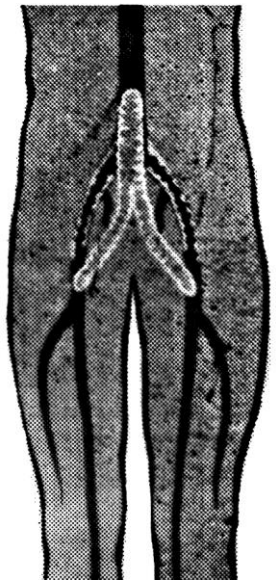












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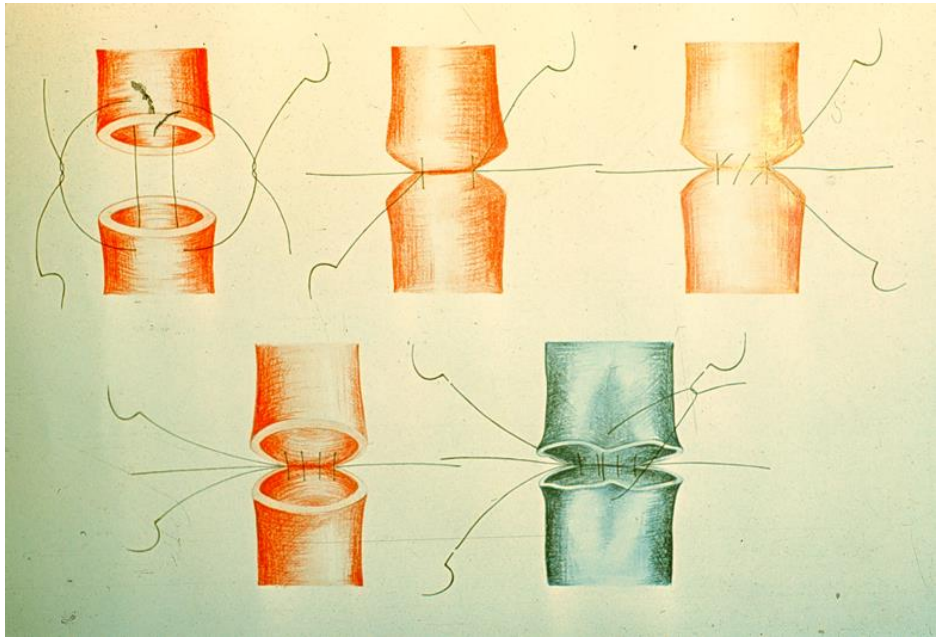
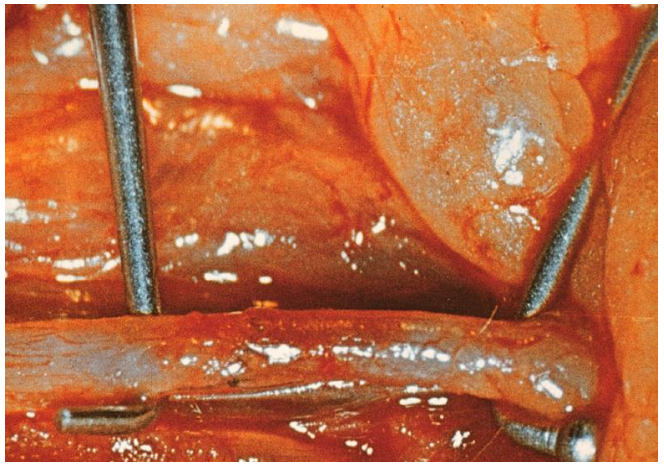
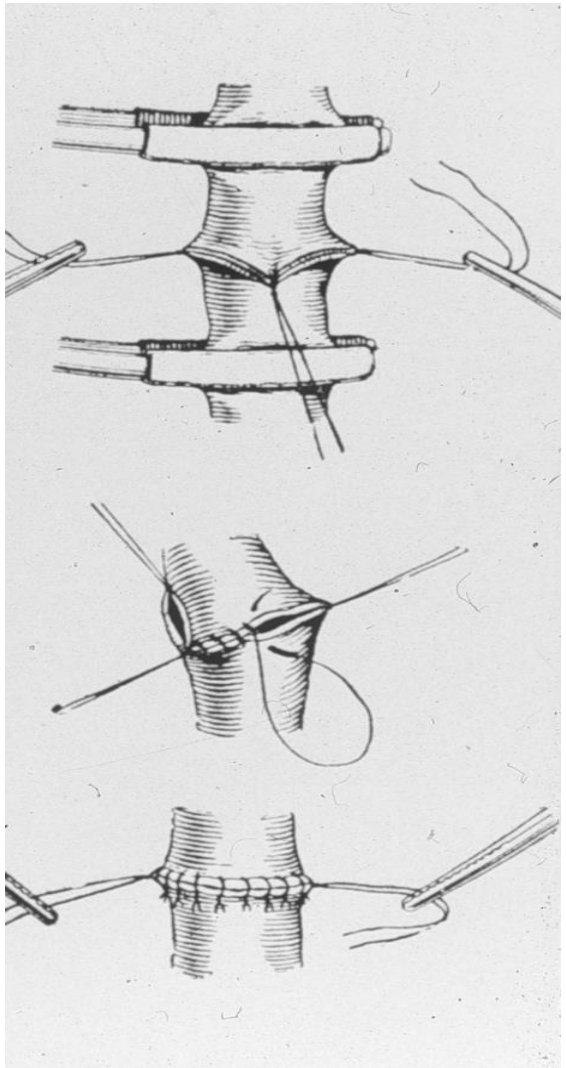
Vascular suture Cabbott



Microsurgical vascular suture



Vascular suture Carrel



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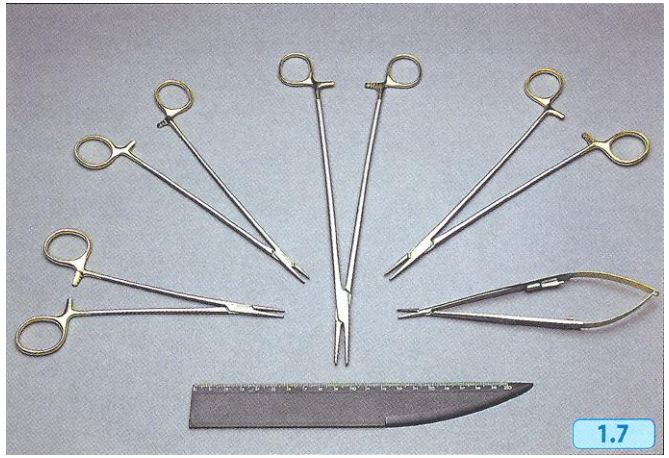
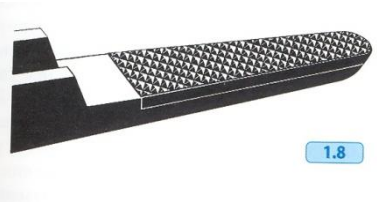
Microsurgical instruments

Vascular tweezers and clamps

Vascular needle holders

Vascular clamps of the "bulldog" type





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Microsurgical instruments

Magnifying glasses

frontal

glasses

A set of microsurgical instruments

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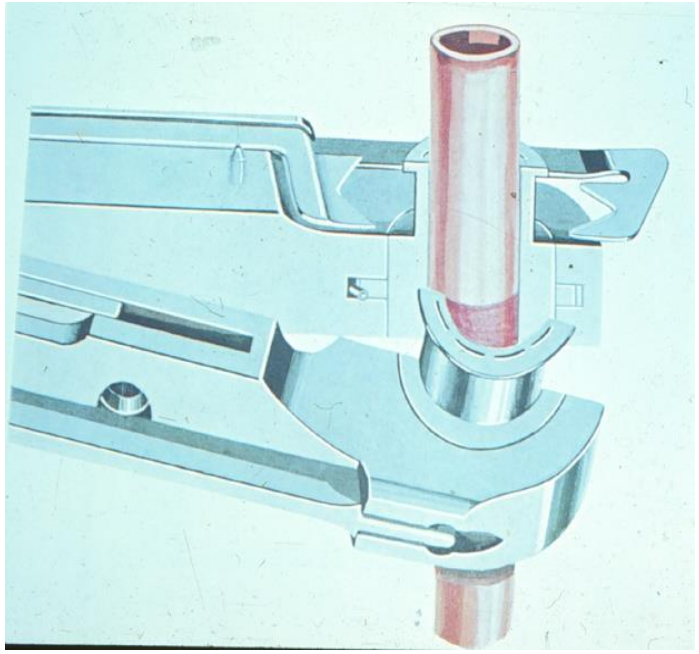
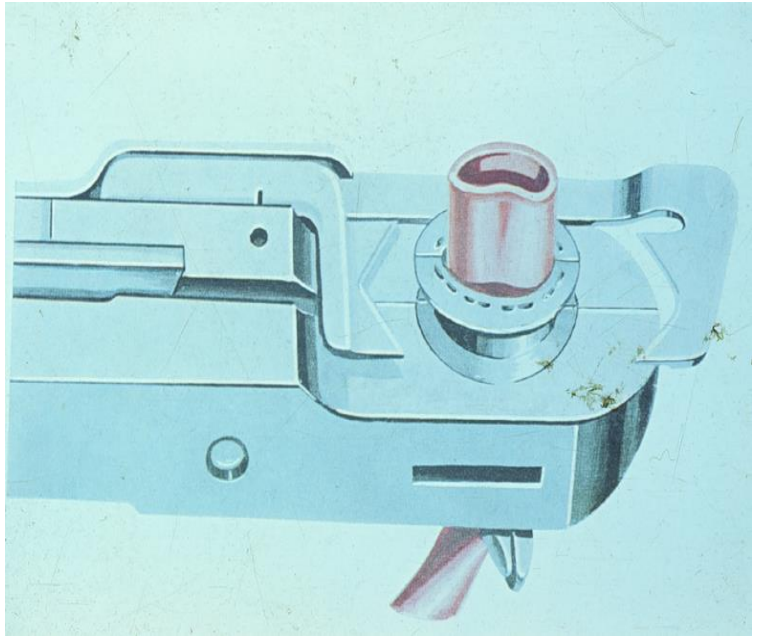
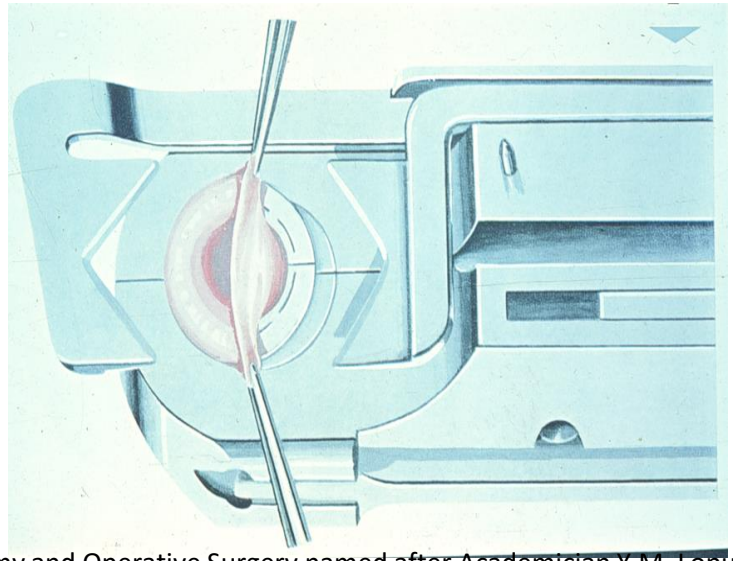
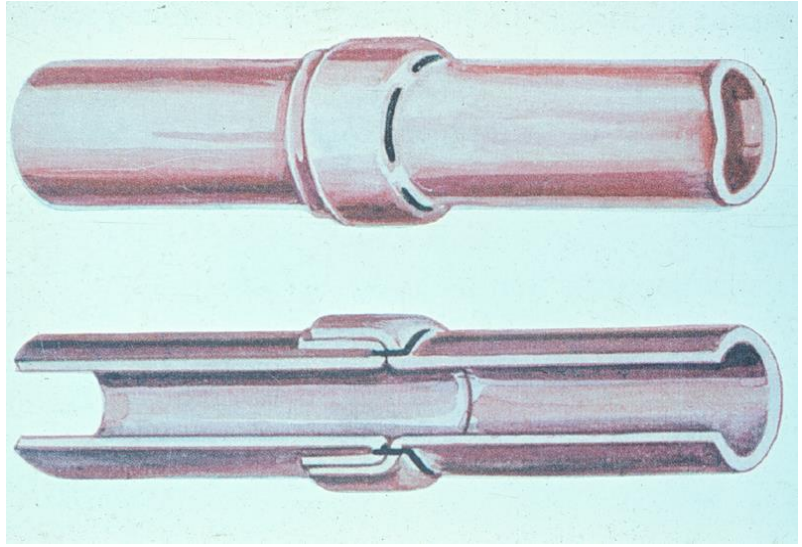
MECHANICAL VASCULAR SUTURE









