

# Lecture: "First Aid to the Population in Case of Bleeding during Accidents, Catastrophes, Natural Disasters and Terrorist Acts" of the Subject "Life Safety" for Humanitarian and Technical Universities

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## Annotation

To prepare the population for first aid in emergency situations, algorithms for the basics of didactics of the educational topic "Bleeding" are proposed. The 30-year experience of teaching the subject in humanitarian state educational institutions of higher professional education of a non-medical profile in Syktyvkar is summarized. For each of the considered educational issues, a brief summary of the material presented is given.

## Introduction

The modern concept of a "single preventive environment" involves, on the one hand, the creation of infrastructure [1-6], information and educational [7-12], regulatory, legal, tax and other conditions that allow the population to lead a healthy lifestyle, on the other hand, motivating the population to preservation of health and longevity, the formation of the responsibility of each citizen for their own health and the health of loved ones [13-20].

When considering the educational topic "First Aid to the Population for Bleeding During Accidents, Catastrophes, Natural Disasters and Terrorist Acts", it is advisable to highlight the following educational issues:

1. The concept of bleeding.
2. Classification of bleeding.
3. Methods for temporarily stopping bleeding.
4. Methods for the final stop of bleeding.
5. First (pre-hospital emergency) aid for external and mixed bleeding from internal organs.

## Bleeding

Bleeding is the process of outflow of blood from the wall of a damaged vessel. Bleeding, accompanied by significant blood loss, can occur as a result of both direct injury and a pathological process in the patient's body (purulent fusion of the wall of a blood vessel or a violation of its permeability, acute and chronic stomach ulcers, dilated veins of the esophagus, ectopic pregnancy, disorders in coagulation and anticoagulant blood systems, manifestations due to inflammatory diseases).

The intensity of bleeding depends on the number of damaged vessels, their caliber and the type of damaged vessel (capillary, vein, artery). The most sensitive to blood loss are children and the elderly. Women tolerate blood loss better than men. The total amount of blood in an adult is 4.5–5 liters, which is about 8% of body weight. A healthy adult, as a rule, does not feel the loss of 300–400 ml of blood. The simultaneous loss of 1-1.5 liters of blood is very dangerous and is manifested by the development of a picture of acute anemia. Loss of 50% of blood is fatal. With bleeding, the main danger is associated with insufficient blood supply to tissues, which causes a violation of the functions of organs and, first of all, the brain, heart and lungs.

Bleeding from large vessels leads to death before any symptoms can appear other than a drop in pressure, the disappearance of the pulse and loss of consciousness. If the bleeding does not occur so rapidly, then dizziness, drowsiness, yawning, thirst, pallor of the integument, short-term fainting, cyanosis and acrocyanosis, and anxiety appear. All these phenomena intensify over time and lead to a terminal state. With internal bleeding, blood often leaks out through the urethra, natural openings (nose, mouth, vagina, rectum). Death due to blood loss occurs as a result of paralysis of the respiratory center and cardiac arrest due to severe oxygen deficiency. In debilitated patients (starvation, fatigue,

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neuropsychic trauma, shock, etc.), even a small amount of blood loss can be fatal. Children (especially the first year of life) and the elderly do not tolerate bleeding.

The problem of bleeding is one of the most acute in the modern system of providing first aid (pre-hospital emergency) to victims. According to the UN, the annual number of people injured on the world's roads reaches 10 million, and 350 thousand people died on the spot. More than 900,000 additional people die from post-accident injuries. For comparison: about 500 thousand people die in military conflicts on the planet. The total losses during the Second World War amounted to 50 million people. In Russia, about 30 thousand people die every year as a result of road traffic accidents, hundreds of thousands receive various injuries accompanied by bleeding.

The approximate volume of blood loss can be determined by the location of the damage: fracture of the lower leg - 300-750 ml, forearm - 500 ml, shoulder - 600 ml, skull - 300-750 ml, thigh - 500-1500 ml, severe chest injury - 1500 ml, abdominal trauma - up to 2000 ml, pelvic bones - 1500-3000 ml.

The "threshold of death" is determined not by the volume of blood loss, but by the number of circulating red blood cells. The critical reserve is 30% of the globular volume, and for plasma it is 70%. The body can survive the loss of 2/3 of the volume of red blood cells, but will not survive the loss of 1/3 of the plasma volume. Normally, the volume of circulating blood (VCC) in men is 66.0 ml/kg, in women - 60.5 ml/kg.

## Classification of bleeding

A) in relation to the external environment:

- external - characterized by the outflow of blood into the external environment;
- internal - can occur in the serous cavity (abdominal, pleural, soft tissues (muscles) or the lumen of hollow organs (stomach, intestine, bladder).

The blood poured into the lumen of a hollow organ eventually enters the external environment. Such bleeding is called mixed (gastrointestinal, uterine).

Diffuse blood impregnation of soft tissues is observed in the form of more or less significant hemorrhages. A limited accumulation of blood in soft tissues is called a hematoma.

