MINISTRY OF HEALTH CARE OF UKRAINE
LVIV DANYLO HALYTSKY NATIONAL MEDICAL UNIVERSITY
CHAIR OF GENERAL SURGERY

GUIDELINES
TO THE PRACTICAL LESSONS

for 3rd-year students of medical faculty Module 1

INTRODUCTION TO SURGERY. EMERGENCY SURGICAL CONDITIONS. FUNDAMENTALS OF ANAESTHESIOLOGY AND RESUSCITATION.

Thematical module 4

TRAUMA AND INJURIES

Topic 11

Wounds and wound process. Prevention of infection in the wound. Treatment of the clean wounds. Infected wounds.

Academic discipline:
G e n e r a l Su r g e r y
3-rd year medical faculty
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1. BACKGROUND

The importance of studying the topic "Wounds" due to the frequency and prevalence of this disease among all segments of the population. Mortality caused by open injuries in Ukraine is 8 - with 15.06 % (A. A. Shalimov, 2000) and has no tendency to decrease. Therefore knowledge of clinic and diagnosis of wounds, the ability to set their character in a timely manner to provide first medical aid and to be able to perform surgical treatment necessary in the training of doctors of any specialty, from the proper action of the doctor depends the fate of the patient. So, every doctor needs to know the typical symptoms of wound complications and the main principles of treatment of open injuries.

2. DURATION: 2 hours.

3. STUDY OBJECTIVE.

Know (theoretical questions):

- the main historical stages in the treatment of wounds and wound infection
- definition and classification of wounds
- morphological and biochemical changes in the wounds
- clinical symptoms of wounds
- the concept of primary surgical treatment of wounds
- methods of treatment clean wound
- types of wound healing, types of primary sutures
- the concept of infected wounds
- the course of the wound process in purulent wound
- the concept of surgical treatment of purulent wounds
- treatment of purulent wounds
- types of drainage of purulent wounds
- the types of secondary sutures
- the methods of plastic closure of the wounds
- modern drugs used in the treatment of wounds

Be able to:

- to assess the condition of the patient with a wound
- to establish a correct diagnosis depending on the nature of the wounds
- to be able to render first aid to the victim with the wound
- to plan the treatment program of patients with different types of wounds (pain management, bleeding control, immobilization)
- to establish the feasibility of introducing PSS and the rabies vaccine
- elements to perform primary surgical treatment of the wounds
- treatment of clean wounds in the postoperative period

- the technique of surgical treatment of purulent wounds
- conduct treatment of purulent wounds in the postoperative period
- to establish the indications for suturing (primary, secondary)
- to establish the indications for removal of sutures
- to establish the indications for the plastic closure of wounds

Practical skills:

- to conduct a survey of patients with various types of wounds
- to master the technique of carrying out of primary surgical processing of a wound
- to master the technique of holding the dressing clean wounds
- to master the technique of holding the dressing of a purulent wound wounds
- learn the technique of suturing (primary, secondary)
- learn the technique for the removal of sutures

4. BASIC KNOWLEDGE, SKILLS NECESSARY FOR STUDYING THE TOPIC (INTERDISCIPLINARY INTEGRATION)

Discipline	To know	To be able
Anatomy	Human anatomy; soft tissues	To determine the anatomical localization of the wound
Histology	The structure of the skin, subcutaneous foundations and deep tissue structures	To determine the depth of wounds
Pathological anatomy	Signs of inflammation in various stages of wound healing.Characteristic changes of tissue and exudate in anaerobic processes. Destructive tissue changes.	To diagnose complications of wounds. The symptoms of degradation.
Pathological physiology	The pathogenesis of inflammation and shock. "Local"(wound) shock.	

Microbiology	Microbiological characteristics of "clean" and "dirty" wounds. The characteristics of the main causative agents of wound infection; bacteriological control microflora of purulent wounds.	

5. TIPS FOR STUDENTS.

To emphasize (to reveal) the importance of the topic for further studying of discipline and professional activity of doctor with the purpose of formation of motivation for purposeful educational activity. To acquaint students with specific goals and a lesson plan.

To conduct a standardised test control of initial level of preparation of students.

After studying this topic the students should have an idea about the definition, classification and types of wounds, wound process, the possible complications of different type of wounds, morpho-histological changes in tissues in renovao process, to be able to render first aid for injuries to the primary surgical dues of infected and festering wounds, to heal the wound at different stages of healing, to apply primary, secondary, and deferred seams to know how to heal and close a large wound defects.