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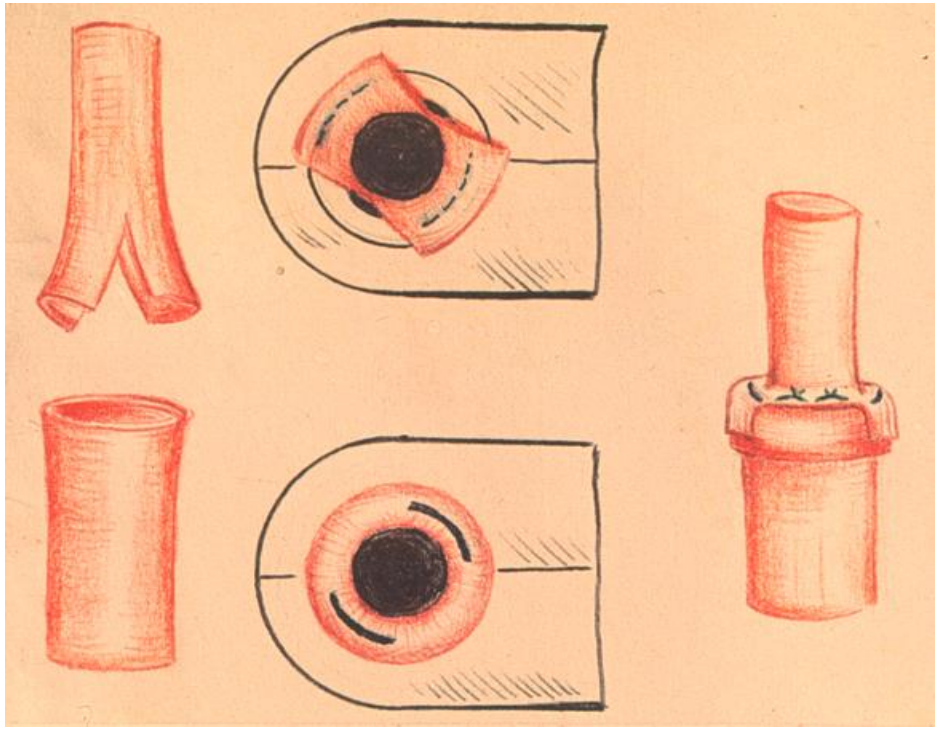
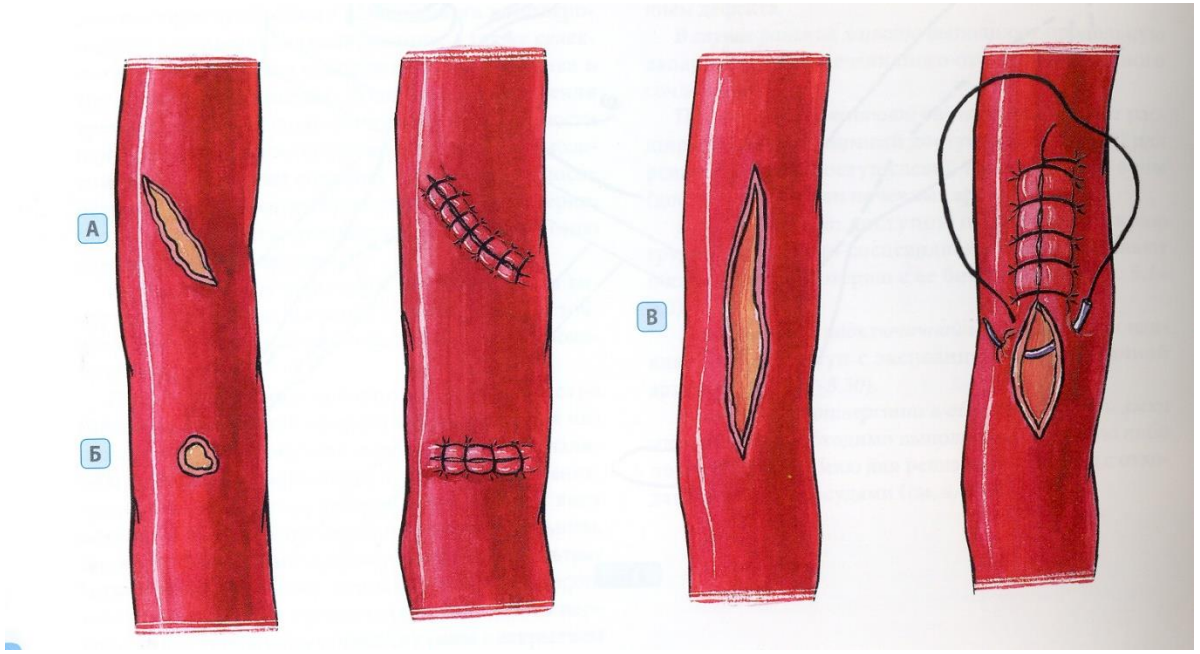
OPERATIONS FOR INJURIES OF BLOOD VESSELS (arteries)

Combined vascular suture



Lateral vascular suture



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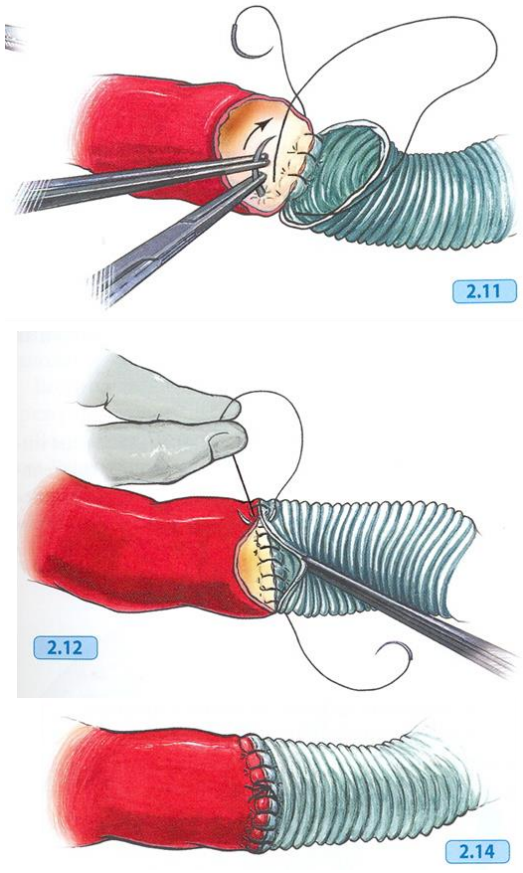
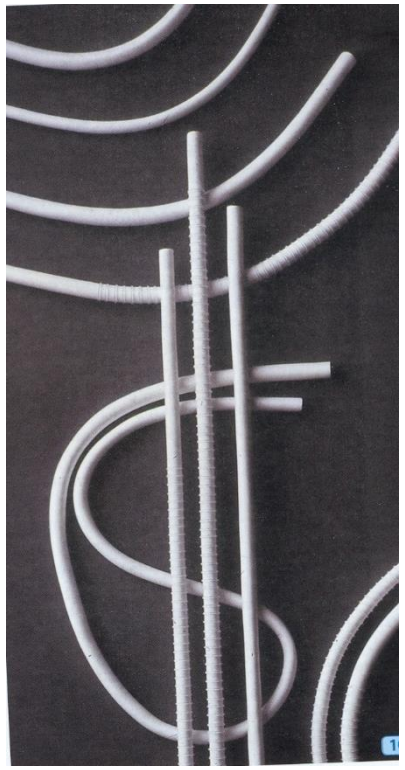
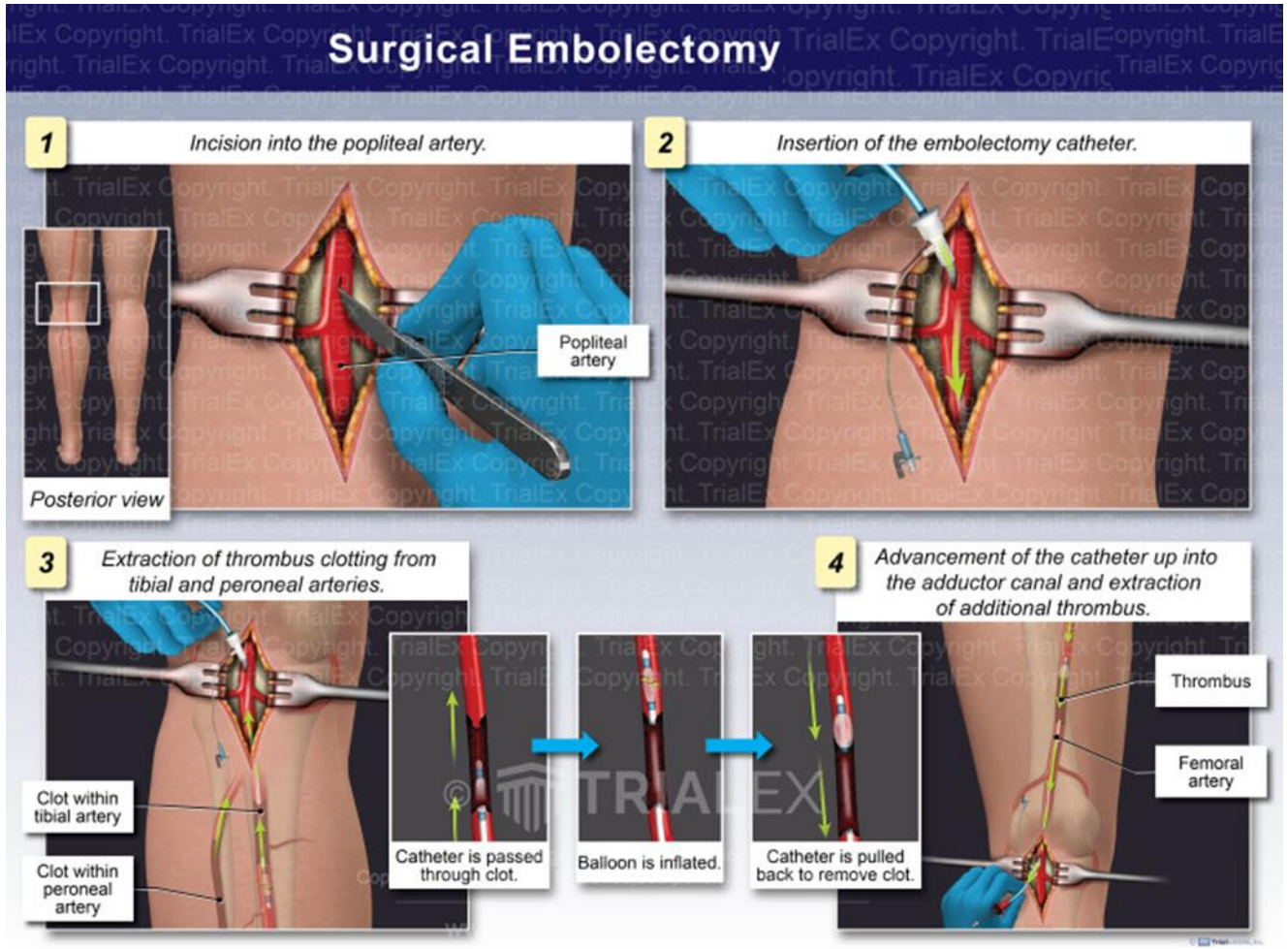
Angioplasty with a synthetic graft



