Bleeding

Bleeding *(hemorrhage)* means the exit of full blood outside the vessels.

Symptoms of bleeding disorders (primary vs secondary hemostasis):

Disorders of primary hemostasis (Inherited vs Acquired):

Division of bleeding

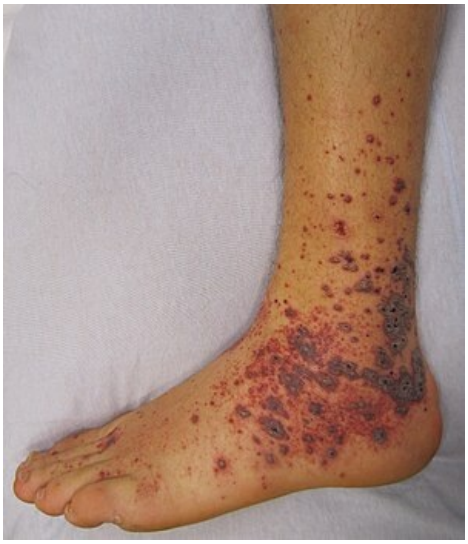
1. **according to the site of bleeding**: **erternal** – directly through the skin to the surface, but also to internal organs and systems that are connected to the external environment (bronchi, GIT, urinary tract, female genitalia); **internal** – bleeding into body cavities, soft tissues – hematoma, joints;
2. **traumatic** (result of injury), **non-traumatic** (gynecological,, rupture aneurysm, esophageal varices etc.);
3. **arterial** (blood light red, squirts), **venous** (blood dark red, flows out), **capillary** (blood leaks);
4. **according to pathogenesis:**
    1. per rhexin – blood vessel rupture (trauma, aneurysm rupture);
    2. per diabrosin – erosion of a vessel by a pathological process (tumor, ulcer);
    3. per diapedesin – permeation of blood through enlarged pores between capillary endotelium (toxic damage to capillaries, venostasis);
5. **according to time onset:**
    1. primary – occurring immediately after the injury;
    2. secondary – only in the further course after the injury (through the release of a thrombus, rupture of a necrotic vessel wall, two-stage rupture of the spleen);
6. **according to macroscopy:**

    - Petechiae – point-like hemorrhages in the skin, mucous membranes, serosas (bleeding conditions).
    - Ecchymosis – a larger subcutaneous swelling ("bruise").
    - Purpura – confluent petechiae.
    - Suggilation – widespread eruption in the skin and subcutaneous tissue (bruise, contusion) or in the mucous membrane.
    - Suffusion – more extensive eruption (bigger bruise).

- Hematoma – a larger compact deposit of swollen blood, compressing the surrounding tissue, raising the surface in the skin and subcutaneous tissue.

- Apoplexy – fragmentary bleeding (e.g. cerebral apoplexy).
- Hemocephalus – bleeding into the ventricles of the brain.
- Hematomyelia – bleeding into the spinal cord.
- Hemorhachis – blood is in the epidural space of the spinal canal.

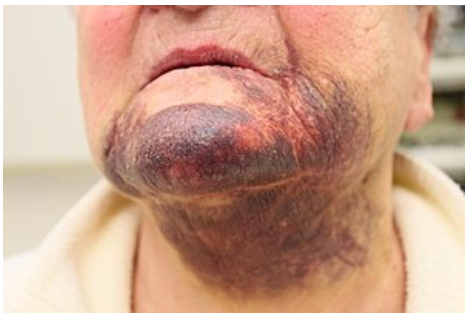
- Epistaxis – nosebleeds.
- Hemoptysis – blood in the sputum.
- Hemoptoe – coughing up blood.



Petechiae (small dots) turn into purpura (larger spots) in vasculitis

- Hematemesis – vomiting of blood (red - esophageal varices, digested - gastric or duodenal ulcer, tumor).
- Enterorrhagia – into the lumen of the intestine, red blood in the stool (tumor, ulcer, esophageal varices).
- Melaena –into the lumen of the intestine, digested black blood in the stool (ulcer, esophageal varices).