5.1. CONTENT OF THE TOPIC.

The history of the treatment of wounds and wound infection originates from the depths of the past. So, from the papyrus of Ebers, which was found in the XIX century, it became known that even for 3000 years B.C. the egyptians used medical oil and wine to treat wound, and closed the wound with a seam of adhesive substances. In Babylon and Assyria there was a staff of surgeons in the military units, that means, that the military field surgery was born. In India laid the Foundation of plastic surgery ("Indian's plastic") defects of the nose, lips, ears. A great contribution to the development of the science of wound made Hippocrates (460-370 to B.C.). Hippocrates collection has become a source of medical knowledge for the next generation. Since that time, actually begins the science of regeneration - primary and secondary wound healing. Hippocrates knew that suppurative complications arise as a result of "contamination" of the wound, demanded that the surgical field had to be clean, covered with a clean cloth. Had to go through 24 centuries to be fully aware of the value of asepsis.

So, the great doctors of the past were aware of the basic principles of treatment of wounds: autopsy a purulent focus, drainage of wounds and suturing. They

also knew about the "infection" of wounds in this connection have spread cauterizing wounds with a hot iron or oil.
In the sixteenth century Ambroise Paré proved that wounds heal better after not burning iron, but under turpentine-ointment armbands. Development of the doctrine of the wound were contributed by numers of wars in XVII-XVIII centuries P. Desault extensive dissection combined with mandatory excision of dead and crushed tissues.
Basic principles of treatment of wounds were described by M. Pirogov (1810-1881), who in the practice of surgery has introduced anesthesia, plaster cast and formed the principle of "efficient treatment of wounds" (rest, limb immobilization, dissection wounds), which drastically reduced the number of amputations. "Need to hurry with the cuts in the deep (subaponeuroticum) heats (infiltration). These principles currently underpin the treatment of any wound. However, neither early amputation, nor other treatment was not able to defeat a terrible enemy - wound infection.
However, in thentication era specified principles of active treatment of wounds could not find wide application because surgeons effords were crossed by infection. And only with the advent of the laws of asepsis and antisepsis (XIX century), designed by K. Semmelweis, D. Lister, T. Billroth and Schimmelbusch radically changed understanding of wounds and their treatment.
So, Semmelweis in 1848 proved that complications of childbirth is the result of an infection (contagion). In 1867 D. Lister found out that the cause of the festering wounds are microorganisms that get into the wound from the air and developed a technique for the prevention of suppuration of wounds using carbolic acid.
In surgery fundamentals of aseptic technique introduced Billroth, who first dressed surgeons in white robes and introduced mandatory hand washing before surgery.
Asepsis and antisepsis in peacetime turned out to be untenable in military terms. In times of war wounds were often complicated by suppuration, increased the number of cases of gas gangrene. Principles of treatment of wounds has been revised by D. Larrey, K. Reuter, who shifted the emphasis towards active surgery a dissection of the wound, removing dead tissue, haematoma and foreign bodies. Recognition of the need for active surgical treatment of wounds has become a revolutionary event in the science of wounds. After surgical processing the treatment of wounds kept open by plugging with tampons with antiseptics and expectations of granulation.
Subsequently, the widely used got two methods. The first (method of Wright) was in the loose performed surgically treated of wounds with swabs soaked with hypertonic sodium chloride solution. The second method, known as method of continuous irrigation of the wound by Carrel - Daken, is the surgical treatment of wounds, drainage with special pipes with side vents, loose tamponade with gauze and prolonged lavage fluid of Daken (chloride of lime). These methods have

received wide recognition of military surgeons, although they had significant disadvantages: prolonged healing of wounds, formation of deep deforming scars. From the experience of the 1st world war develope the following concept of treatment of gunshot wounds:

1. Every gunshot wound is infected.
2. Early (primary) debridement should occur in the first 6-8 hours after the injury and consist in a wide dissection of the wound and excision of devitalized tissue.
3. Treatment after early debridement should be made by opened method.
4. After remitting inflammatory phenomena, it is expedient to impose secondary seams.

From a practical point of view adopted is the classification of I. Rufanov, who distinguished two phases of wound healing: I - hydration; II - rejection and dehydration.

Based on the doctor's experience of the 2nd world war was developed the basic principles and guidelines on the treatment of gunshot wounds and primary surgical treatment. The term "debridement" began to define only those surgeries, which performed by cutting tool under anesthesia.

Operetion of surgical processing involves wide dissection of wound, remove blood clots and foreign bodies and also excision of devitalized tissue. If intervention is performed after the injury, it is called "primary surgical treatment". In the case of the operation of the secondary indications (wound abscess) it is called "secondary surgical treatment of wound". A significant addition of this operation is the use of primary-deferred and secondary seams (superimposed after attenuation of inflammatory phenomena in the wound).