Synthetic prostheses



Embolectomy from the femoral artery



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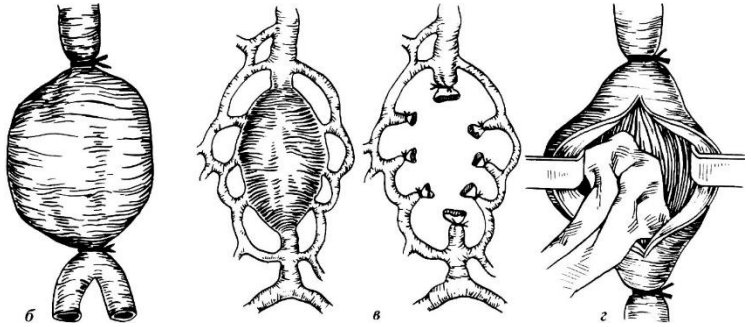
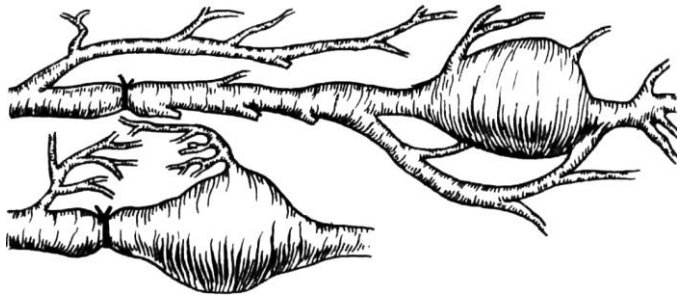
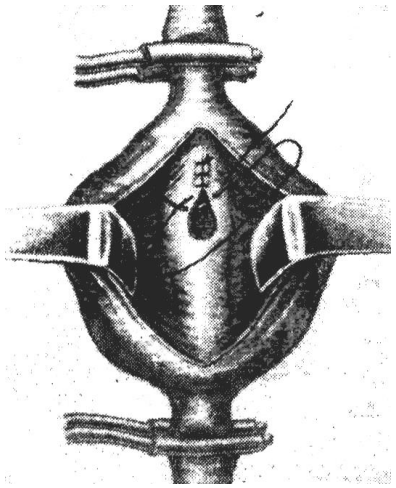
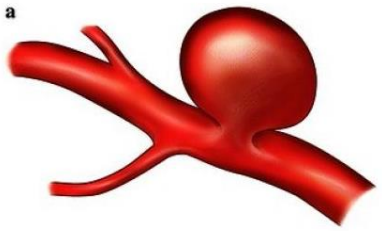
ANEURYSMS

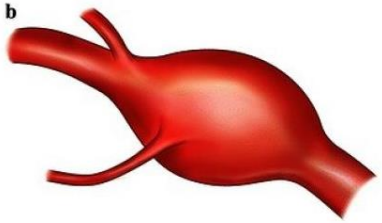








Saccular Aneurysm

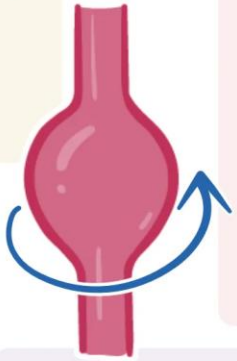


Fusiform Aneurysm

BACKGROUND

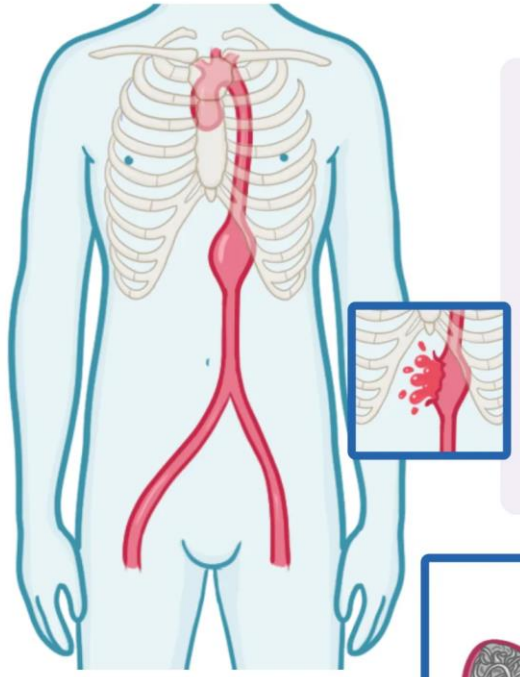
* ANEURYSM with CIRCUMFERENTIAL & BALLOONING SHAPE
  - PORTION of BLOOD VESSEL WALL BECOMES WEAK & DILATES
  - WALL MUST DILATE to 50% of NORMAL DIAMETER

BALLOONING on ALL SIDES



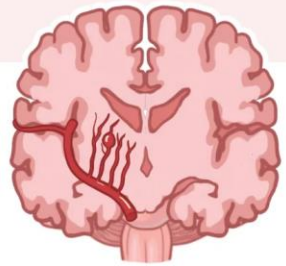
CAUSES

* ATHEROSCLEROSIS
* CONNECTIVE TISSUE DISEASES
* SMOKING
* HYPERTENSION
* INFECTIONS
* PREGNANCY
* SYSTEMIC LUPUS ERYTHEMATOSUS
* FIBROMUSCULAR DYSPLASIA
* TRAUMA



SIGNS & SYMPTOMS

* CEREBRAL:
  - HEADACHE, DIZZINESS, LOSS of CONSCIOUSNESS
  - NEUROLOGIC DEFICITS from PRESSURE on SURROUNDING PART of BRAIN
* ABDOMINAL:
  - ABDOMINAL, BACK, or GROIN PAIN
* RUPTURE:
  - SEVERE BLOOD LOSS
  - DEATH

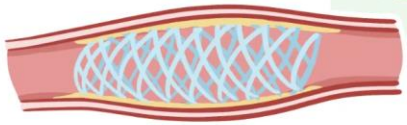


TREATMENT

* BLOOD PRESSURE MANAGEMENT
* CHOLESTEROL LOWERING MEDICATION
* COILING
* CLIPPING
* REGULAR IMAGING
* STENTS

DIAGNOSIS

* ULTRASOUND
* CT ANGIOGRAPHY



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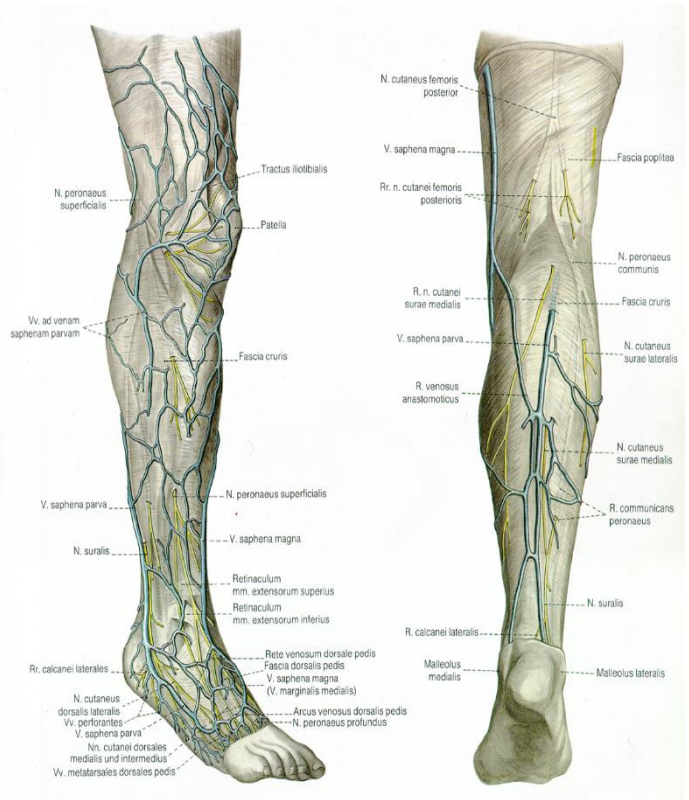
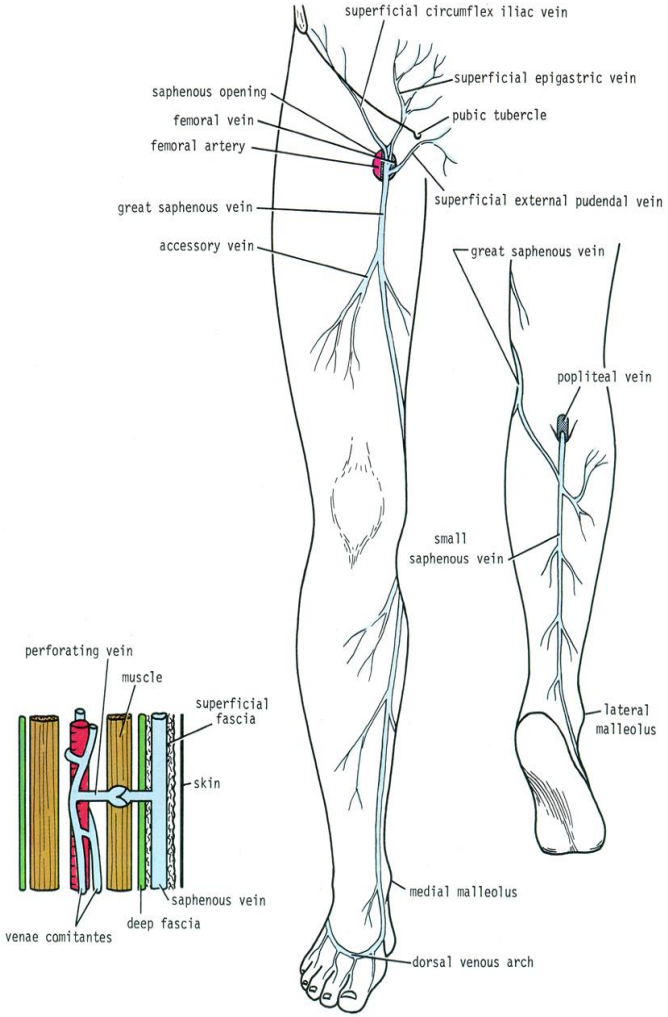
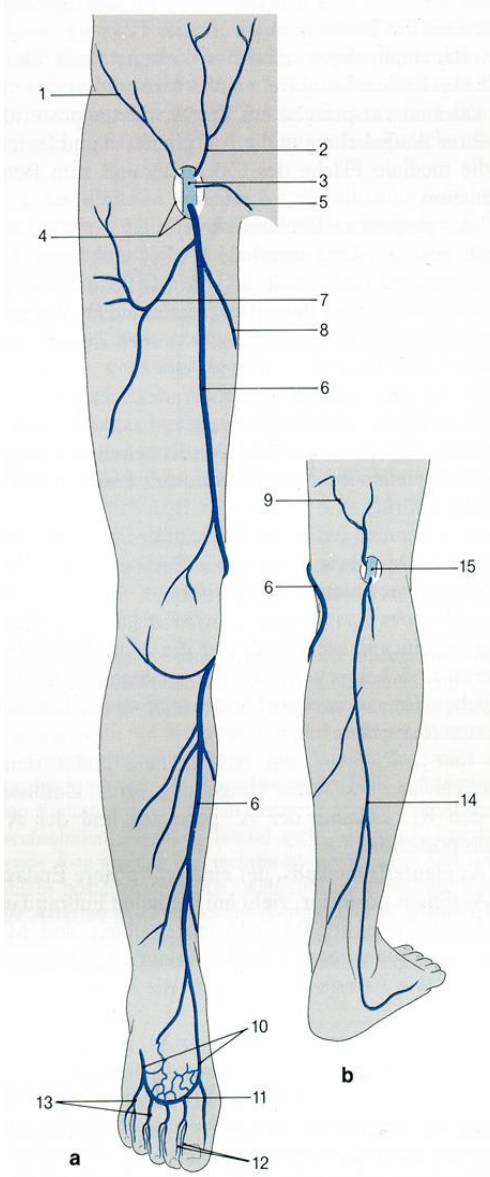
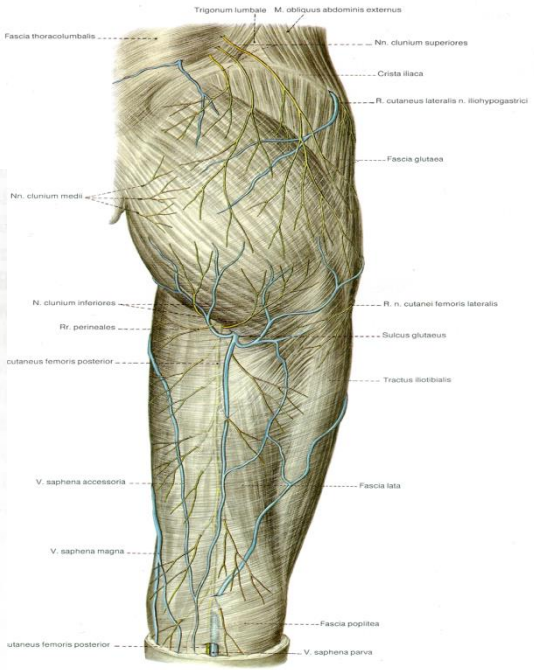
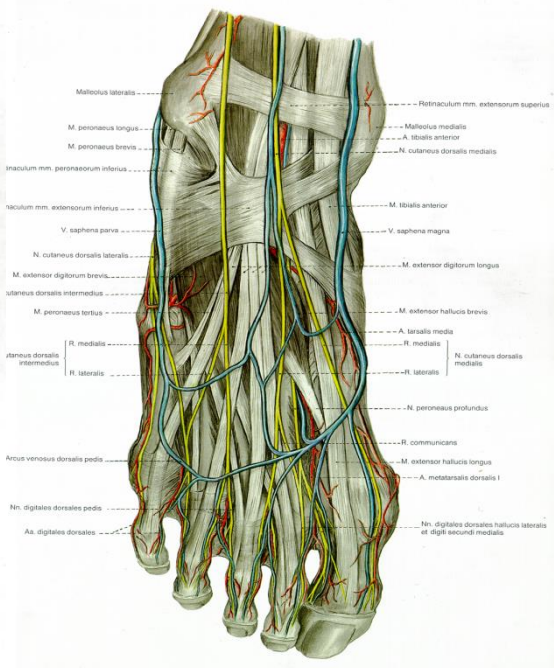
SURGICAL INTERVENTIONS ON VEINS