B) By type of damaged vessel:

- venous - dark-colored blood flows in a continuous stream. Occurs most frequently. Venous bleeding, even very profuse, is well stopped by a tight pressure bandage. If it is soaked through with blood, you need to put another layer of cloth (cotton wool) on top. This will help the doctor determine the amount of blood loss by the thickness of the bandage;
- arterial - blood flows in a scarlet pulsating stream. It is extremely difficult for people who do not have experience to distinguish arterial bleeding from venous bleeding by color in extreme situations. Therefore, the color of the blood does not play a major role in determining what kind of bleeding it is?

If you translate the normal blood pressure of a healthy person 120/80 millimeters of mercury into atmospheric pressure, you get more than 1.4 atmospheres. It is easy to imagine what arterial bleeding will look like when blood begins to gush through a small defect in a damaged artery under a pressure of one and a half atmospheres. It is by the

pressure and height of the fountain of blood that arterial bleeding is unmistakably identified. Delay in providing assistance can lead to the death of the victim. An urgent tourniquet is needed.

- capillary - diffuse bleeding of the entire wound surface without the ability to determine a specific bleeding vessel;
- parenchymal - bleeding from the vessels of the parenchyma of internal organs (liver, kidneys, spleen, pancreas), which lack the ability to collapse, so blood clots do not form. Such bleeding cannot stop on its own;
- mixed (arterio-venous) - with simultaneous damage to the vessels of the arterial and venous bed.

C) By the nature of the action of the agent that causes bleeding:

- primary - bleeding resulting from direct exposure to a traumatic agent;
- secondary - bleeding, as a result of secondary causes - infection in the wound with damage (arrosion) of the vascular wall or the occurrence of bedsores in the vessel wall caused by bone fragments and foreign bodies remaining in the wound.

Secondary bleeding can occur as a result of slippage of the ligature applied to the vessel during the primary treatment of the wound, as well as when the primary thrombus is melted or detached from the damaged vessel, which is more common with wound infection. Secondary bleeding may recur, which is typical for the development of a purulent process.

D) For reasons of occurrence, bleeding can be:

- spontaneous, associated with local pathological processes or general diseases;
- traumatic or post-traumatic;
- operating rooms;
- postoperative (post-manipulation).

D) According to the compensation of bleeding. According to the currently accepted criteria, acute blood loss is divided into two clinical forms - unsharp (compensated) and sharp (decompensated).

With mild (compensated) acute blood loss, both pulse and pressure remain within normal limits, there are no significant changes in the blood picture (erythrocyte count, hemoglobin within normal limits), and the patient's general health remains relatively satisfactory.

Sharp (decompensated) acute blood loss is characterized by severe disorders of the circulatory function up to the development of hemorrhagic collapse. With this form, the sharp pallor of the patient, lethargy, adynamia, reduced reaction to the environment draws attention. The pulse is small, frequent, heart sounds are muffled. Arterial pressure is lowered. Breathing is frequent, shallow.

In the absence of timely assistance, blood pressure drops to a critical level (50 mm Hg), the patient's consciousness becomes confused or completely lost, the skin becomes waxy, the pulse on the peripheral arteries is not palpable, heart sounds are barely perceptible. This indicates the development of hemorrhagic collapse, which can lead the patient to death [21,22].

## Methods for temporarily stopping bleeding

Blood has an important protective property - thrombosis. A clot of coagulated blood (thrombus) clogs the hole in the vessel resulting from

the injury. This can lead to spontaneous stop of bleeding (capillary or venous). There are 8 ways to temporarily stop bleeding [23-26].

**The elevated position of the limb** - is used for capillary and small venous bleeding.

The victim is placed on his back. Under the bleeding limb (arm, leg) enclose a roll of clothing, a pillow. This leads to a decrease in blood flow to the limb and a decrease in pressure in the eyelids, which contributes to the rapid formation of blood clots in the wound, the closure of the damaged vessel by a thrombus and the cessation of bleeding. This method is often used with a pressure bandage.

### Pressure bandage

Comes down to applying a layer of cotton wool rolled into a roller over a sterile napkin and tightly bandaging with circular bandage tours. It is used for venous bleeding and bleeding from small arteries. It is most effective where soft tissues lie in a thin layer on the bones (the integument of the skull, the area of the wrist, elbow, knee, ankle joints, the anterior surface of the lower leg). A sterile gauze napkin is applied to the wound in several layers, over its tight lump of cotton wool (not a roll of bandage or a clean handkerchief folded in a dense roller). Without a gauze pad, cotton cannot be applied directly to the wound. Produce a tight fixation with circular tours of the bandage. A lump of cotton wool (bandage roll) compresses the gaps of the damaged vessels and the bleeding stops. Compressed blood vessels are rapidly thrombosed, so this method of temporarily stopping bleeding can become final.

