UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
"NICOLAE TESTEMIȚANU" DIN REPUBLICA MOLDOVA

Hemorrhage and hemostasis

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Definition

Haemorrhage **or** ***bleeding*****, is the leakage of blood from the blood vessels into the tissues and cavities of human body or outside, as the result of an injury or defect in the permeability of the blood vessel wall.**

Etiology

1. Injury /Trauma [+ operations]-It commonly results in tearing or cutting of a blood-vessel-integrity of wall breached

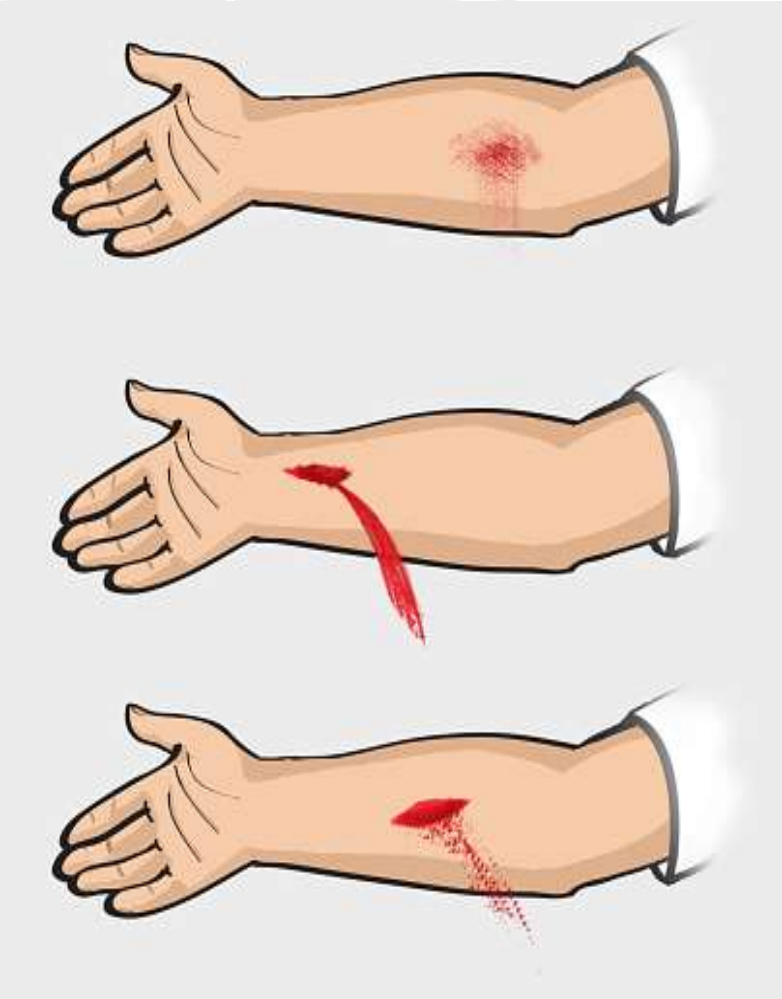
2. Diseases that alter coagulation

- **Congenital :**
  - **Platelet defects**
  - **Coagulation factor defects**
- **Acquired:**
  - **Scurvy**
  - **Sepsis**
  - **Disseminated intravascular coagulation syndrome (DIC)**

Classification of bleeding

1. Anatomical classification (according to kind of bleeding vessel):

- Arterial hemorrhage
- Venous hemorrhage
- Capillary hemorrhage
- Parenchymatous hemorrhage