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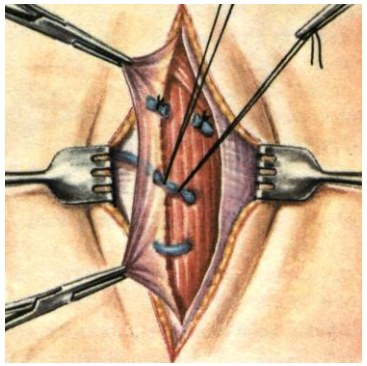
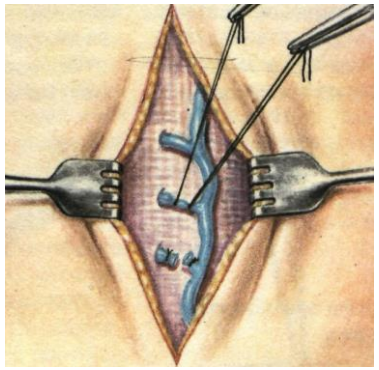
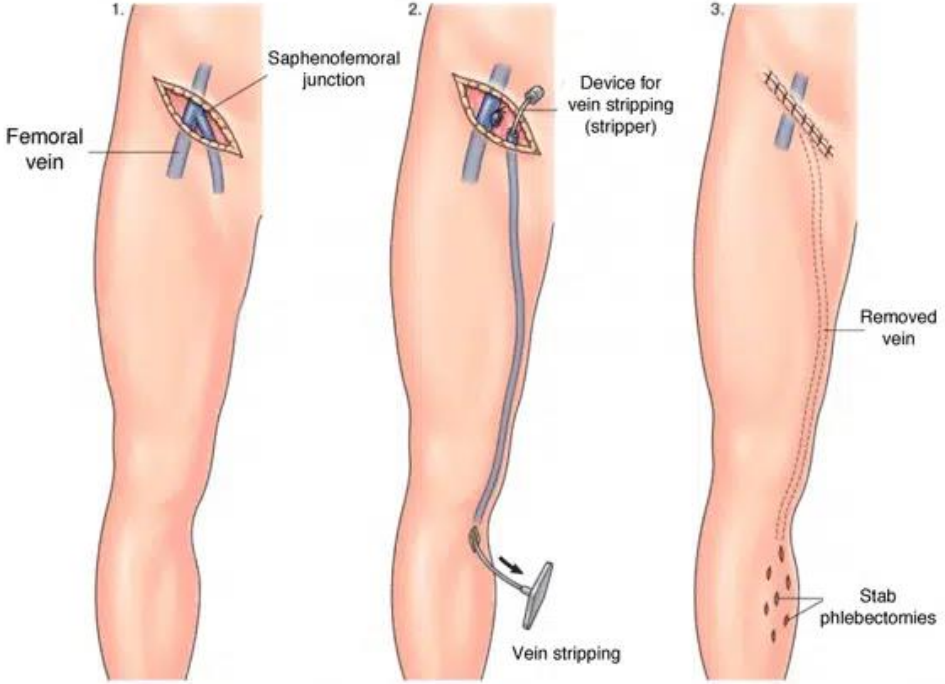
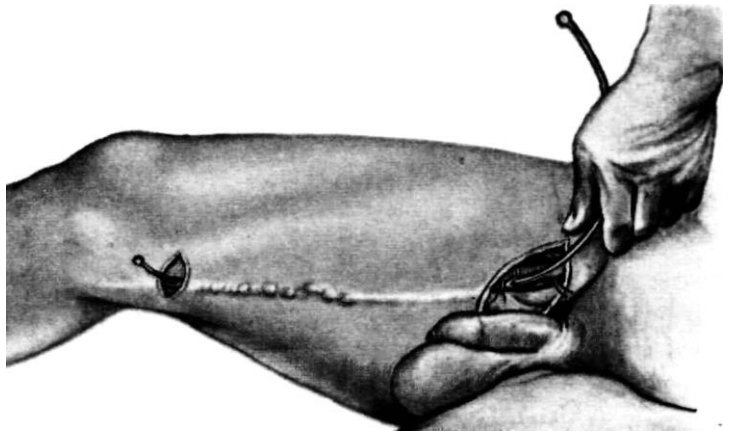
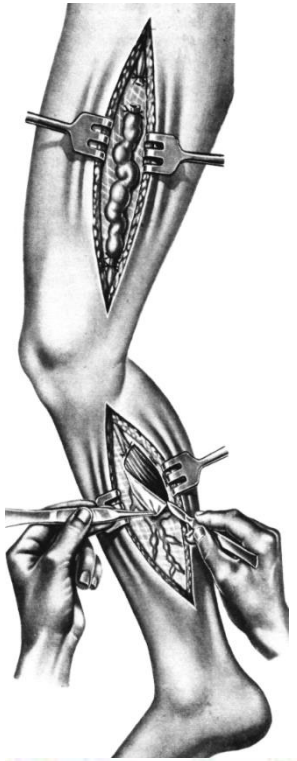
Surgery for varicose veins of the lower extremities