In recent decades, advances in medicine have allowed to reveal the mechanisms of the wound process. New methods of treatment were introduced into practice (vacuum and ultrasound treatment, active drainage, etc.). The wide and often uncontrolled use of antibiotics in 60-70 years has led to changes in species composition of microorganisms of wounds: the first position as the causative agent instead of streptococcus aureus came, increased the proportion of pathogenic flora, especially Pseudomonas aeruginosa, Proteus (Struchkov V. I., Grigoryan V. A., 1973). These circumstances forced surgeons to take a new approach to the problem of treatment of wounds.

Today wound (vulnus) is called sudden disruption of the integrity of the skin, mucous membranes and other tissues that occurs as a result of mechanical damage.

Classification of wounds. The nature of traumatic agent wounds are divided into:

1. Cut (Vulnus Incisiim)
2. Puncture (Vulnus Punctum)
3. Chopped (Vulnus Contusum)
4. Torn (V. Laseratum)
5. Bitten (V. Morsum)

6. Poisoned (V. Venenatum)
7. Gunshot (V. Sdopetarium)
8. Mixed (V. Mixtum).

Depending on the combined action of cutting tool can be stab-cut, beaten-torn wounds, and other combinations. By the reasons of defeat wounds are: operating (aseptic), that are result of surgical operations; and random. In other group are separated highlighted gunshot wounds.

For the presence of microorganisms in the wounds they are distinguished into: aseptic, infected, purulent.

All accidental wounds have primary contamination, but not in every develops purulent process. Wounds in which inflammation, suppuration started, are called purulent.

In relation to the body cavities of the wound are: penetrating, if they penetrate into the chest, abdomen, skull; non-penetrating, when it is not affects the peritoneum, pleura, dura mater.

In turn, the penetrating wounds may be with the defeat of the internal organs (lungs, stomach, liver, intestines, etc.) and without defeat.

Distinguish uncomplicated wounds, when defeat is due only to mechanical factors and complicated when the mechanical factor join other: poison, poisonous and radioactive substances, burns.

- By length and relative to the body cavity wounds are: shear, blind, through, non-penetrating and penetrating into various cavities.

- By shape wounds are linear, perforated (vcontact), patchwork, scalped, and the like.
- By number of injuries of one victim (patient) distinguish single, multiple and combination wounds.
- By look of damage distinguish wounds with changes in the soft tissues, fracture of bones and joints, with lesions of the large arteries and veins, nerves and internal organs.
- By anatomical features wounds are distinguishedon head wounds, neck, chest, abdomen.

Complications of wounds - early (immediately after injury) bleeding, acute blood loss, anemia, shock. Late - within a few days. This includes late secondary bleeding, suppuration of wounds, General purulent infection, sepsis, etc.

The major symptoms of wounds are pain, bleeding, hiatus of wound, traumatic functional disorders.

Pain is inevitable for all accidental injuries, the intensity and duration depends on the topography of the wound, the condition of the Central nervous system, from the object that hurts, from the presence foreigh bodies, etc. The most painful wounds are in the nerve trunks and plexuses, abdominal cavity, periosteum.

Bleeding is observed from each wound, but the intensity and duration depends on the caliber of the damaged vessels, types of wounds, bleeding from jagged, lethal,