**Maximum flexion of the limb in the joint** is used when wounds are located at the base of the limb, when it is difficult to apply a tourniquet. For a more reliable stop of bleeding, a cotton-gauze roller is placed in the place of the fold, the maximum bending of the limb is performed, which is fixed in a bent state. This method is effective when the wound is below the joints - elbow, hip, knee. So, for example, when bleeding from the forearm and hand, you need to put a cotton-gauze roller into the cubital fossa, bend the arm as much as possible in the elbow joint and fix the forearm to the shoulder in the flexion position. If the femoral artery is damaged, the limb is bent as much as possible in the hip and knee joints, the thigh is bandaged to the stomach. In case of bleeding from the lower leg and foot, the leg is fixed in the position of maximum flexion in the knee joint.

### Finger pressure of the vessel in the wound

With arterial bleeding, the central (proximal) segment of the damaged artery is clamped. With venous bleeding, on the contrary, the peripheral (distal) segments of the damaged veins are pressed, which are located in the lower corner in wounds on the limbs and torso, and on the neck at the top. Therefore, with wounds on the limbs and torso, tissues are pressed in the upper corner of the wound, and on the neck - the lower one. It is used for arterial bleeding as a method of preparing for the imposition of a hemostatic tourniquet or other methods of stopping bleeding. Pressing the damaged vessel is made with several fingers to the bone in typical places.

This method is the fastest and quite effective, but very tedious for the caregiver, excludes the possibility of transporting the victim to a medical facility and requires considerable effort. Even a physically strong person should use it for more than 10-15 minutes. difficult. Therefore, this method should be considered preparatory for other methods of temporarily stopping bleeding. It makes it possible to gain time to prepare for the arrest of bleeding in other ways, allowing the victim to be transported.

Technique of digital pressing of the artery. The vessel is pressed to the bone with two fingers, and a large artery (femoral artery, abdominal

aorta) is pressed with a fist with the help of the second hand in those places where the artery is located superficially and near the bone. Having pressed the artery, one should not let it go, because the hematoma will displace the vessel and it will be impossible to find it: if the fingers are tired, they are pressed with the second hand. It is good to press the key and femoral artery, it is more difficult to press the carotid and especially the subclavian artery.

Each large arterial vessel has a typical place where it is digitally pressed.

**The superficial temporal artery** is pressed against the zygomatic process of the temporal bone, 1 cm anterior to the ear tragus.

**External maxillary artery** - 2 cm forward from the angle of the lower jaw.

**The common carotid artery** is pressed with two to four bent fingers in the triangle of the same name of the neck to the transverse process of the 6th cervical vertebra. When the victim is lying on his back (providing assistance is from the back), you should turn the head of the wounded person in the opposite direction from the injury. Place the first finger on the back of the neck, and with the rest of the fingers press the carotid artery at the indicated point.

**Subclavian artery** - to the first rib, to the outside of the attachment of the sternocleidomastoid muscle. When the victim is lying on his back (the person providing assistance is facing him), it is necessary to turn the head of the wounded person away from the injury, grab the back of the neck with four fingers, and press the artery with one finger.

**Axillary artery** to the head of the humerus in the axillary fossa.

**Brachial artery** - to the inner surface of the humerus in the groove along the inner edge of the biceps of the shoulder.

**Radial artery** - to the radius at the site of probing the pulse.

**Ulnar artery** (on the opposite side) to the ulna.

**Abdominal aorta** - with a fist to the spinal column at the level of the navel. The victim is laid on his back. The assisting person presses with the fist of the right hand, straightened at the elbow, on the stomach in the midline above the navel, increasing the pressure by grabbing the right wrist with the left hand and the weight of his body.

**Femoral artery** - pressed with a fist to the pubic bone of the pelvis in the middle of the inguinal fold. Pressing is carried out with the first two fingers of the hands with the girth of the thigh. In case of ineffectiveness, you can press the artery in the region of the inguinal fold to the horizontal branch of the frontal bone with the fist of the right hand, increasing the pressure by grabbing the right wrist with the left hand. In obese people, you can press the artery with your knee.

**Popliteal artery** - in the popliteal fossa to the distal epiphysis of the femur.

**The posterior tibial artery** is pressed 1 cm below the medial malleolus.

**Artery of the rear of the foot** - to the bones of the rear of the foot.

**Compression of the vessel throughout (at a distance from the wound or injury site)**

It is not always possible to stop bleeding at the site of injury (wound). Knowing the location of the finger pressure points, this can be done at a certain distance. Compression of the central (proximal) segment of the damaged vessel (proximal) is performed with arterial

bleeding. With injuries of the upper and lower limbs above the wound, with a wound in the neck below it, since here the arterial blood flow is carried out from the bottom up. Compression of the peripheral segment (distal) is performed with venous bleeding. In case of injuries of the upper and lower extremities below the wound, in the neck - above.