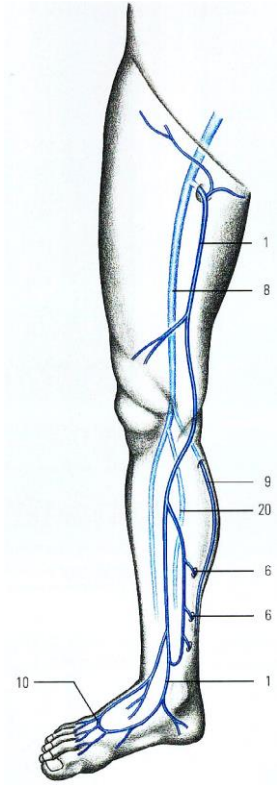


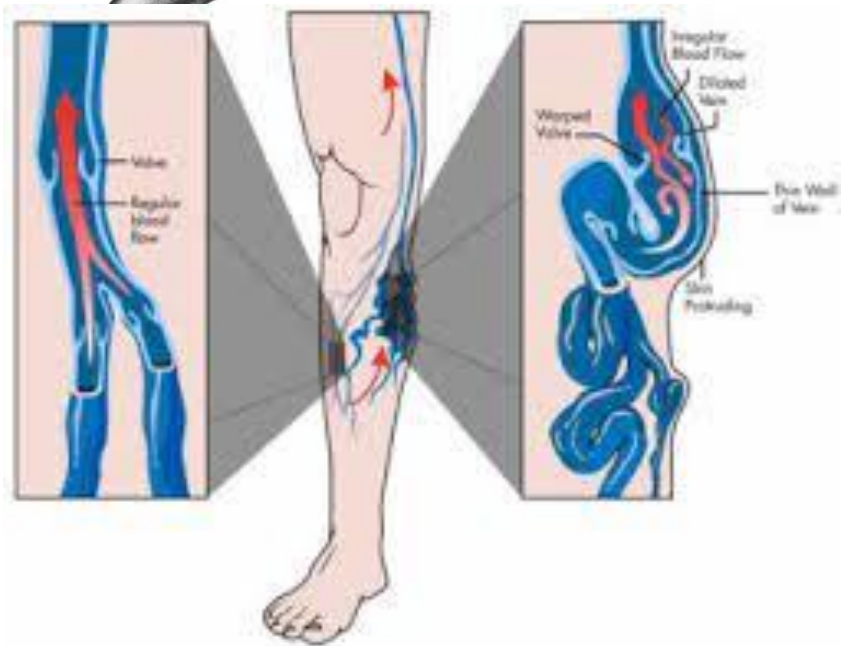












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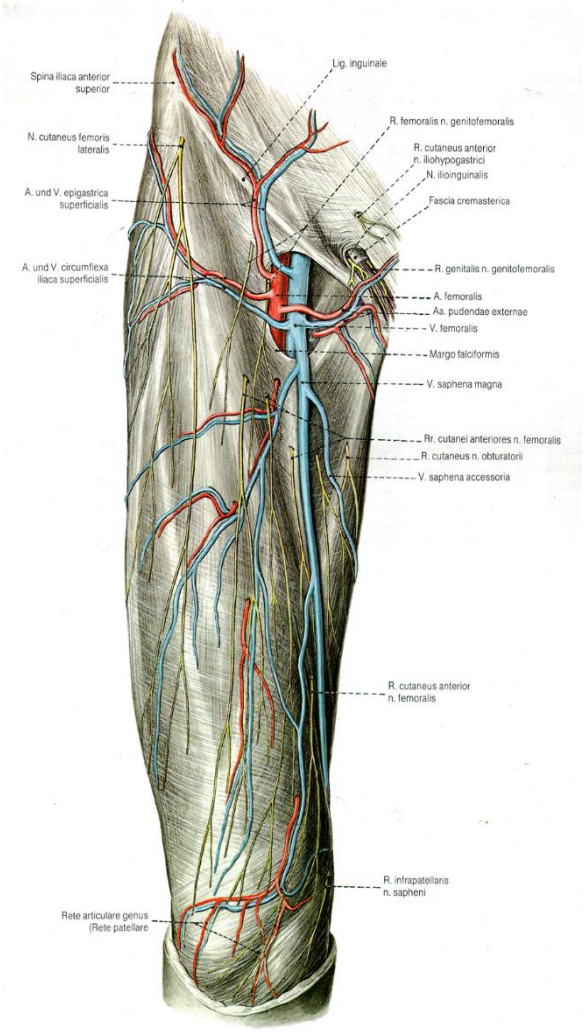
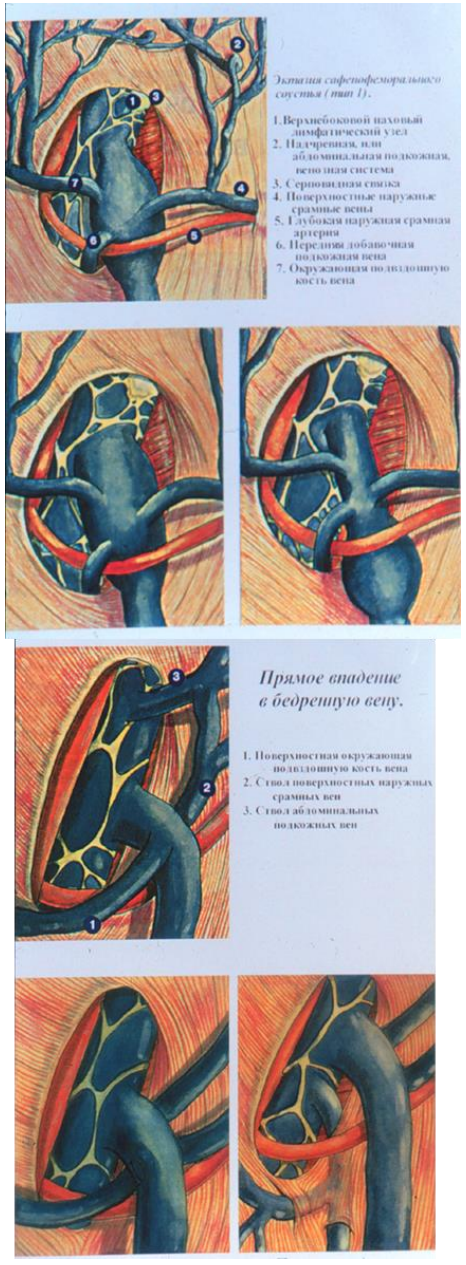
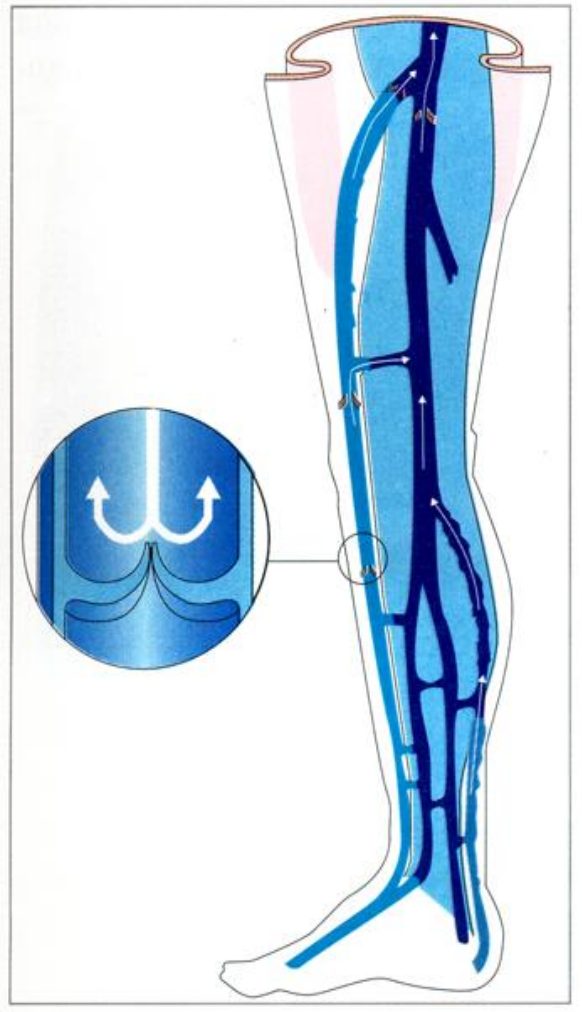
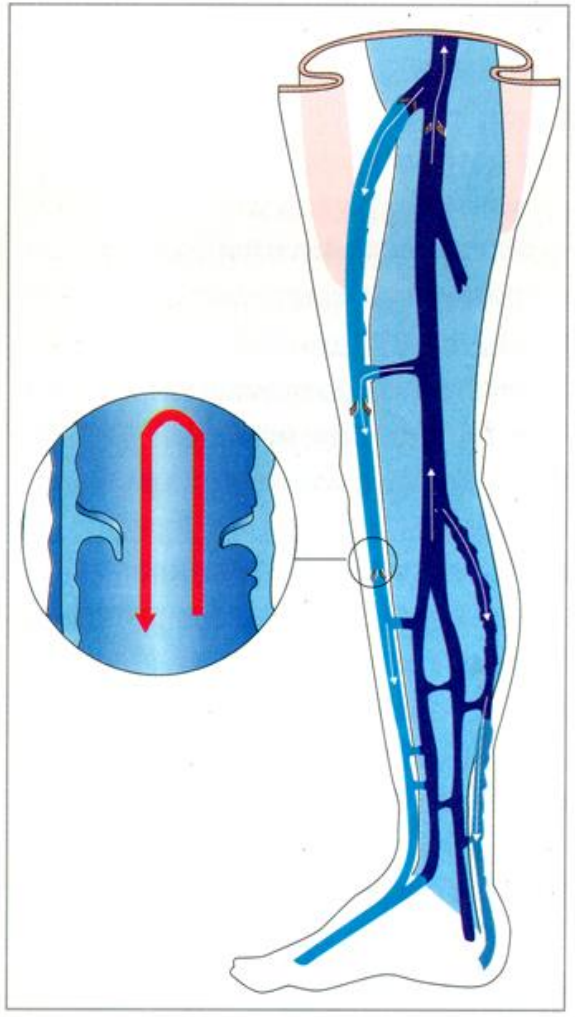






Venous outflow from the lower limb is normal (diagram)



Venous refluxin varicose veins (scheme)

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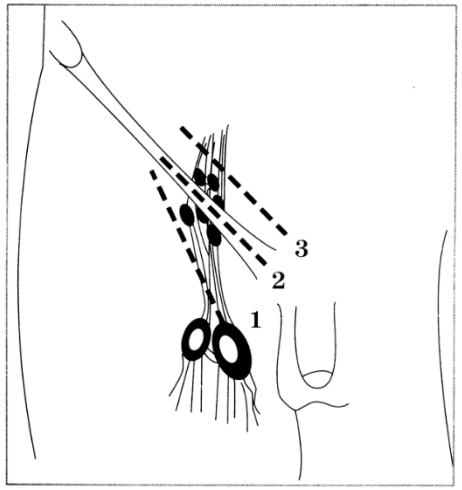
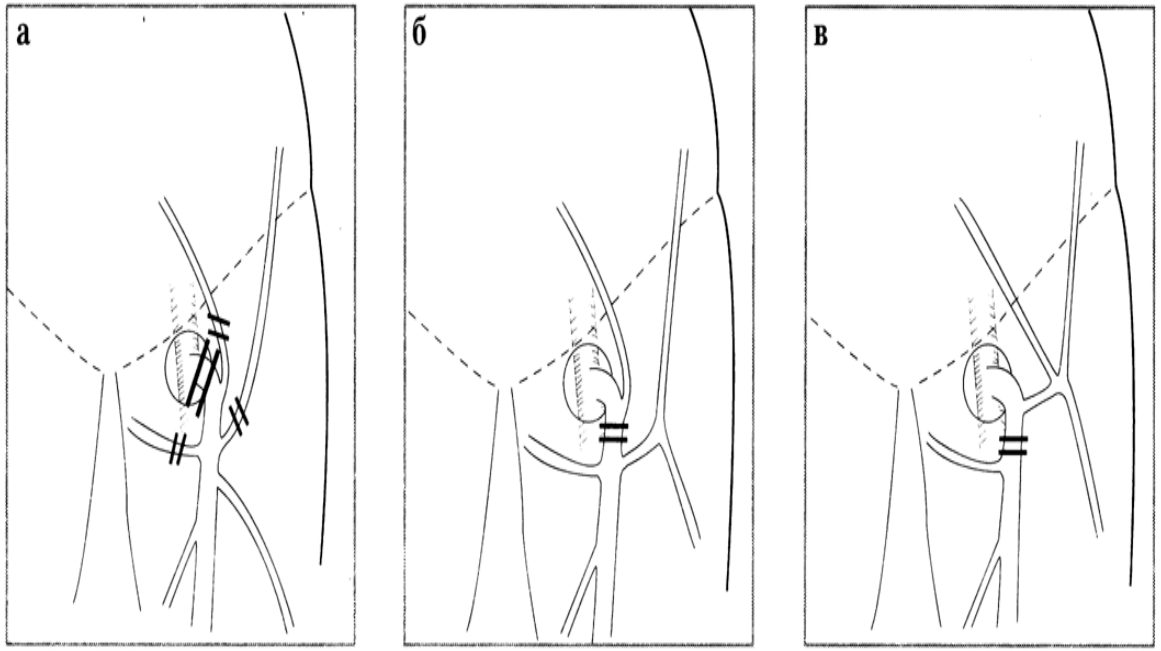


- **Troyanov–Trendelenburg surgery** – ligation and crossing of the large saphenous vein (v.saphena magna) on the thigh



Crossectomy is a high near–mouth resection of the large saphenous vein with all tributaries