- Hematuria – blood in the urine (glomerulonephritis).
- Metrorrhagia – bleeding from the uterus outside the cycle (tumor).
- Menorrhagia – abnormally heavy menstrual bleeding.
- Hematometra – blood in the uterus.
- Hematosalpingx – blood in the uterine tube.



Hematoma

- Hemoperitoneum (hemascos) – blood in the peritoneal cavity.
- Hemothorax – blood in the pleural cavity.
- Hemopericardium – blood in the pericardial cavity.
- Hemarthros – blood in the joint (trauma, hemophilia).

Consequences of bleeding

1. **local** – oppression of surrounding structures by the formation of a hematoma (epidural hematoma oppressing the brain, hemopericardium causing cardiac tamponade,, hemothorax oppressing the lungs, compartment syndrome on the limbs), formation of a pseudoaneurysm;
2. **gerenal** – hypovolemia (shock), lack of blood in tissues (ischemia), posthemorrhagic anemia.

The fate of the hematoma

1. Partial resorption;
2. organization of granulation tissue – non-specific granulation tissue grows into the hematoma along the fibrin fibers from the edges, in smaller hematomas it permeates the entire hematoma and it turns into a rust-colored scar. In the case of larger hematomas, the central part of the hematoma usually liquefies before the fibrin fibers have been replaced by granulation tissue – which then creates a fibrous capsule around the liquefied hematoma – a posthemorrhagic pseudocyst is formed (it can osmotically absorb water and thus increase in size, e.g. in chronic subdural hematoma), or posthemorrhagic hygroma after discoloration.

Stopping the bleeding

1. Spontaneous (primary and secondary hemostasis, resulting in the formation of a thrombus);
2. medical intervention;
    1. **temporary** (compression of a bleeding vessel in the wound or supply vessel, pressure bandage, tourniquet, tamponade in the wound, fixation of the limb in a flexed position);
    2. **definitive** (surgical treatment of an injured vessel – ligature, vascular suture, coagulation, prick by a needle, suture of a parenchymatous organ).

First aid for bleeding

1. Compression of the bleeding vessel directly in the wound (fingers, through a mule or tampon);
2. compression of the supply trunk against a hard base (bone) at pressure points;
3. applying a pressure bandage (cover layer, pressure layer - several turns of the bandage, outer layer);
4. tourniquet application (it is necessary to record in writing the time the tourniquet was applied, apply the tourniquet only after the 3rd pressure bandage has soaked through, NEVER release the tourniquet after application, leave it to the medical personnel)
5. autotransfusion or Trendelenburg (anti-shock) position with raised lower limbs;
6. ensuring venous access, infusion (first colloids, then crystalloids and possibly blood derivatives).

estimation of blood loss (onset of shock – limit at BP below 100 mmHg, pulse over 100/min)

blood loss in %	pulse (beats/min)	BP (mmHg)	diuresis (per day)
10	standard (72)	standard (120)	standard (1,5 l)
20	over 100	below 100	oliguria (below 500 ml)
35	over 120	below 90	anuria (below 100 ml)
50	over 120	below 60	anuria (below 100 ml)

shock index=$\frac{pulse}{BPsyst}$ (standard: 60 / 120 = 0,5, onset of shock 100 / 100 = 1, shock 120 / 60 = 2)