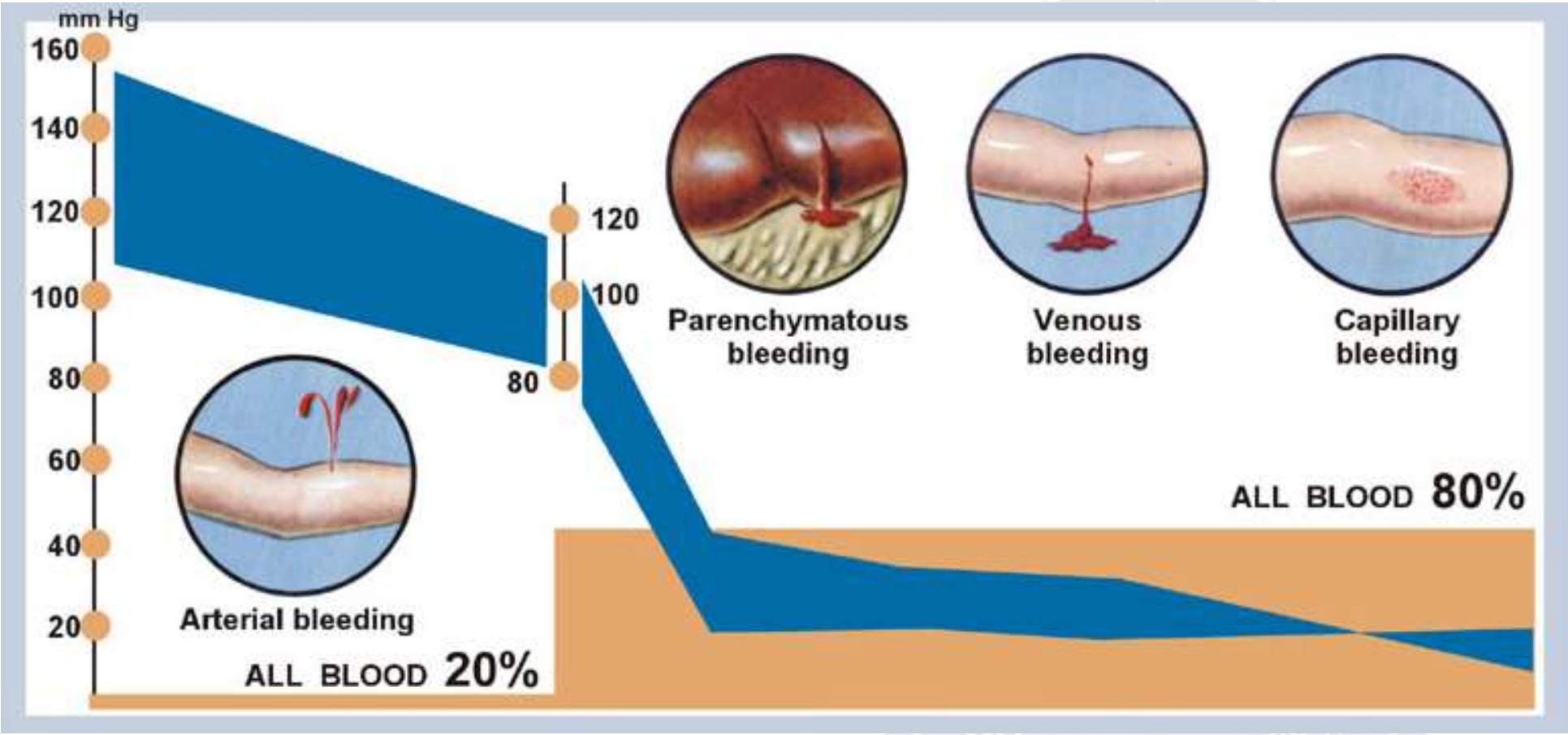


Classification of bleeding

2. By mechanism(in latin):

- Per rhexin (vessel rupture)
- Per diabrosin(arrosive hemorrhage - during suppurative melting of vessel wall)
- Per diapedesin(diapedetic hemorrhage - increased permeability of the vascular walls)

Classification of bleeding



Classification of bleeding

3. By site:

- External bleeding
- Internal bleeding:
  - Intraluminal
  - Intracavitary
  - Intratisular

4. By time of appearance:

- Primary bleeding (begining imediatly after injury)
- Secondary bleeding:
  - Early secondary bleeding - begining early after injury, in the firs hours or days after trauma, but before puss infestation of the wound.
  - Late secondary bleeding – that beginning after development of the infection in the wound.

Classification of bleeding

5. By evolution:

- Acute
- Chronic

6. By grade of severity:

Mild - loss of 10-15% (500-700ml) of circulatory blood volume

Moderate - loss of 15-20% (1000-1400ml) of circulatory blood volume

Severe - loss of 20-30% (1500-2000ml) of circulatory blood volume

Massive - loss of >30% (>2000ml) of circulatory blood volume

Body's response to hemorrhage

- Bleeding generally becomes dangerous, or even fatal, when it causes hypovolemia (low blood volume) or hypotension (low blood pressure).
- In chronic bleeding the loss of CBV even about 50% may not have a risk for patient life.
- In acute bleeding the loss of CBV about 40% is considered to be incompatible with life

Body's response to hemorrhage

Hemorrage

↓

Decreasing of CBV + Anemia

↓

Hypotonia (Hypovolemic shock)

Hypoxemia

Tissue hypoxia (CNS, heart)

Body's response to hemorrhage

I. Adaptive reactions (develop as a response of the organism to decreasing CBV):

- Spasm of veins
- Interstitial fluid inflow
- Tachycardia
- Oliguria
- Hyperventilation
- Peripheral arteriolospasm
- Sympaticoadrenal system activation
- Activation of fibrinolytic system and hemopoiesis stimulation
- Centralization of circulation