**The imposition of a tourniquet** (standard rubber Esmarch, cloth, improvised) [27].

The tourniquet is a rubber band 125 cm long and 3–4 mm thick. One end of the harness has a metal hook, the other has a metal chain. Currently, a new version of the harness is used - a rubber band, at one end of which there are two plastic buttons located along the harness, and at the other - several round holes.

A tourniquet is applied for arterial bleeding, as well as bleeding that does not stop in other ways. It is not applied with pronounced vascular sclerosis and suppurative processes at the site of the tourniquet.

### Rules for applying a tourniquet for arterial bleeding:

1. Before applying a tourniquet in case of arterial bleeding, you should immediately press the central segment of the damaged artery (on the upper and lower extremities - above, on the neck - below the wound) to the underlying bone with your hand.
2. Before applying the tourniquet, the injured limb should be lifted up, otherwise the applied tourniquet turns off a significant amount of blood from the circulation, for example, in an undamaged vein, which is not indifferent to the already existing blood loss.
3. To prevent damage to the skin, take a flat, wrinkle-free lining (a piece of clothing from the victim, a towel, a bandage).
4. The tourniquet is applied as close as possible to the wound, in order to thereby minimize the bleeding area of the limb. To apply a tourniquet, it is necessary to stretch and fix the first round around the limb. The next 2-3 turns of the tourniquet, also after stretching, are applied not to the previous one, but close to the first one. Only subsequent turns of the tourniquet can be superimposed on the previous ones.
5. The overlay tourniquet is located on the outside of the limb. The tourniquet is brought in from the inside. The end with a hook or buttons is placed on the forelimb and directed obliquely upwards. The cone-shaped sharpening of the plastic buttons should be directed outward. The rest of the tourniquet hangs from the inner-lateral surface, in this position the tourniquet is held together with the limb segment with one hand, and the hanging part is taken with the other hand, it is strongly stretched and wrapped around the limb, while pressing the obliquely directed end with the hook (buttons). Fix the first round. The next 2-3 turns of the tourniquet, also after stretching, are applied not to the previous one, but close to the first one. Only subsequent turns of the tourniquet can be superimposed on the previous ones. Gradually reducing the tension of the bundle, subsequent turns partially cover the previous ones. This reduces the risk of skin pinching. The direction of the turns goes from the periphery to the center. The application of the tourniquet is completed by fastening the hook protruding from under the last turn with a chain. If the harness has other fastening elements (plastic buttons and holes), the buttons are pushed into the holes. When stretching the end with holes, the latter lengthen, which greatly facilitates fastening. Under the last turn of the tourniquet, a note is placed indicating the date, time in hours, minutes and the name of the person providing assistance. With a large number of victims, a

note with the time of applying the tourniquet can be written with a marker on ... the forehead (almost always an open part of the body) of the victim. Employees of the Ministry of Emergency Situations believe that this way there are more chances that information will not be lost. After applying the tourniquet, the victim must be given painkillers, because the imposition of a tourniquet is accompanied by the development of severe ischemic pain, immobilize the limb and wrap it up in the cold season. Evacuate the wounded with a tourniquet should be in the supine position, and in the first place. **The maximum time for applying a tourniquet in an adult in the summer is 2 hours, in the winter - 1 hour. In children, these periods are reduced by 2 times, respectively, in summer - 1 hour, in winter - 0.5 hours.** When applying a tourniquet in winter, it is recommended to additionally insulate the injured limb during transportation of the injured to avoid frostbite.

At the same time, every 30-40 minutes. the tourniquet should be relaxed for a few minutes, in the absence of a blood clot and bleeding resumes, switch to finger pressing of the vessel in the wound, and then again apply the tourniquet above the original place to its width. This achieves partial restoration of blood circulation in the limb below the tourniquet.

The tourniquet can be applied to both single-bone (shoulder, thigh) and two-bone (forearm, lower leg) segments of the limbs. On the forearm and lower leg, the vessels are compressed in the interosseous space by the muscles. A tourniquet should be avoided in the middle third of the shoulder, because this can lead to damage to the radial nerve. In addition, due to the lack of muscles in the wrist and above the ankles, when a tourniquet is applied, bleeding from the interosseous artery may continue, and tissue necrosis under the tourniquet often develops in these areas. When bleeding from a wound located in the upper third of the shoulder and thigh, a tourniquet is applied in the form of a figure eight. They start imposing with 2-3 rounds on the upper third of the limb, and then lead along the body, where they are fixed.

**The imposition of a tourniquet on the neck.** When bleeding from the carotid artery, its short-term stop is achieved by finger pressing the artery to the transverse process of the sixth cervical vertebra along the inner edge of the sternocleidomastoid (sternocleidomastoid) muscle. In exceptional cases, a tourniquet may be applied to temporarily stop bleeding from the carotid artery. To prevent compression of the trachea and vessels of the healthy side of the neck, a Cramer splint is placed on this side, which is bent along the lateral surface of the shoulder and neck. With this method, when applying a tourniquet to the neck, it is possible to compress the vessels of the neck from the side of the injury and protect the healthy half of the neck from compression. When applied to the neck, the tourniquet should not be strongly stretched. The necessary force for pressing the carotid artery itself is achieved by placing a small cloth or rubber pad under the tourniquet, which must be glued to the skin at the point of pressing the vessel. In the absence of a Cramer splint, you can put a hand behind your head from the healthy side, bent at the elbow joint, or use an impromptu splint.