cracked wounds less intense than the cut, when the small skin and muscle vessels are bleeding, more over larger.
At slaughter, torn wounds ends of vessels are rumpled, twisted, the walls collapsed and stuck together, these circumstances contribute to the unauthorized stop of bleeding.
Hiatus of wound - the divergence of its edges, associated with the elastic properties of the injured tissue, direction of the wound, depth, location, size of damage and the tissue defect.
Clinical characteristics of individual wounds.
Cut wounds - emerge after being injured by sharp objects (knife, razor, glass) and have flat, smooth edges, vessels are damaged, bleeding, can have a flap of soft tissues, may be damage of major blood vessels, nerves, tendons.
Chopped wounds – applied by heavy sharp object (axe, sword), have flat edges, are characterized by deep tissue damage with bleeding around the edges of the wound. Differ by heavy bleeding, bones damage and internal organs.
Stab wounds occur after action of bared, sharp object (awl, bayonet, nail, needle etc). Have the small size of the entry of opening, injury can be that penetrate into the chest, in the abdomen with damage of internal organs and major blood vessels. In these wounds there are conditions for microbial contamination and poor wound healing.
Slaughter wounds are irregular in shape, caused by a blunt object, during the fall, when compression. The edges of the wound are uneven, fractured tissue around the wound bleeding, hematomas, there are areas of necrosis (necrosis). The vessels are crushed, thrombosed.
Torn wounds - are applied by moving parts of mechanisms, transmission, saw, splinters, etc. The edges of the wound are irregular in shape, with pronounced defect of the soft tissues (skin, muscles), observed massive hemorrhage into the skin, muscles; wound filled with blood clots (hematoma), bleeding moderate, rupture of tendons, muscles, vessels.
Bite wounds occur by animals or humans bite, is always infected with the highly virulent microflora of the mouth. They have torn and bruised edges, irregular form, sometimes of soft tissue defects, visible traces of the teeth regenerate poorly, complicated by purulent infection.
Poisoned wounds - the consequences of the bites of poisonous snakes, scorpions, insects, etc. This is a damage, which was combined, with the appearance of the wound it gets poison, poisonous substance. At snake bite, the poison has local and general effect on the body. In the area of the bite there is pain, swelling, sometimes on the skin is formed phur with hemorrhagic content, necrosis of the soft tissues. Scorpions, spiders, mosquitoes, bees, wasps inflict stings that lead to systemic intoxication, there are dizziness, headache, fever, weakness, etc. It all depends on the quantity and quality of poison, individual sensitivity and endurance of the body.

Gunshot wounds are caused by firearms (bullet, shrapnel or grenades). At appearance they are diverse and have a number of features unlike wounds of non-firearm origin. Gunshot wounds are studied in the course of military-field surgery.

Wound process is the body's response to injury, which is characterized by consistent leaks of stages (phases) with pathological, biochemical and clinical features.

Distinguish the following phases (stages) of wound process:

1. Phase of inflammation is characterized by exudation, development of inflammatory edema, necrason, hydration.
2. The proliferation phase which is characterized by a predominance of restorative, regenerative processes, formation of granulation tissue dehydration.
3. Phase of healing is the maturation of scar tissue and epithelialization of the wound.

The first phase of wound healing begins immediately after infection and lasts an average of 4 days. The wound is filled with a clot of blood, lymph, wound exudate. Everything is covered with fibro membrane, water and airtight layer, which constitutes the first protective barrier of the wound. Develops vasospasm, as a result of hitting the walls the blood vessels clots appeares. Initial vasospasm after 10-15 min is replaced by their dilatation, a violation of vascular permeability, exudation and the development of tissue edema. In the first 2-3 days exudate is dominated by neutrophilic granulocyte, apoptosis, lymphocytes and macrophages appeare. Migrating into the wound white blood cells within the first day, create a leukocytic shaft (barrier). It separates the area and provides phagocytosis. In clean wound, an important role is played by macrophages, which contain a powerful set of lysosomal enzymes - ribonuclease, acid phosphatase etc.

The second phase of wound healing begins on 3-4 days after injury, clear boundaries of the transition between the 1 and 2 phases is not defined. Necrolysis continues, wound cleansing of necrotic tissue and development of granulation tissue, proliferative process in the wound begins. The formation of granulation tissue starts from the bottom of the wound, big importance in this phase has the endothelium of capillaries and fibroblasts, the formation of new blood vessels by pinching old one. In addition to endothelial cells granulation tissue contains a large number of fibroblasts, which form collagen fibers. Collagen provides the elimination of tissue defect, maturation of granulation tissue and scar formation. Granulation tissue in addition to participating in the reparative process, performs a protective barrier between sunsim and internal environments of the body, This is due to the phagocytosis of leukocytes and macrophages and the presence of proteolytic enzymes. The second phase of wound healing ends in 15-30 days.

The third phase of wound process - scarring and epithelialization of wounds begins from 20-30 days. Is an active process of development of collagen and

elastic fibers, that is, the scar tissue is formed. At the same time with the maturation of granulation tissue, the process of epithelialization happens as migration of epithelial cells from the edges on its surface. Healing of large wound areas may not provide by migration of the epithelium of the wound edges, for this skin grafting is necessary. The final formation of connective tissue (scar) and epithelization of the wound ends up to a week. The time of healing of the wound depends on: the size of the wound, extent of damage surrounding tissues, the number of species and virulence of the microorganisms which trapped into the wound, the depth and plane of necrosis, age, and condition of the person, the presence of comorbidities, surgical approach, treatment methods and other factors.

Types of wound healing. Distinguish primary wound healing, secondary intention, and under a scab.