Body's response to hemorrhage

II. Pathological disturbances:

- Sequestration of about 10 % of blood in capillary bed(decentralization of circulation)
- Aggregation of erythrocytes and platelets – blockage of capillary circulation
- Tissue hypoxia and acidosis
- Decreasing of myocardial contractibility
- Interstitial pulmonary edema(shock lungs)
- Acute renal failure (decreasing of blood pressure in renal arteries)
- Ischemic necrosis of hepatic tissue

Clinical manifestations

I. General symptoms (are common for all types of bleeding and depend of the volume and the speed of blood loss)

1. Subjective symptoms (complaints): Weakness, Dizzines, Anxiety, Nausea.

2. Objective symptoms (clinical findings):

- Tachycardia
- Hypotension
- Paleness
- Dyspnea
- Oliguria
- Drowse
- Depression

Clinical manifestations

II. Local symptoms (differ by type of hemorrage):

- Haemobilia – haemorrhage from biliary ducts;
- Haematuria - haemorrhage from kidneys and urinary system;
- Haemoperitoneum - haemorrhage in abdominal cavity;
- Haemothorax - haemorrhage in pleural cavity;
- Haemopericardium - haemorrhage in pericardial cavity;
- Haemartrosis – haemorrhage in joint cavity;
- Metrorrhagia – uterine bleeding;
- Proctorrhagia – rectal bleeding;
- Hemorrhagic insult – cerebral hemorrhage
- Etc.

Diagnosis

Main laboratory tests used in diagnosis of bleeding:

- Red blood count (RBC) normal value 4,0-5,0x10^{12}/g
- Hemoglobin level(Hb) normal value 125-160 gr/l
- Hematocrit(Ht) normal value 44-47%

Hypovolemic shock

- is an emergency condition that refers to a medical or surgical condition in which severe blood and fluid loss makes the heart unable to pump enough blood to the body and results in multiple organ failure due to inadequate circulating volume and subsequent inadequate perfusion.
- Most often, hypovolemic shock is secondary to rapid blood loss (hemorrhagic shock).
- Two common causes of rapid internal blood loss are solid organ injury and rupture of an abdominal aortic aneurysm.
- Hypovolemic shock can result even from refractory gastroenteritis and extensive burns.

Hypovolemic shock

Symptoms:

- cold or clammy skin
- pale skin
- rapid, shallow breathing
- rapid heart rate
- little or no urine output
- confusion
- weakness
- weak pulse
- blue lips and fingernails
- lightheadedness
- loss of consciousness

Hypovolemic shock

Diagnosis :

- blood testing to check for electrolyte imbalances, kidney, and liver function
- CT scan or ultrasound to visualize body organs
- echocardiogram, an ultrasound of the heart
- electrocardiogram to assess heart rhythm
- endoscopy to examine the esophagus and other gastrointestinal organs
- right heart catheterization to check how effectively the heart is pumping
- urinary catheter to measure the amount of urine in the bladder

Hypovolemic shock

Principles of treatment:

- Replenish the blood lost and improve circulation by blood plasma transfusion, platelet transfusion, red blood cell transfusion, intravenous crystalloids
- Administration of vasopressors that increase the heart's pumping strength to improve circulation such as dopamine, dobutamine, epinephrine, norepinephrine
- Treating the injury or illness that caused the shock, if possible
- Antibiotics may be administered to prevent septic shock and bacterial infections

Hemostasis

- („hemo”=blood; sta=„remain”) is the stoppage of bleeding
- 2 types:

1. Spontaneous hemostasis(physiologic hemostasis)
2. Artificial hemostasis

Spontaneous hemostasis

1.Primary hemostasis:

- Constriction of damaged vessel
- Adhesion of platelets to vascular wall in site of injury and platelet aggregation (platelet clot formation)