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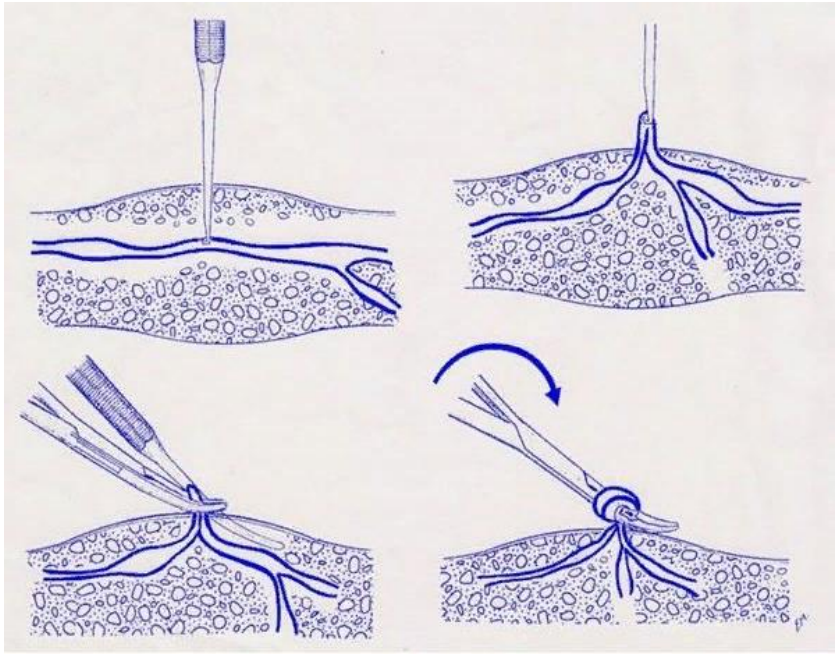