1. Healing by primary intention (sanatio per primam intentionem) occurs during cut wounds, when the walls and the edges of the wound are connected to each other, during sewing of operation wounds. In this case the walls of the wound are glued together, clumped together due to febrina membrance. This healing is possible with the full and close contact of the wound edges, but without tension of tissues, in the absence of infection in the wound, in the absence of hematoma, while maintaining viability of wound edges, in the absence of foreign bodies, infected bodies and fire of necrosis. By primary intention of wounds heal after clean operations, i.e. aseptic wounds in 6 to 8 days.
2. Healing of secondary intention (sanatio pensecundum intentionem) occurs when the edges and sides of the wound do not lean on each other when there is a wound cavity, tissue defect, a lot of the dead tissue, the infection develops. There is necrosis, purulent process, wound cleansing, execution of the defect of granulation tissue, collagen, elastic fibers with the formation of connective tissue (scar). Wound healing of a secondary tension occurs through suppuration, granulation, the wound contraction, scar formation and epithelization. The term wound contraction means uniform concentric contraction of the wound cavity by reducing its walls, fabric ties, due to the reduction of myofibroblast.
3. Healing under a scar is observed after small surface skin wounds (abrasions, surface burns), when the wound defect is covered by a crust (scab), which consists of blood, lymph, interstitial fluid. The scab performs a protective, barrier function under which happens the reparative process due to the formation of granulation tissue and regenerating of the epidermis. After epithelization the scab falls off.

Treatment of fresh wounds. The main goal of treatment of any wounds is the restoration of form and function of injured in trauma tissue, by connecting the anatomical structure suturing the tissue. To achieve this main goal the provision of assistance at different stages of treatment are making following measures.

When providing first aid at the prehospital stage a wounded man is carried out: to stop bleeding, infection prevention; anti-shock activity; timely evacuation into the surgical department.

Under the primary surgical treatment of wound is a meaning of the first account of operative intervention performed on the primary purpose and aimed at elimination (prevention) of conditions for development an infection, at the final stop of bleeding, restoration of anatomical structures in the wound, functions of the affected organ and a speedy recovery of wounded. There are early primary surgical treatment performed in the first 24 hours, delayed up to 48 hours and late - after 48 hours from the moment of the impression, with the use of antibiotics. Surgery of primary surgical processing of a wound is performed in the operating room under anesthesia or local anesthesia, closely follows the rules of asepsis. The essence of primary surgical treatment can be described in two verbs "cut – cut off". While the surgical treatment is carried out excision of necrotic and non-viable plots in the wound, cut off the rim around the wound with a width of 0.5-2 cm, on the face (only if it is extremely needed) skin is cut off with a width of 1-2 mm. Surgical treatment is needed to create unfavorable conditions for the development of infection, any wound must be converted into the cut. In peacetime are not subject to primary surgical treatment of superficial incised and puncture wounds, clean in appearance, they can heal by primary intention, under a dry scab. Wounds of the face, scalp, external genitals, heal by primary intention after the imposition of the primary seams without surgical processing.

After dissection of the wound and remove the scraps of clothing, blood clots, foreign bodies and go on to the autopsy of crushed and contaminated tissues. Nonviable muscles are dull, do not bleed, dark red in color, not reduced by the touch of the tweezers - cut within healthy tissue. Undamaged large vessels, nerves, tendors during the treatment of the wound should be saved, from their surface gently remove the contaminated tissue. Freely positioned in the wound small bones fragments are removed, sharp fragments are nibbled by cutting pliers. If blood vessels, nerves, tendons are damaged their integrity should be recover. During the wound treatment is necessary stop the bleeding carefully. If during the surgical treatment of the wound all nonviable tissue and foreign body are completely removed, primary seam is imposition on the skin.

Late surgical treatment is performed according to the same rules that early, but if there are signs of purulent inflammation it reduces to the removal of foreign bodies, cleansing wounds from dirt, remove of necrotic tissue, the autopsy of edema, pockets, abscesses in order to provide the conditions for the wound exudation. Primary seam after primary treatment restores the anatomical continuity of the tissue, prevents contact of secondary infection; creates conditions for wound healing by primary intention.

Types of seams. Primary seam is imposed on the wound immediately after aseptic surgical operations, after primary surgical processing of a wound without signs of infection. Primary-deferred seam impose a term of up to 5-7 days after primary

surgical treatment of wounds before the advent of granulation, provided that no festering of wounds begins. Deferred seams can be applied in the form of provision: the operation is complete suturing of the wound edges and tighten them after a few days, if there was no suppuration of the wound.