**A unique case of emergency care for bleeding from the carotid artery** is described by V. Raskazov in the article "In collusion with death" in the weekly newspaper "Arguments and Facts", No. 12 (753) 03/22/1995, which occurred on the Tajik-Afghan border to the author by doctors of the Dushanbe hospital of the border troops.

"During the battle, an explosion thundered next to Lieutenant Efremov. A fragment hit him in the neck, severing his external carotid artery and vein and hitting his internal ones. One of the soldiers, seeing

the falling lieutenant, rushed to him and pinched the wound with his fingers. The comrades who arrived in time made a dressing and applied a tourniquet.

The weather was non-flying, and Efremov had to be carried on a stretcher. Only after 36 hours did he finally get to the hospital. When the surgeons began to remove the bandage in the operating room, they could not believe their eyes. With such a wound, they live only a few seconds, and here 36 hours. If it were not for the fighter who clamped the wound with lightning speed, the matter would have ended tragically. Lieutenant Efremov was discharged from a hospital near Moscow, where he underwent a course of rehabilitation treatment. But the savior fighter was never found, and Efremov does not know to whom he owes his life ..."

### Classic tourniquet locations:

For wounds of the forearm - the lower third of the shoulder;

For shoulder wounds - the upper third of the shoulder

With wounds of the lower leg - the middle third of the thigh;

With wounds of the knee joint - the middle third of the thigh;

For thigh wounds - the upper third or base of the thigh.

### Signs of a properly applied tourniquet are:

- cessation of bleeding;
- lack of pulse on the peripheral vessels;
- blanching of the skin.

If the limb turns blue, and the bleeding from the wound intensifies, the tourniquet is loosely tightened, it should be immediately shifted. If the tourniquet is overtightened, soft tissues can be crushed, resulting in very severe pain. In this case, it is necessary to carefully relax the tension until the first drops of blood appear in the wound and again, with a little effort, but sufficient to stop the bleeding, tighten the tourniquet.

### The most common mistakes when applying a tourniquet:

- the tourniquet was applied without indications, i.e. the bleeding could have been stopped in another way;
- the tourniquet is applied to the naked body;
- the tourniquet is tightened weakly, as a result, only the veins are compressed, venous congestion occurs, which leads to increased bleeding from the wound;
- excessively strong pulling of the limb can cause damage to the nerve trunk with the development of paralysis or necrosis of the limb;
- the absence of a note indicating the date, the exact time of the application of the tourniquet, as well as the name of the performer;
- transport immobilization was not carried out and narcotic analgesics (promedol, morphine) were not introduced;
- the tourniquet is covered with clothing and a bandage bandage is applied over it. This is strictly prohibited. The harness should be conspicuous.

**Complications arising from the application of a tourniquet.** The most dangerous complication is the so-called **tourniquet shock** is one of the varieties of revascularization syndrome. This severe complication can lead to death. It is due to the entry into the blood of a significant amount of toxins that have formed in the tissues below the tourniquet.

This condition develops after the tourniquet applied for several hours is removed. Excessively tightened tourniquet causes muscle crushing and nerve damage, resulting in persistent paresis, paralysis and muscle atrophy. Prolonged pulling with a tourniquet of a limb (more than 2 hours) leads to its necrosis. In persons who have had a tourniquet applied for a long time, the resistance of infection tissues decreases and their regeneration worsens. Wounds heal slowly and often fester. The cessation of oxygen delivery to tissues creates fertile ground for the development of gas gangrene.

**Stopping bleeding with improvised means (improvised tourniquets)** in the absence of a standard tourniquet at the scene can be carried out: with a rubber bandage (it injures soft tissues less); rubber tube; narrow trouser belt; scarf; scarf; tie; handkerchief; a piece of matter twisted in the form of a strip 2-3 cm wide; etc.

**Do not use tourniquets that are too wide** - they do not allow you to achieve sufficient pressure to compress the artery.

**It is impossible to use** thin ropes and cords, wire, fishing line, threads, strings, thin cable as harnesses, as they can penetrate deep into soft tissues and (or) cut through the skin with vessels not yet damaged. The material used to improvise the tourniquet must be strong, of sufficient length (at least wrap the limb segment twice) and width.

**Improvisation of a hemostatic tourniquet with a belt.** The belt is folded in the form of a double loop - first the outer, and under it the inner. The injured limb is inserted into the internal loop. The caregiver pulls on the free end of the belt. When tightening the belt, both loops rotate clockwise. The left hand supports the segment of the limb and fixes the clothes, preventing the clothes from shifting along with the belt.