Stopping the bleeding during surgery

1. Compression of the bleeding site with a tampon moistened in warm physiological solution;
2. angiotripsy (bruising of the vessel end), angiotorsion (twisting of the vessel end);
3. electrocoagulation;
    1. direct monopolar electrocoagulation – we touch the bleeding vessel with the probe (the other pole – the electrode placed on the patient's limb);
    2. indirect bipolar electrocoagulation – we touch the ticks holding the blood vessels with the probe;
4. ligature (simple ligature), prick by a needle (we also use the needle to capture tissues around the bleeding vessel), puncture ligature;
5. vascular reconstruction – simple suture or with a patch, we sew a completely interrupted vessel end-to-end or with a replacement with a vein graft (interpositum or bypass);
6. ligation or compression of the supply vascular trunk (e.g. Pringle touch - compression of the hepatoduodenal ligament during liver rupture);
7. tamponade with masks (e.g. perihepatic tamponade - packing);
8. bone bleeding – Horsley wax pressed into spongiosa;
9. bleeding from cerebral vessels - loading of Cushing clamps;
10. resection of the bleeding organ – spleen, part of the liver, stomach – in case of unstoppable massive bleeding;
11. exposure to heat (irrigation of the peritoneal cavity with a warm physiological solution) and cold (irrigation of the stomach with a cold physiological solution in case of erosive gastritis).

- We ligate small vessels with an absorbable fiber, larger ones with a non-absorbable one;
- vascular sutures are performed with atraumatic non-absorbable fiber;
- when interrupting an artery and a vein, first sew the vein, then the artery;
- if it is necessary to sever an artery during surgery, we either ligate it with a Deschamps needle and cross between the ligatures, or apply vascular clamps, cross the vessel between them and then ligate;
- during operations on the limbs (amputation, hand surgery) we use the so-called **operation in bloodless terrain** – the limb is elevated and covered as proximally as possible with Martin's bandage (we leave it on for a maximum of 2 hours), before closing the surgical wound we loosen the compression and carefully stop all bleeding.

Special types of bleeding and their stopping

- **Bleeding into the GIT** (esophageal varices, stomach ulcers);

1. ***volume and oxygen therapy***;
2. ***pharmacotherapy***;
    1. vasoconstriction – vasopressin, terlipressin (Remestyp);
    2. substances that reduce blood flow to the splanchnic – somatostatin, octreotide (Sandostatin);
3. ***endoscopic therapy***;
    1. mechanical means – ligature, metal clips;
    2. injectable agents – vasoconstriction (adrenaline, ornipressin), sclerotization (ethanol, polidocanol), tissue adhesives (Tissucol, Histoacryl);
    3. thermocoagulation means – electrocoagulation, argon beamer, laser;
4. ***mini-interventional radiology***;
    1. embolization;
    2. TIPS (transjugular intrahepatic portosystemic shunt) in portal hypertension;
5. ***surgical treatment***;
    1. local procedures (ligature, prick by a needle, devascularization) up to resection of part of the stomach or esophagus;
    2. surgically established porto-systemic connectors in portal hypertension.

- For **esophageal varices** tamponade with a balloon probe is also possible, for stomach ulcers omeprazole (Helicid – H+ pump inhibitor) is given;
- bleeding from the resection surface of a **parenchymal organ** (liver, kidneys, spleen).

1. ***Performing the resection:***
    1. finger-fracture (digitoclasia), Kelly-fracture, ligatures or punctures of vessels and bile ducts;
    2. RF-assisted resection;

    3. CUSA (ultrasonic dissector), harmonic scalpel;
    4. Water-jet dissector (by a stream of water);
2. ***treatment of the resection area:***
    1. fibrin adhesives (Tissucol) in spray, adhesive collagen plates (Lyostipt, Surgicel);
    2. coagulation techniques (argon beamer, RF coagulation, hot air (Hot-jet coagulator), laser);
    3. parenchymal suture.

- **Procedure for bleeding in liver rupture:**

1. Pringle maneuver (compression of lig. hepatoduodenal);
2. if the bleeding does not stop, it is a rupture of the hepatic veins - a partial (clamping of the relevant hepatic vein) or total (clamping of vena cava inferior above and below the liver) vascular exclusion is performed with subsequent reconstruction;
3. in the case of unstoppable bleeding, temporary perihepatic tamponade with masks with consideration of the next procedure, possibly by transport to a specialized center.

Links

Related articles

- Bleeding (first aid)
- Bleeding from the alimentary canal
- Epistaxis

External links

- Traumatic life-threatening bleeding — interactive algorithm + test (https://www.akutne.cz/algorithm/cs/259--/)

References

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