In wounds, that was sew by primary seam, the inflammatory process is poorly expressed, and the healing takes place by primary intention. Early secondary seam is applied on granulating wound without clinical signs of infection. Granulation tissue is not dissected, the edges of the wound are not mobilized. Terms of imposing 8-15 days. Late secondary seam are placed on the wound in 20-30 day on a granulating wound, the wound edges are mobilized. Infected and festering wounds are their features.

Any accidental wound has a primary microbial contamination, but contact with microorganisms in a wound does not always cause infection in it. Process of infection, wound infection occurs when there is a disturbed interaction of forces between organism and microorganisms, which fell into the wound. In the wound there are signs of inflammation that Celsus described:

1. Redness (Rubor)
2. Pain (Dolor)
3. Temperature rise (Calor)4.
4. Swelling (Tumor)
5. Dysfunction. (Functio leasa)

Wound infection is accompanied by general and local clinical symptoms. Common symptoms: resorptive fever, chills, associated with the flow in the blood of the microbes and their toxins and products of tissue decay, tachycardia, cardiac rhythm disorders, insomnia, headache, suffocation, dry mouth, nausea, changes in the general condition of the patient, which can be slight or sever. With banal purulent infection they are less pronounced, with severe infections are dramatically pronounced. The healing of purulent wounds is occured by secondary intention, by replacing of the wound defect with granulation tissue, scar formation and epithelialization. Infected wound has clinical signs of an infectious inflammation of the serous character; redness of the edges of a wound, serous exudate, slight swelling, which is poorly expressed.

Local (local) manifestations of infected wounds: 24-28 hours clearly pronounced, pain in the wound is a characteristic sign of the inflammatory process. Around the wound swelling, sealing, the bottom of the wound and its contents have a dirty grey color, the skin around the wound is hyperemic, sore, hot by the touch. Purulent wounds are expressed by greater extent signs of inflammation and the presence of purulent exudate and also purulent wound accompanied by clinical symptoms.

Infected wound, depending on its origin, size and localization must be treated as running accidental wound (24-48 hours after its receipt). Infected wounds are treated by holding in full amount in late primary surgical treatment and closed by primary seams with drainage. In the postoperative period are used physical and

chemical methods of antiseptics and antibioticotherapy. In some cases, after surgical treatment of the infected wound it is left open with the subsequent imposition of a primary-deferred seam.

Purulent wound is accompanied by in-depth action of microbes and their toxins, general wounds intoxication of the organism, the presence of purulent exudate in the wound and general clinical symptoms. Purulent wound is worse treated in comparison to infected one. The treatment of purulent wounds includes the elimination of intoxication, causes of wound infection through common and local activities. Local wound treatment is carried out mainly by closed method under the bandage.

Depending on the origin there are primary and secondary purulent wounds. The primary purulent wounds are wounds that formed after operation intervention: opening of abscesses, phlegmon, after differences of wounds edges in connection with suppuration. Secondary are the result of re-infection or due to the appearance in the wound of secondary foci of necrosis.

The development of purulent-inflammatory process of the wound in the first 3-5 days after the injury, called the primary suppuration, and at a later date -secondary suppuration, which is caused by the secondary infection of wounds hospital strains of microorganisms.

The principles of local treatment of infected and festering wounds. The existence of general biological laws of healing wounds of any origin, defines a single, general principles of treatment of wounds as "fresh" and purulent.

The main principles are:

1. Stuggle of infection;
2. Early removal of necrotic tissues;
3. The acceleration of reparative processes;
4. Reduction of terms of the wound healing.

Local treatment of the wound infection is aimed at control the infection and prevention of secondary microbial contamination. In the treatment of infected wounds in the first 48 hours (early stage) the local antibacterial therapy is assigned in the form of imposing on the edges of the wound or antibiotics electrophoresis.

Osmotic active ointments which are based on water-soluble basis are used (polyethylene glycol), which include antibiotics or antiseptics: levosin, doxepina ointment, mefenat. With the aim of creating unfavorable conditions for the development a wound's infection during the first aid is performed the toilet of the wound. Its essence lies in the lubrication of the skin around the wound with 5% iodine solution, alcohol, cleansing the wound with hydrogen peroxide, furacilinum, rivanol and the imposition of aseptic bandage on the wound.

Treatment of wounds in 1st and 2nd phase. The main objectives of treatment of purulent wounds in the 1st phase are: suppression of infection, normalization of local gomeostaza (elimination of hyperemia, acidosis, excessive proteolysis), adsorption of toxic exudates, the activation of rejection of necrotic tissue and

elimination of pain syndrome. In the first phase of wound process is also used the next ointments: levosin, levomekol, dermazin, duokxicol.