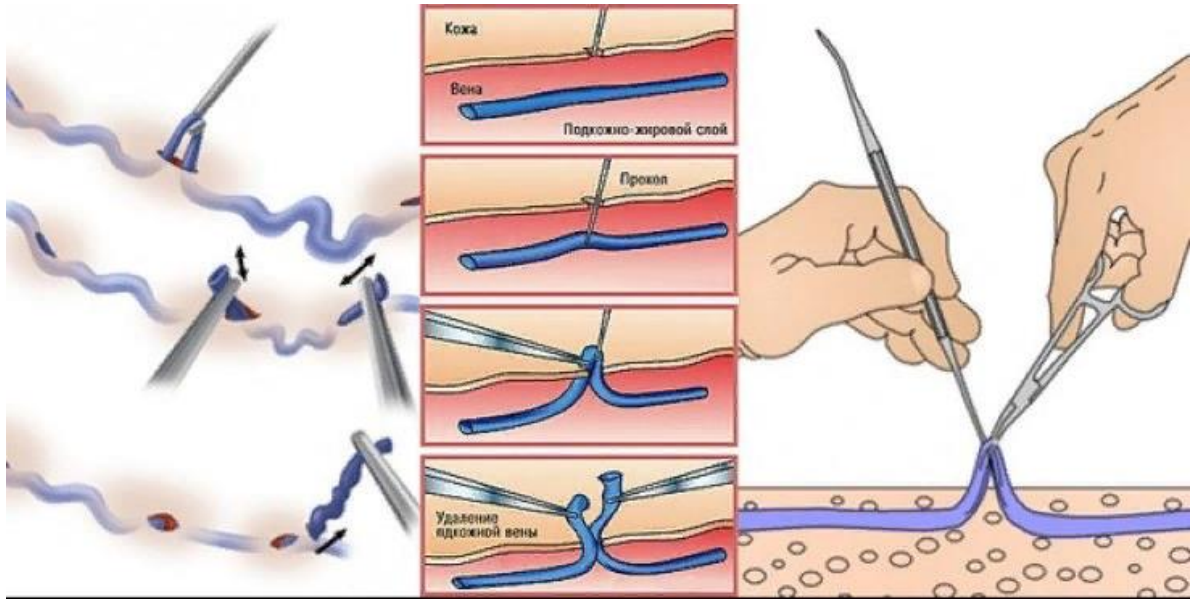

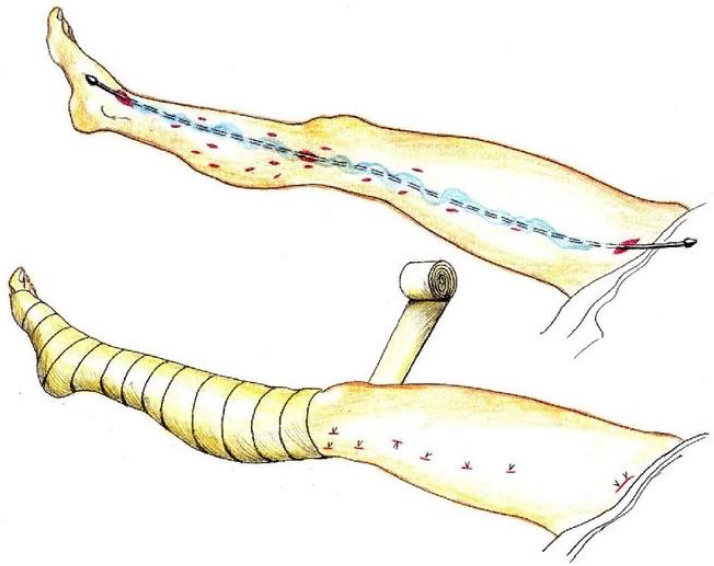

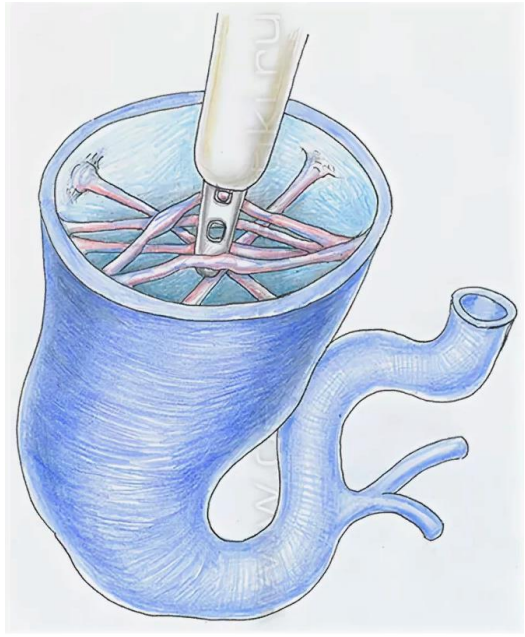

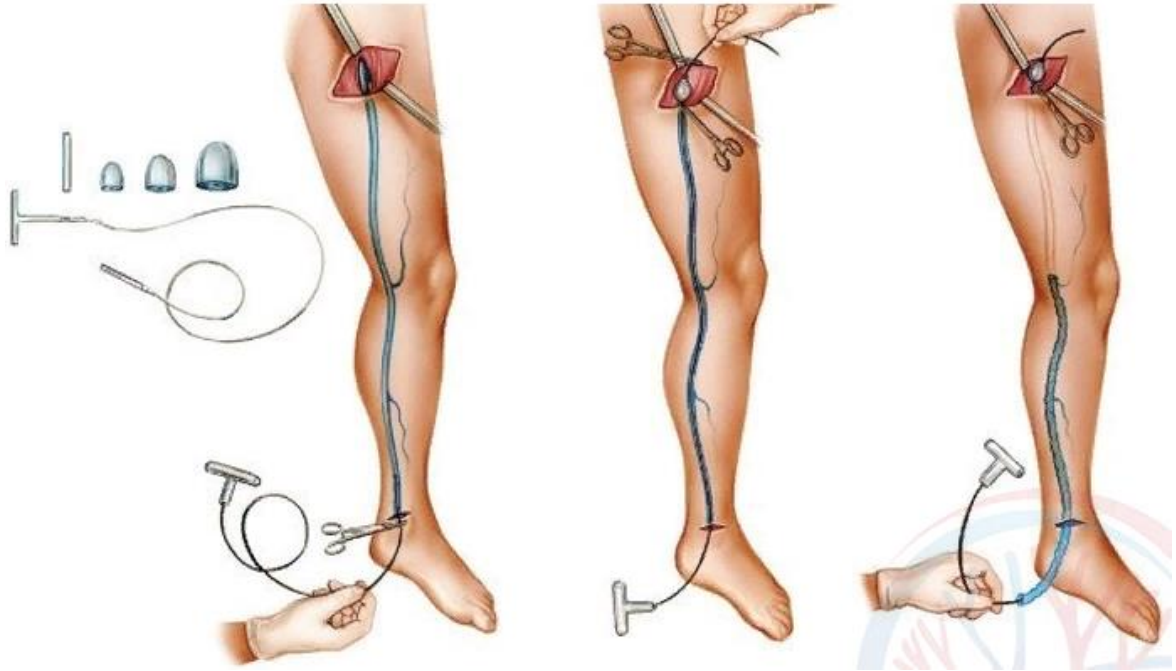

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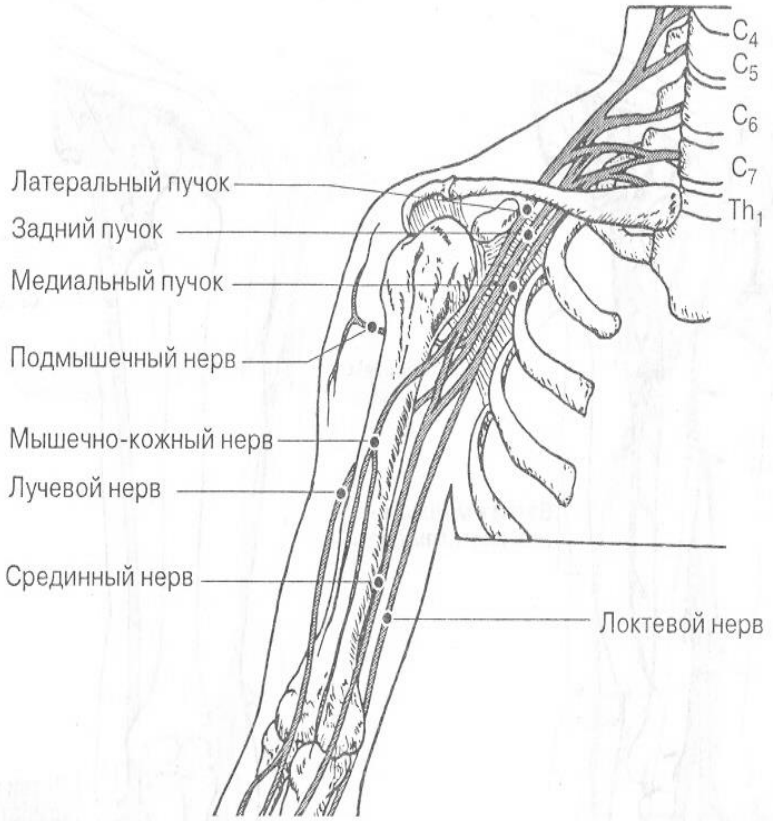
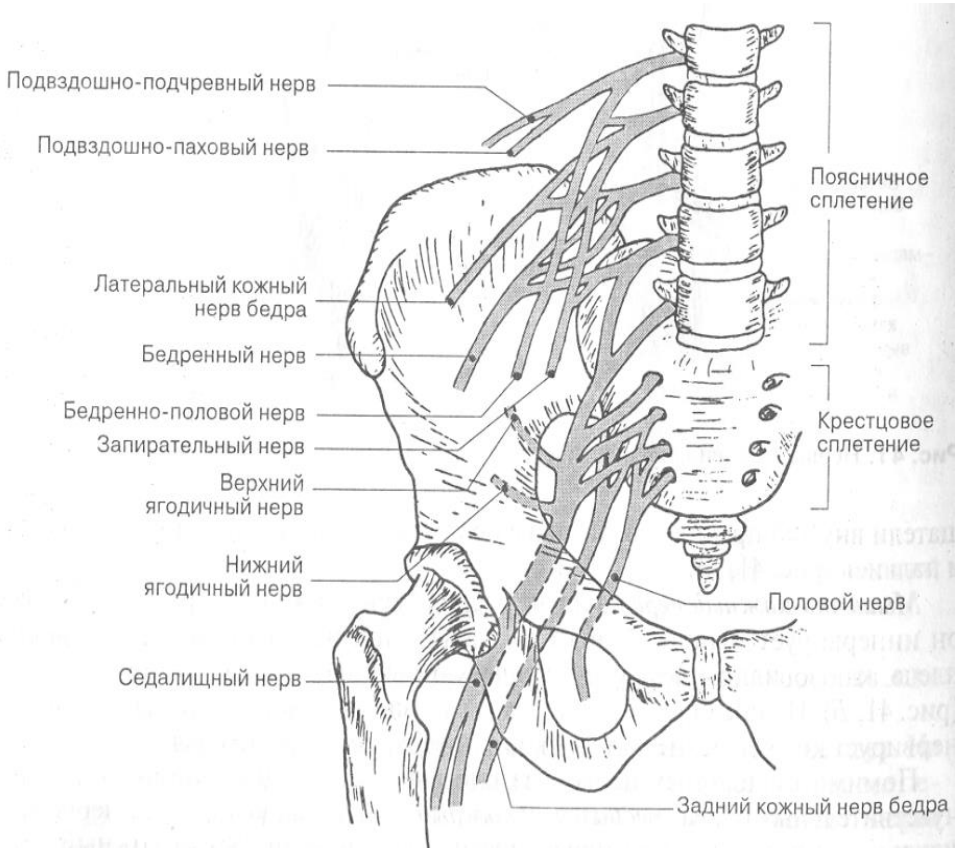
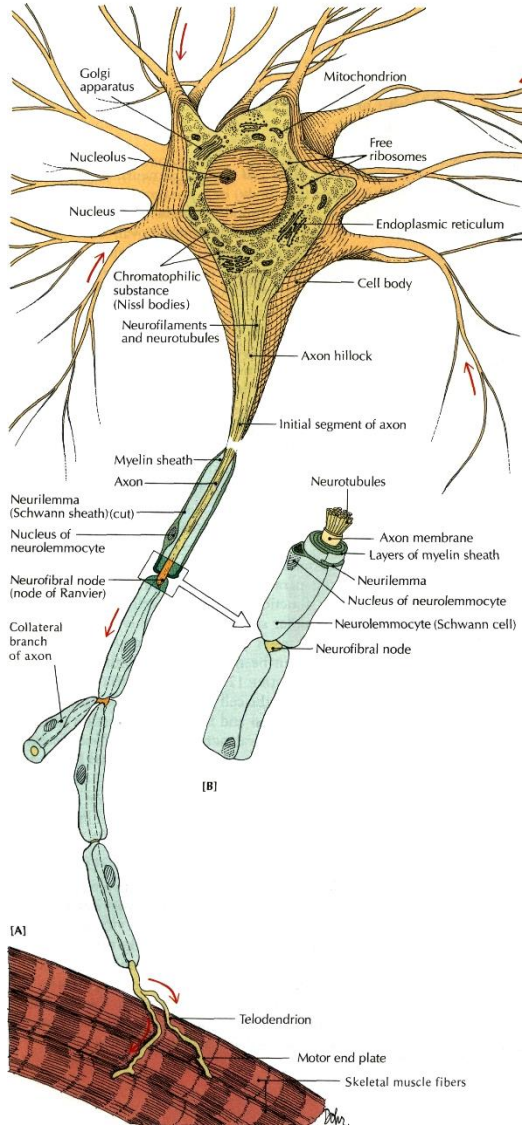
SURGICAL INTERVENTIONS ON PERIPHERAL NERVES

Cervical and brachial plexus



Lumbar and sacral plexus





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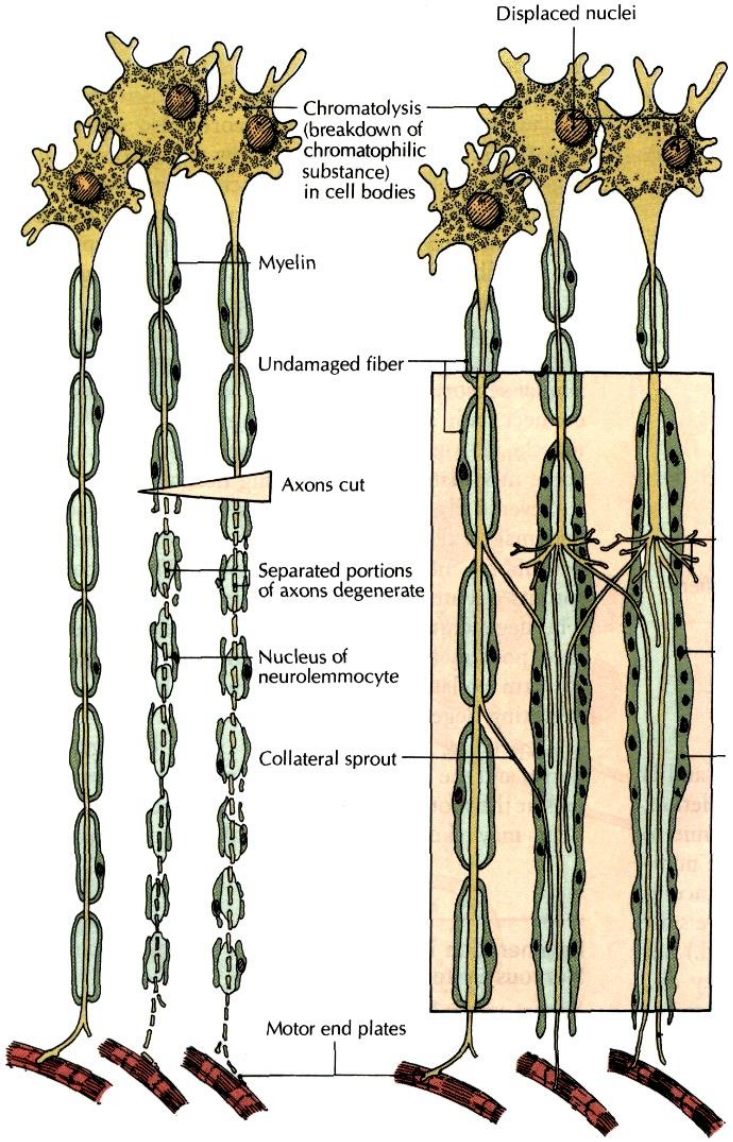
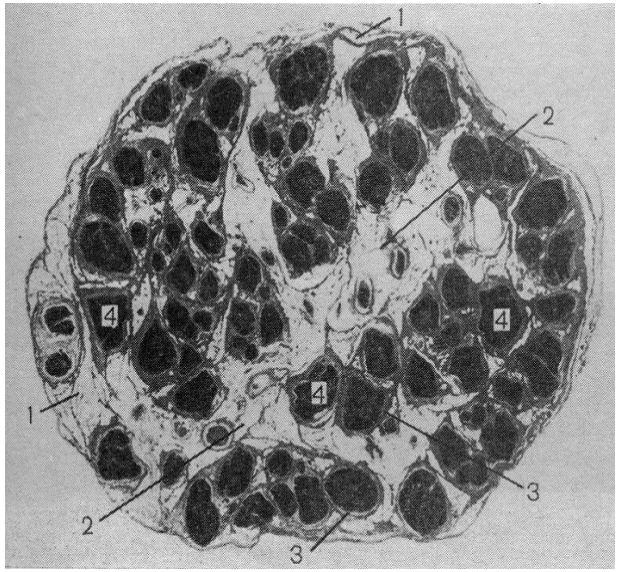
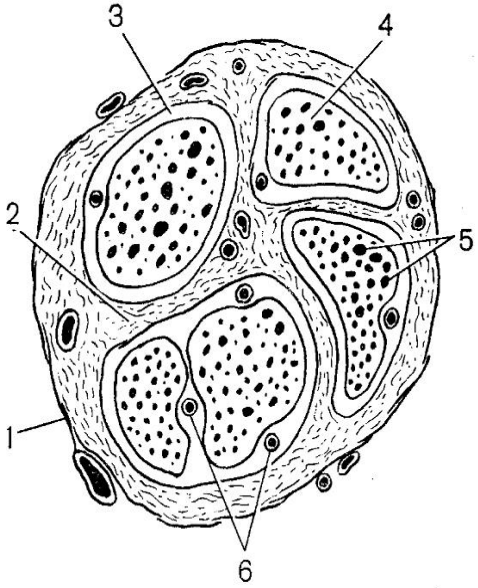
OPERATIONS ON PERIPHERAL NERVES (types)

1. ***Neurolysis***
2. ***Nerve suture***
3. ***Nerve plasty***







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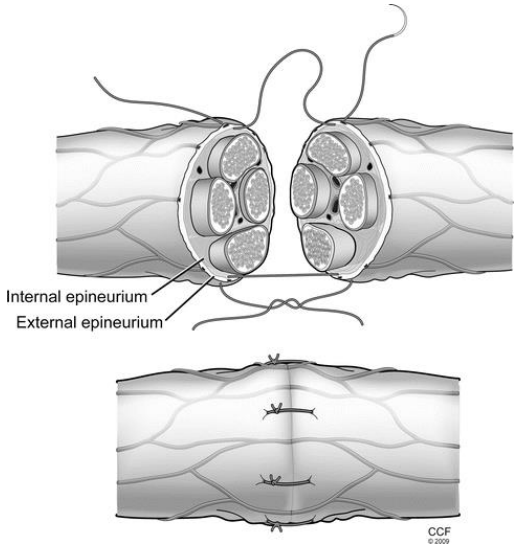
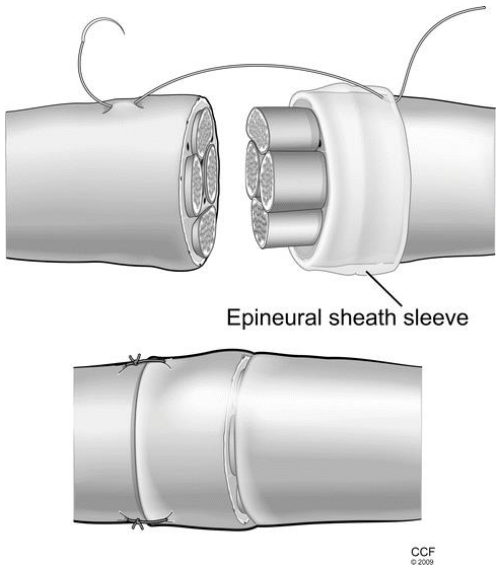
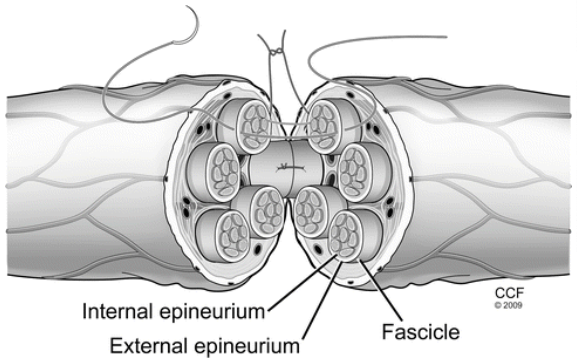
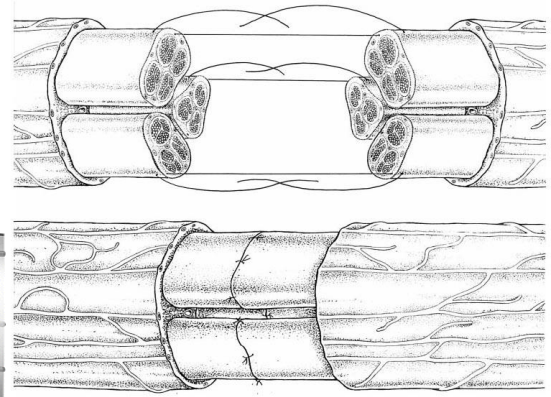
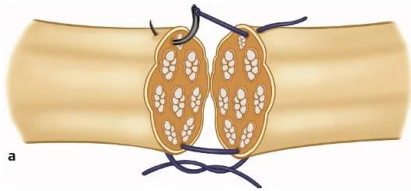
Nerve suture