**Twisted tourniquet.** An impromptu tourniquet (kerchief, scarf) is folded in the form of a multilayer tape and wrapped around the limb. The ends are tied with a double knot. A stick is inserted between the nodes and, rotating it, the tourniquet is tightened until the bleeding stops completely. To prevent infringement of the skin during twisting and reduce pain, a dense material is placed under the knot. Along the course of the main vessels, a tight cotton-gauze roller or bandage roll should first be placed under the tourniquet-twist. This further contributes to squeezing blood vessels and stopping bleeding. The stick is fixed to the limb with a bandage, a handkerchief, or, if possible, with the ends of an impromptu tourniquet. About the time of applying the tourniquet-twist, a mark must be made according to the general rules for the tourniquet.

**In children under 3 years old**, due to weak muscle development, to temporarily stop external bleeding from the distal extremities, in most cases it is enough to apply a pressure bandage to the injured limb without the use of a hemostatic tourniquet or twist.

**Tight wound tamponade** - used for deep wounds in muscle masses when it is impossible to isolate a bleeding vessel. At the same time, tampons consistently and tightly fill the entire wound.

**The imposition of sterile clamps** is used in outpatient and stationary conditions.

### Methods for the final stop of bleeding

There are four ways [28-30] to finally stop bleeding:

- 1) mechanical;
- 2) physical (thermal);

3) chemical;

4) biological.

#### The mechanical method:

- ligation of the vessel in the wound;
- ligation of the vessel throughout;
- imposition of a vascular suture (circular, mechanical suture with titanium clips, circular suture with Donetsk rings, lateral vascular suture, patching a lateral wound or a defect in the vessel wall, transplantation and prosthetics of blood vessels, etc.);
- pressure bandage;
- tamponade of the wound;
- twisting of the vessel.

The physical method is based on the property of low temperatures to lead to vasospasm and the property of high temperatures to cause protein coagulation and accelerate the formation of a blood clot. To do this, apply a bubble with ice or snow. With bleeding from muscles, parenchymal organs, skull bones, etc. produce irrigation with chlorethyl, use tampons with hot saline. An ultra-high frequency current is often used, which easily causes coagulation of blood proteins and bleeding vessels.

Hot steam, red-hot metal (iron) are also used for local exposure. These two methods are used relatively rarely.

The chemical method is based on the use of vasoconstrictor and blood clotting agents. Vasoconstrictor drugs include:

- epinephrine, applied in a solution of 1: 1,000 topically;
- ergot extract (uterine horns) (25 drops orally 2-3 times / day);
- liquid extract of viburnum vulgare (30-40 drops 3 times / day);
- water pepper extract (30-40 drops 3 times / day);

Of the astringents and cauterizing agents, solutions of silver nitrate 1:200 (for washing the bladder), hydrogen peroxide, tampons moistened with an aqueous solution of ferric chloride are used.

In gynecological practice, pituitrin is used for bleeding from the uterus.

Blood clotting agents include calcium chloride, which is administered intravenously in 10 ml of a 10% solution. Less effective is the intake of a 10% solution of calcium chloride orally, 1 tablespoon several times a day. Instead of calcium chloride, calcium gluconate can be used.

The biological method Biological drugs used to stop bleeding have a general and local effect.

Biological preparations of general action:

- drip transfusion of small hemostatic doses (100–200 ml) of preserved blood
- vitamin K (vikasol)
- vitamin P and vitamin C
- fibrinogen.

Biological preparations of local action:

- thrombin

- hemostatic sponge

- gelatin sponge.

#### First (pre-medical emergency) aid for external and mixed bleeding from internal organs [31-38].

Nasal bleeding occurs as a result of nasal trauma, surgical interventions in the nasal cavity, nasal tumors, acute infectious diseases, arterial hypertension, hemorrhagic diathesis.

Nosebleeds can start suddenly, for no apparent reason, or after a latent period. Usually the source of bleeding is in one half of the nose. Nosebleeds may stop spontaneously or continue for a long time.

First (pre-medical emergency) aid:

1. Lay the victim on his back with his head slightly raised, unfasten the collar and belt.
2. With a slight bleeding - press the wings of the nose to the nasal septum with your finger. Small children need to be reassured, laid with a raised head end, and their head thrown back a little. They should be prohibited from blowing their nose and especially trying to remove crusts and foreign bodies from the nose with a finger.
3. The imposition of cold lotions on the bridge of the nose, an ice pack on the back of the head.
4. If there is no effect, doctors apply anterior tamponade of the nasal cavity: with a long gauze swab moistened with hydrogen peroxide or liquid paraffin, all the deepening of the nasal cavity are sequentially performed. An ice pack is placed on the back of the head, which in a reflex way helps to reduce bleeding. After anesthesia, the bleeding area can be cauterized with lapis, trichloroacetic or chromic acid.
5. The introduction of novocaine under the mucous membrane of the nasal septum at the site of bleeding.
6. If these methods are ineffective, they resort to posterior nasal tamponade.
7. In rare cases, the leading vessels are ligated along the length (external and internal carotid arteries, internal maxillary artery).