With the appearance of granulation (2nd phase of healing) are used indifferent ointments that contribute to the strengthening of reparative processes that do not cause irritation and allergic reactions. As the cleansing of purulent wound,its filling with granulation tissue are using an early or late secondary seam, or free autodermoplasty split skin graft for large lesions suturing. Overlay of seam on the purulent wound reduces the time of treatment of patients improves the functional and cosmetic results.

Secondary surgical treatment is repeated surgical intervention on the secondary indicators in connection with the development of purulent-inflammatory process, with formation of purulent cavity, secondary necrosis in the wound. It is performed in some cases after primary surgical treatment, regardless of the timing of injury and pursues the following main purpose: radical excision and removal of purulent-necrotic foci in the wound, opening of pockets, streaks, ensuring the conditions for good outflow wound discharge, evacuating the products of tissue decay and toxins and reduce by this general intoxication. The creation of favorable conditions for the flow of wound process, by reducing fluid overload and acidosis in the wound, the normalization of metabolism in tissues, etc.

The standard technique of secondary surgical treatment of purulent wound contains excision from purulent-necrotic sequestrum and microbial flora (mechanical cleansing of the wound) by a scalpel and scissors, opening of pockets, laps and all non-viable tissue. After that, the wound treated with 3% hydrogen peroxide solution, furatsilinum or other antiseptic.

Local methods of treatment (physical, chemical, biological). A common technique of secondary surgical treatment of purulent wounds does not provide the final removal of microbial flora. Therefore, at the present time together with the "classical" surgical treatment of the wound using additional measures of local effects on the wound.

Modern physical methods:

1. Treatment of the wound by pulsating stream of antiseptic solution.
2. The use of laser radiation. After treatment of the wound with a scalpel, the wound surface is treated with a focused laser beam.
3. On the principle of physical impact on the microflora of the wound is based method of treatment of wounds with ultrasound. The ultrasonic vibrations cause the destruction of microbial cells due to physical effect.
4. Methods of cryotherapy, accelerate wound cleansing, stimulate the repair processes.
5. Method of hyperbaric oxygenation (HBO). It provides a bacteriostatic effect on the microflora in connection with formation in the cultures of microorganisms elevated concentrations of hydrogen peroxide, stimulates phagocytosis, increases the activity of antibiotics.

6. The treatment of purulent wounds by method of drainage. There are both passive and active drainage of wounds. Passive - purulent discharges are flowing from the wound under the force of gravity, when active, the outflow is ensured by using a special device forming a rarefaction. Passive drainage is carried out using drains of different types. The first type includes the drainages - graduates in the form of tubes of rubber, plastic, fluoroplastic, silicone with numerous holes. Also are used doubletranslucent drains, glove-tubular, rubber strips. Ehen it's difficult configuration of wounds, with the presence of individual cavities and pockets, there is a need to use several drainages. The drains of the second type based on the capillary properties of the drainage material, usually gauze. Gauze should loosely fill the cavity wounds, as in the other way filling in drainage becomes a tampon.
7. Chemical methods. Method of local treatment of purulent wounds under a bandage with the use of various chemical compounds in the form of solutions, ointments, powders, and in the present remains the main. For the local treatment of wounds, there is a large arsenal of drugs (more than 2000). All chemical drugs have some influence on the wound: antimicrobial or anti-inflammatory, stimulating and suction (osmotic drying) action. Widely is still used hypertonic solution of sodium chloride (10 %), any hypertonic solutions (30% solvent of urea, 5 % boric acid, etc.) on the festering wound effect for 3-4 hours. During this time, diluted the wound secretion and lose their osmotic activity.
For local treatment the powders, ointments and emulsions are used. Ointments made of fat basis (petrolatum, lanolin, etc.) do not mix with wound exudate, the water, don't absorb wound secretions. Fat basis not firing antibacterial agents of the composition, do not conducive their implementation in the depth of the tissues where are the microbes. From these positions justified the use of solutions of dimexidum, iodopiron, dioxyde, furagin, solafur that have an effective impact on the microflora and local treatment, but they do not have degarelix properties. Currently, in treatment of purulent wounds are using multicomponent ointments, which are based on hydrophilic basis of the first phase of the inflammatory process (“laevosin”, “laevomecolum”).
8. Biological methods. Wide use in purulent surgery for the local treatment of wounds received broad-spectrum antibiotics, proteolytic enzymes (chymotrypsinum, terrilytin, collagenase). Antbiotics used purposefully after determining the sensitivity of microflora in the form of ointments solution, depending on the phase of wound process.