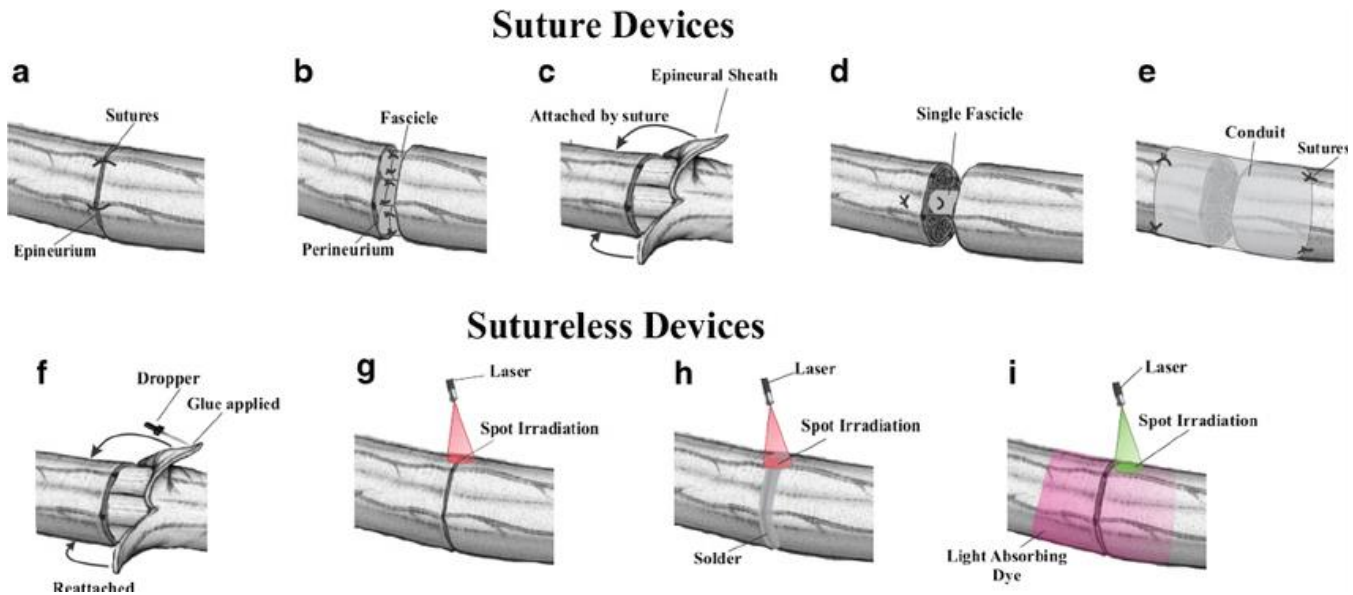












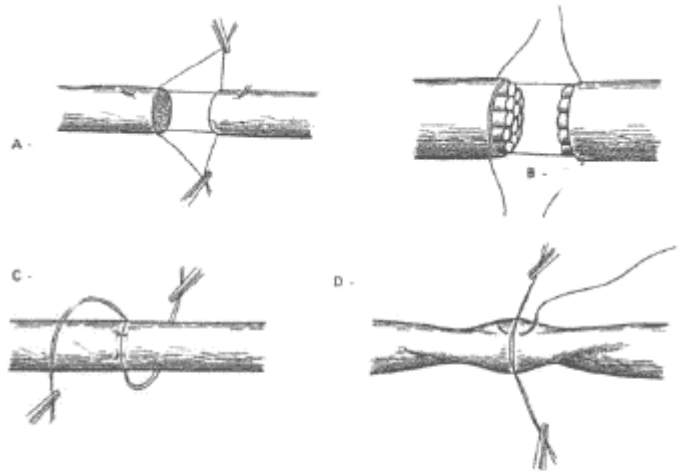
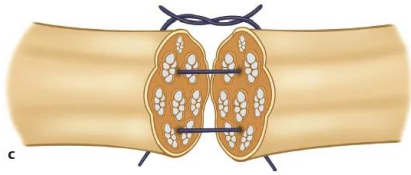
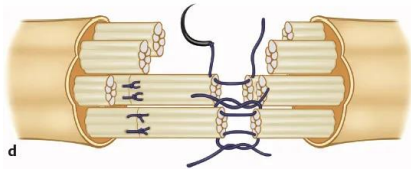


Figure 13 - Epineural conventional suture - Courtesy Goth, F.S. [15]
A - support stitches
B - positioning of the stumps
C - rotation of the nerve
D - back suture





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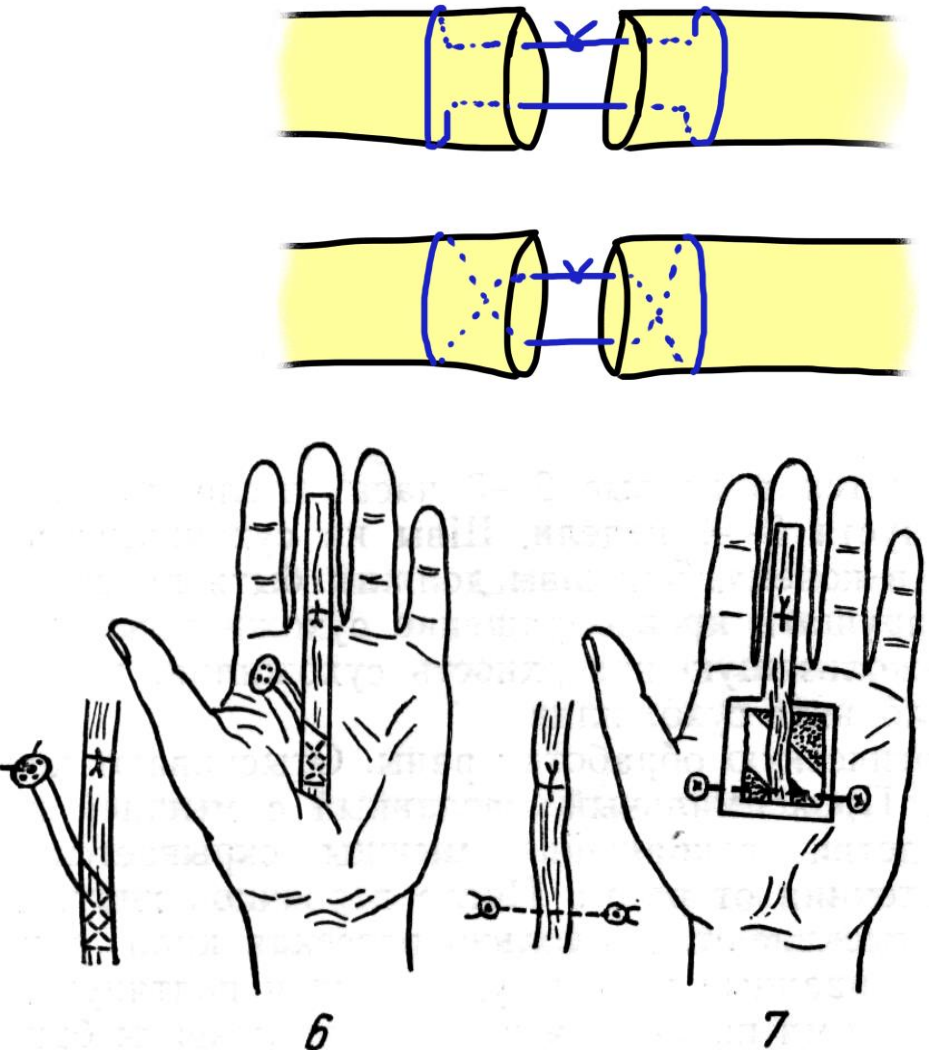
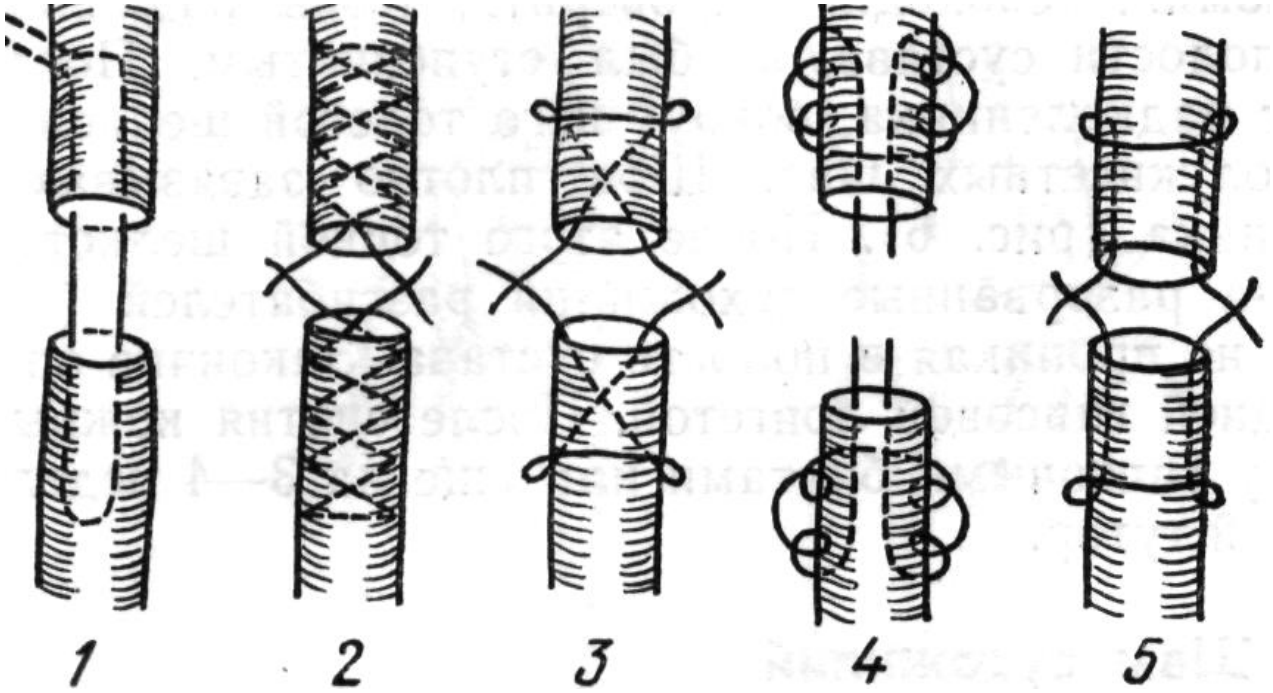
TENDON SUTURE





1- Lange, 2- Cuneo, 3- Bloch-Bauer, 4- Kazakov, 5- Pink, 6- Bennell, 7- Doletsky-Pugachev