With nose bleeds, do not blow your nose and rinse your nose with water. Blood flowing into the nasopharynx, the victim must spit out.

Bleeding from the ear is observed with injuries of the external auditory canal and with fractures of the base of the skull. The first (pre-hospital emergency) assistance consists in applying an aseptic bandage to the ear and giving it a horizontal position with a slightly raised head. You can't wash your ears.

Bleeding from the oral cavity often occurs after tooth extraction, due to biting of the mucous membrane, from a decaying tumor, with blood diseases, ulcerative and narcotic stomatitis, injuries of the maxillofacial region.

First (pre-hospital emergency) aid: in case of severe bleeding from the arterial vessels of the oral cavity, to avoid aspiration asphyxia, the victim should be placed on the stomach; turning his head so that the bleeding half of his face is on the outside (on top). When large vessels of the tongue and jaws are injured, the common carotid artery should be pressed against the transverse processes of the cervical vertebrae. If at the same time there is a wound of the soft tissues of the face, you should press the damaged vessel in the wound with your fingers, apply a pressure bandage (if this does not threaten to displace the fragments

of the jaw during a fracture) or pack the wound. It is necessary to clean the oral cavity from blood clots.

Cold is applied to the injury site to prevent asphyxia. Patients with bleeding from the maxillofacial region should be transported in a sitting position (if possible) with a slightly lowered head or lying on the stomach with the head turned to one side (facing the doctor).

**Bleeding after tooth extraction** usually stops after 5–20 minutes. A gauze ball, which presses down on the wound (biting), helps to stop bleeding. The process of stopping bleeding after tooth extraction is violated by various mouth rinses.

Causes of bleeding after tooth extraction can be:

- rough tooth extraction with rupture and crushing of the gums;
- inflammatory process in the hole;
- vasospasm after the use of adrenaline before tooth extraction and their subsequent expansion;
- infection of the well with subsequent disintegration of the thrombus;
- violations of blood coagulation in avitaminosis and blood diseases.

A threat to health and life is slow, almost imperceptible, prolonged bleeding "drop by drop", which after a few hours or even days can lead to severe blood loss.

First (pre-medical emergency) aid:

1. Tamponade of the hole with a narrow strip of gauze, starting from the very bottom of the wound (the swab can be moistened with hypertonic solution or antibiotics).
2. Tamponade of the well with a hemostatic sponge or fibrin film.
3. Suturing ruptures of the mucous membrane, closing the hole of the mucous membrane and the imposition of deaf sutures.
4. Compression of the bleeding interradicular bone septum with extraction forceps, followed by tamponade of the hole.

Tampons in the hole are changed after 3-4 days. Over the tampons and sutures, the patient is given a gauze ball (pressure bandage) to bite and is observed for about an hour. If the bleeding continues, the swab is changed to a tighter one and cold (ice pack) is prescribed. Prohibit food and hot drinks for 1-2 days.

**Hemoptysis is the expectoration of blood from various parts of the respiratory tract**, pulmonary hemorrhage is the simultaneous expectoration of a large amount of whole blood. Small streaks of blood are in the sputum even with ordinary bronchitis due to injuries of small vessels of the inflamed mucous membrane when coughing. Abundant hemoptysis and bleeding are most often found in tuberculosis, bronchiectasis, bronchogenic cancer, myocardial infarction, or lung injury. Blood pouring into the respiratory tract is thrown out with a cough, but some of it can flow into the posterior-lower sections of the lungs and cause aspiration pneumonia.

Signs. With pulmonary hemorrhage, the patient sometimes feels a sudden warmth in the chest. Following this, with a cough, scarlet, often foaming blood begins to stand out. With hemoptysis, its color ranges from bright red (blood just from a vessel) to chocolate (blood has poured out long ago and was in the lung). The patient is frightened, pale, breathing is often bubbling (wheezing can be heard at a distance). Arterial bleeding is very rare, but leads to death within minutes. It is possible to distinguish hemoptysis from bleeding by the amount of blood

that has poured out. Up to 200 ml - hemoptysis; over 200 ml - bleeding. Heavy bleeding tends to recur at intervals of several hours or days. Following the bleeding, the temperature may rise, the cough may intensify.

Pulmonary bleeding is characterized by the release of blood with a cough, the scarlet color of sputum and the admixture of foam. In contrast, gastric bleeding is not accompanied by a feeling of warmth spreading in the chest, the blood leaves with an eructation or vomiting, it does not foam and is often dark. After stopping the bleeding, an X-ray examination of the lungs is mandatory.