5.2.QUESTIONS FOR SELF-CONTROL.

1. Definition and classifica wounds.
2. The clinical symptoms of the wound.
3. Complications of wound (early and late).
4. The morphology and pathomorphology of the wound process.
5. Phases of the wound process and their characteristics.

6. Treatment of fresh wounds.
7. The treatment of infected wounds.
8. Primary surgical treatment of wounds, definition, purpose.
9. The appearance of the seams, the indications and contraindications for their imposition.
10. Infected and festering wounds, and their features.
11. The principles of treatment of infected and festering wounds.
12. Secondary surgical treatment of wounds.
13. Methods for the local treatment of wounds (physical, chemical, biological).
14. General treatment of patients with wounds.
15. The role of antibiotics and proteolytic enzymes in the treatment of purulent wounds.
16. Common body reactions to the wound.

5.3. TABLES FOR SELF-CONTROL

1.What contributes the development of infection in the wounds?
A. High virulence of the pathogen;
B. The presence of hematoma in the wound;
C. The presence of crushed tissues, muscles;
D. The presence of foreign bodies;
E. All right.

2.Which drugs should be used for the treatment of wounds with the strong purulent infection?
A. Solution of furacililinum 1:5000;
B. Solution of boric acid;
C. Solution of penicillium;
D. Chymotrypsinum;
E. Solution of rivanolum;

3. Which volume of help is done during primary surgical treatment of wounds?
A. Treatment of the wound with antiseptic (iodopironum, 3% hydrogen peroxide, furacillinum 1:5000), bandage;
B. Toilet skin around the wound, treatment of the wound with antiseptic, bandage with antibiotic penicillinum;
C. Cutting out the damaged edges of the wound, the bandage;
D. Cutting edges, walls and bottom of the wound, antiseptic treatment, suturing, bandage;
E. Treatment of the wound and around the wound 3 % hydrogen peroxide, furacilinum 1:5000, sutures, bandage.

4. In which terms the primary surgical treatment of the wounds ?
A. Up to 12 hours;
B. Up to 24 hours;
C. Up to 36 hours;
D. Up to 48 hours;
E. Before the advent of signs of infection

5. Name the local signs of fresh wounds.
A. Bleeding;
B. Cleft (Hiatus) ;
C. Pain;
D. Disturbance of organ functions (of the body);
E. All above;

6.Which processes in the wound are characteristic in the first phase of inflammation?
A. Alteration, phagocytosis, acidosis, migration of leukocytes and macrophages, active proteolysis, catabolic processes, accudata;
B. Acidosis, phagocytosis, alteration;
C. Alteration, exudation;
D. Alteration, phagocytosis, exudation;
E. Exudation, necrosis, infiltration of cells.

7.Which processes in the wound are characteristic during the second phase of inflammation?
A. Proliferation of vascular endothelium, tumor vessels, fibroblasts, histiocytes, lymphocytes;
B. Alteration, phagocytosis, exudation;
C. Exudation, necrosis, phagocytosis;
D. Acidosis, accudata, migration of leukocytes;
E. Necrosis, infiltration of cells, exudation.

8.How is the degree of cleft (Hiatus) determine?
A. Damage of the muscles and tendons;
B. Damage of the fascia;
C. Damage of nerves;
D. Depth damage;
E. Damage of elastic fibers of the skin.

9.Which wound would heal faster?
A. Cut;
B. Choped;
C. Bitten;

D. Torn;
E. Slaughter-torn.

5.4. Situational tasks.

1. In a surgical hospital admitted a patient who had a chopped wound of the right shin. Which is the volume of aid?
2. To the surgical department came a patient, 40 years old, who fell from a height of 3 meters and received a wound of the hip, it has already passed 10 hours after an injury. Which surgical treatment of the wound should be held?
3. As a result of a stab wound of the femoral artery, during the primary surgical treatment of wounds, on the femoral artery the vascular seam was impositioned. On 7th day, the patient's temperature rise to 38,8, there was throbbing pain and purulent discharge from the wound. During removal of the seams from the wound arterial bleeding was occured. Tourniquet was applied. What is your surgical tactics?.
4. The patient with a crush injury of the lower third of the hip was admitted to the hospital. Wound contaminated by soil, in the wound there are bone fragments. The patient is inhibited. BP – 80/50 mm, pulse 130 beats / min. Which is the treatment tactics?
5. The patient, 45 years, 12 days after wounding (injury), the wound of the left hip 5x2 cm, clean, covered with granulations, its edges are built easily without effort. Which seam should be impose on the wound?