2. Secondary hemostasis:

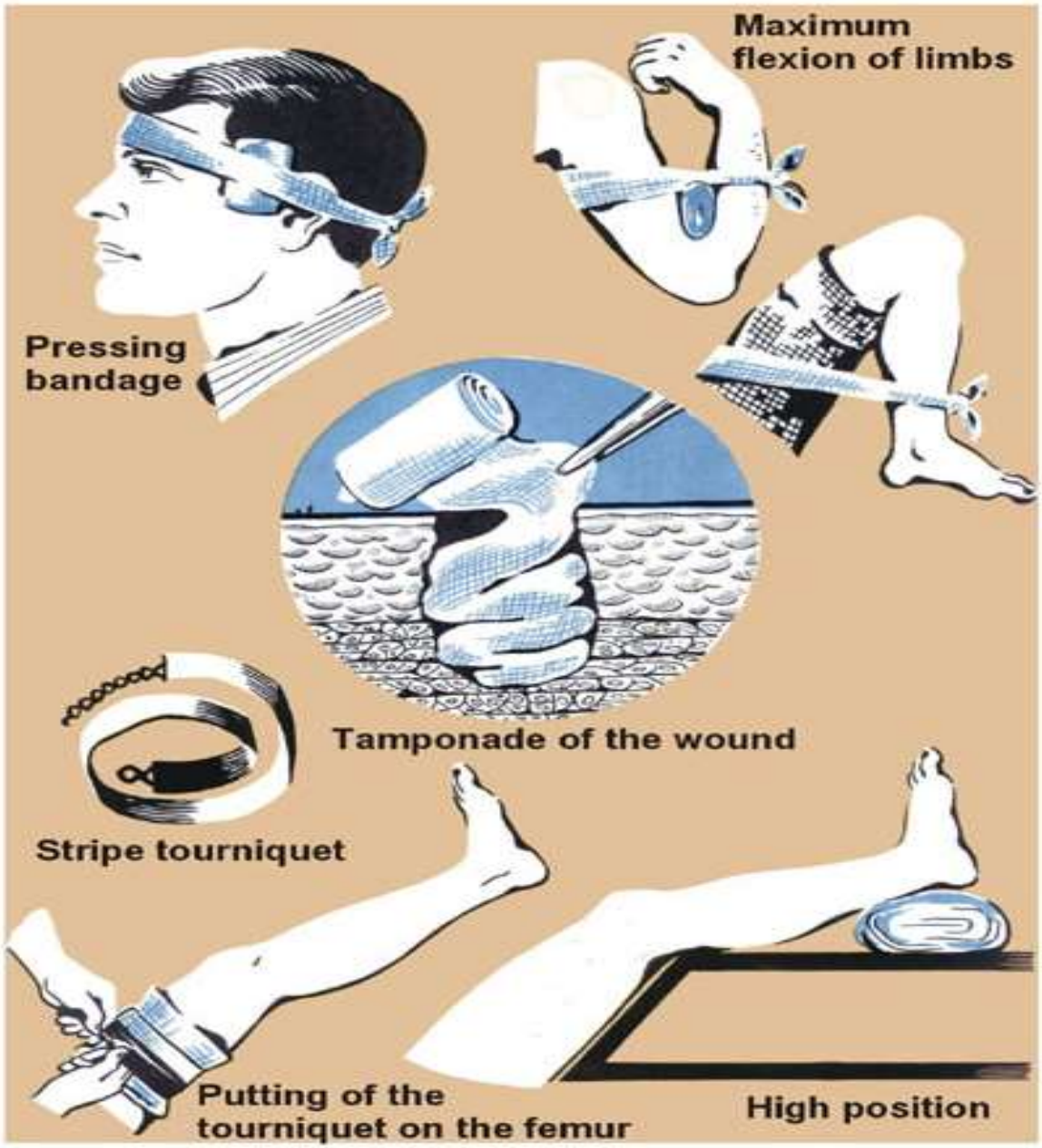
- Interaction between platelet clot and erythrocytes and coagulation factors from plasma
- Retraction of blood clot
- Fibrinolysis

Artificial hemostasis

1. Temporary hemostasis:

- Digital compression of bleeding vessel
- Hemostatic tourniquet application
- Compressive bandage
- Elevated position of extremity
- Application of hemostatic forceps

Artificial hemostasis



Artificial hemostasis. Definitive hemostasis

2. Definitive hemostasis:

Mehanical methods:

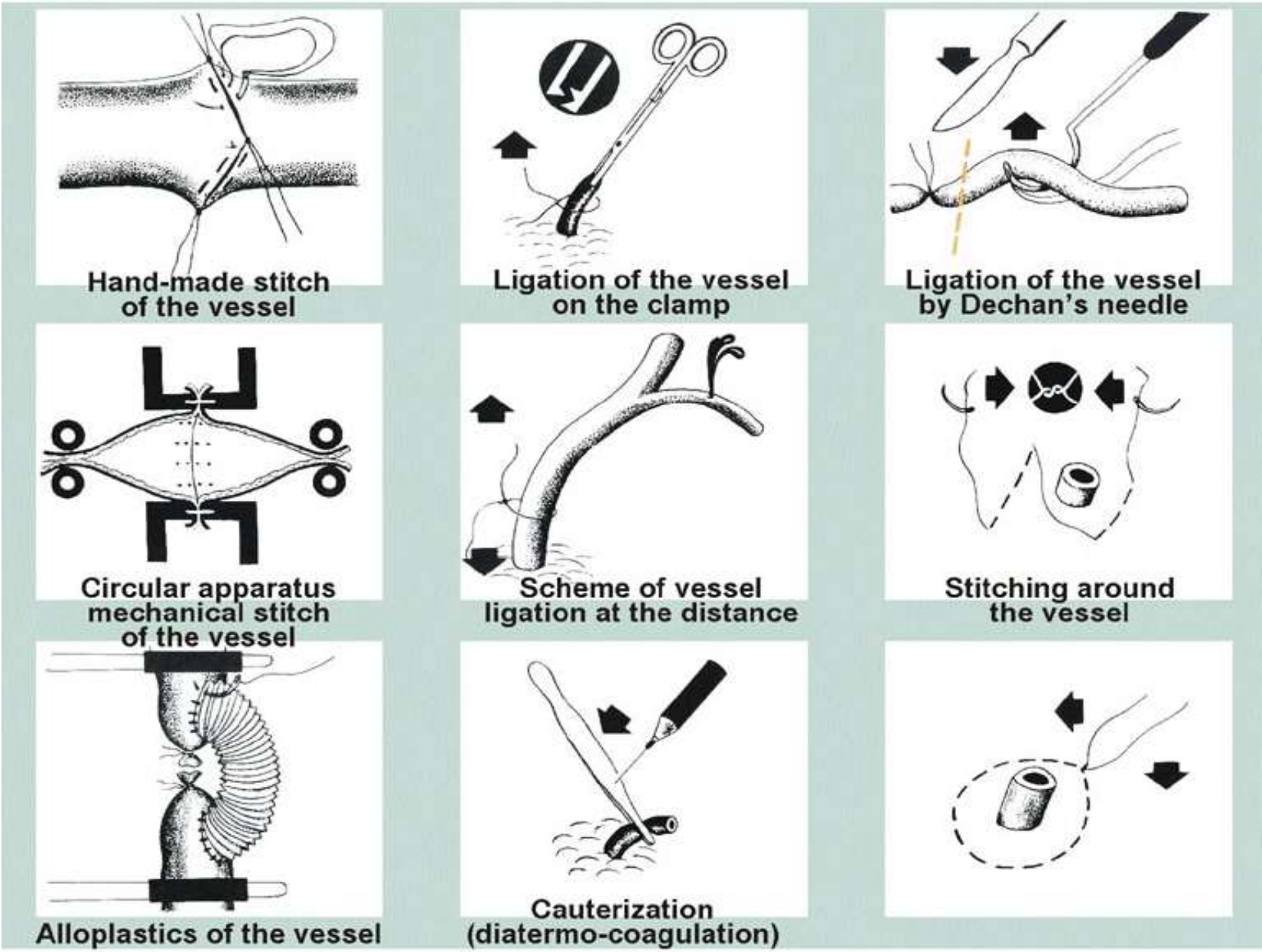
- Ligating a vessel in a wound
- Ligating a vessel at a distance
- Under-running a bleeding vessel
- Vasoversion, a crush of a vessel
- Tamponade of a wound (cavity), a pressure bandage (serves as a temporary method, but sometimes - as a final method to control bleeding)
- Embolization of vessel
- By - pass operation.

Artificial hemostasis. Definitive hemostasis

Physical methods

- Action of low temperature (a local hypothermia, a cryosurgery)
- Action of high temperature (action of hot solutions, a electrocoagulation, a laser photocoagulation, a plasma scalpel)

Artificial hemostasis. Definitive hemostasis



Artificial hemostasis. Definitive hemostasis

Chemical hemostasis:

- Local hemostatics (hydrogen peroxide, vasoconstrictive agents, inhibitors of a fibrinolysis, gelatine preparations, wax);
- Hemostatics of absorbtion action (inhibitors of fibrinolysis, calcium chloride, an agent which accelerate formation of a thromboplastin, substances of specific action - Pituitrinum, synthetic analogues of vitamin K, substances which normalize a vessel wall permeability).

Artificial hemostasis. Definitive hemostasis

Biological hemostasis:

1. The tamponade of the bleeding wound with patient's own tissues (omentum, muscular tissue, subcutaneous fat, fascia)
2. Blood, plasma, serum, fibrinogen and antihemofilic globulin transfusion.
3. Vitamine administration.
4. Local application of blood derivates (trombin, haemostatic sponge, isogenic fibrinous film, biological antiseptic pack, etc.)

Hemorrhage and hemostasis

Thank you !!!