First (pre-medical emergency) aid:

1. Give a small child a sitting or half-sitting position, calm him down, forbid sudden movements and conversation, do not give hot food, tea, put an ice or cold water bubble on his chest, give him a 5% solution of table salt to drink.
2. An adult patient should be placed in bed with a high headboard, half-sitting, for which a roll of clothes, a pillow-roller are placed under the back. The collar of the garment must be unbuttoned. Apply a cold compress or ice pack to the chest area on the chest. Swallowing small pieces of ice, drinking small sips of cold water is recommended. The victim must not speak or move. Pulmonary bleeding causes fear in the patient, so it must be reassured.
3. A tourniquet can be applied to the upper and lower limbs (shoulders, hips) for 20-30 minutes, so that the pulse can be felt. This ensures the redistribution of blood in the bloodstream.
4. The introduction of hemostatic drugs (10 ml of a 10% solution of calcium chloride intravenously; 5-10 ml of a 0.3% solution of vikasol intramuscularly).
5. Removal of excitation with sedatives (chlorpromazine, meprobamate).
6. Fractional transfusion of hemostatic doses of preserved blood (150–200 ml).
7. Antibiotics are prescribed to prevent haemoaspiration pneumonia.
8. After stopping the pulmonary bleeding, the patient is carefully (on a stretcher) transported to the hospital.

**Gastric bleeding** occurs with peptic ulcer of the stomach and duodenum, ulcerative gastritis, stomach tumors, cirrhosis of the liver and varicose veins of the esophagus. The blood poured into the cavity of the stomach is evacuated either with vomiting (for example, with a stomach ulcer) or with stool (for example, with a duodenal ulcer).

Signs of internal bleeding: general weakness, dizziness, flickering of "flies" before the eyes, pronounced pallor of the skin, moist and cold skin, nausea, thirst, rapid breathing, rapid weak pulse, drop in blood pressure. In the later stages, liquid black stools are melena (decomposed blood), an even greater decrease in blood pressure. When you try to stand up, you may faint. There may be vomiting of blood

Gastric bleeding can stop on its own, and the patient recovers. However, depending on the causes (callous, prone to degeneration into malignant ulcers), persistent recurrences of bleeding occur, which sharply worsens the prospects for treatment.

Establishing the correct diagnosis is helped by an assessment of the appearance, a survey of the victim.

**Intestinal bleeding** can occur with duodenal ulcer, intestinal polyps, tumors, nonspecific ulcerative gastroenterocolitis, infectious diseases, spleen diseases, vascular diathesis, hemorrhoids, anal fissures.

When the process is localized in the upper sections of the intestine, black stools (tarry stools), with bleeding from the lower section, the blood in the stools is scarlet, undecomposed.

Signs of intestinal bleeding: dizziness, blanching of the skin, weakness, sometimes only black loose stools, pain in the anus during bowel movements, abdominal pain.

First (pre-medical emergency) aid:

1. The patient needs absolute rest. It is laid in a semi-sitting position with legs bent at the knees and hip joints.
2. An ice pack is applied to the stomach area.
3. The patient should not be fed or given water.
4. Emergency hospitalization in a surgical hospital, transportation is carried out on a stretcher, with signs of acute anemia - with the head end lowered.

**Bleeding from the kidneys and urinary tract** occurs with tumors, injuries, tuberculosis, inflammation of the organs of the urinary system. In cases where hematuria (excretion of blood in the urine) is determined by the naked eye, they speak of gross hematuria. In addition, there are:

- total gross hematuria, in which urine is stained with blood throughout the entire act of urination with the same intensity;
- initial (initial) gross hematuria, when only the first portion of fresh urine is stained with blood;
- terminal (final) gross hematuria, when blood is released only at the end of the act of urination.

First (pre-medical emergency) aid:

1. After establishing the presence of gross hematuria, the patient should be provided with rest.
2. In case of injuries of the urethra with open injuries, it is necessary to press the wound with a sterile bandage, apply cold to the wound.
3. In case of bladder injuries, rest, cold on the suprapubic cavity are necessary.
4. It is necessary to transport patients with injuries of the urinary organs carefully, ensuring their immobility, especially in cases of combined injuries of the urinary organs and pelvic bones. As a rule, they are in a state of shock, and the slightest movement of them leads to the displacement of fragments of the pelvic bones and deterioration. Transportation must be carried out on a wooden board.
5. Patients undergo hemostatic therapy, if indicated, surgical treatment.

**Bleeding from the female genital organs** can be caused by functional and organic diseases of the female reproductive system, the pathological course of pregnancy and childbirth, as well as trauma.

First (pre-medical emergency) aid:

1. Reassure the woman, lay on her back.
2. Put an ice pack or cold water on the perineum.
3. Inject painkillers (1 ml of a 1% solution of promedol subcutaneously, 2 ml of a 50% solution of analgin).
4. With heavy bleeding, vaginal tamponade or a pressure bandage on the perineum is sometimes necessary.

5. Women with all types of bleeding from the genital tract are subject to urgent hospitalization in the hospital.

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