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PREVENTION AND TREATMENT OF PUSCULAR-SEPTIC COMPLICATIONS RESULTING FROM GUNSHOT INJURIES OF THE ARMS AND LEGS

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PREVENTION AND TREATMENT OF PUSCULAR-SEPTIC COMPLICATIONS RESULTING FROM GUNSHOT INJURIES OF THE ARMS

The monograph states that injuries to body organs and tissues resulting from firearms are a pressing medical and socio-economic problem in both developing and developed countries. illuminates.

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ENTRANCE

The relevance and necessity of the topic of the monograph. According to WHO, injuries to organs and tissues of the body as a result of the effects of firearms are an extremely urgent medical and socio-economic problem in both developing and developed countries. The situation is becoming more complicated with the increase in terrorist acts using firearms. "Taking into account the possibilities of providing qualified and specialized medical care at the same time in the conditions of urban medical centers, there is a need to improve the organization of medical care for the wounded during mass admission of victims during evacuation stages in urban conditions." In conditions of armed conflicts, when the wounded arrive in large numbers, determining the volume of triage and surgical care during evacuation stages is of great importance for the lives of the wounded. From the first days of our country's independence, systematic measures have been taken to organize a completely new, high-quality medical care for the population, effective models of organizing the healthcare system have been introduced, and positive results have been achieved. Despite the fact that in peacetime the wounded are usually immediately hospitalized in a well-equipped medical institution and provided with qualified medical care, the basic principles of treatment and organization are the same as those used in military field surgery. "This situation is reflected in the term military-civilian surgery." At the same time, experience shows that civilian surgeons are not sufficiently aware of the specifics of gunshot wounds inflicted by modern weapons, which does not allow them to provide timely assistance to the wounded. Taking into account the above, prospects for further improvement of emergency medical care have been identified, which determines the relevance of this study.

Currently, the most relevant research in gunshot wound surgery in world practice remains work aimed at improving algorithms for treating civilians. This takes into account the armament, energy of the wound, the time and type of care provided, as well as the specific characteristics of the environment. Promising

research is being conducted on determining the optimal timing and type of wound closure, irrigation and debridement, the use of systemic and local antibiotics, the use of antimicrobial coated implants and bone morphogenetic protein-2.

The modern development of surgery in our country includes a number of measures aimed at improving the results of treatment of patients with gunshot wounds of the limbs and improving treatment tactics. The seven priority areas of the New Uzbekistan Development Strategy for 2022-2026 set the tasks of improving the quality of qualified medical care for the population. The implementation of these tasks, including by improving the results of treatment of patients with gunshot wounds, is one of the current directions of surgery and medicine in general, given the high medical and social importance of this pathology.

This Monograph study, to a certain extent, serves to implement the tasks set out in the Decree of the President of the Republic of Uzbekistan No. PF-5590 dated December 17, 2018 "On comprehensive measures to radically improve the healthcare system of the Republic of Uzbekistan", No. PQ-5254 dated October 4, 2021 "On measures to transform surgical services, improve the quality and expand the scale of surgical operations in the regions" and No. PQ-4891 dated November 12, 2020 "On additional measures to ensure public health by further improving the effectiveness of medical preventive work", as well as other regulatory legal acts related to this area.

Compliance of the research with the priority areas of the development of science and technology of the republic. The dissertation research was carried out in accordance with the VI priority area of the development of science and technology of the republic "Medicine and Pharmacology".

Review of foreign scientific research on the topic of the monograph. Scientific research aimed at improving the diagnosis and treatment of gunshot wounds is being conducted not only by military surgeons, but also in leading scientific centers and higher educational institutions of the world. In particular, the Department of Surgery, Faculty of Medicine, Cairo University (Cairo, Egypt);

Department of Plastic and Reconstructive Surgery, Washington University in St. Louis (USA); Department of Hand Surgery, RWTH Aachen (Aachen, Germany); Department of Burns and Plastic Surgery, Jilin University First Hospital (Chang Chun, China); Orthoballistics Research Center, Department of Orthopedic Surgery, University of Cape Town (South Africa); Department of Surgery, Plastic and Reconstructive Surgery, Ahmadu Bello University Teaching Hospital (Kaduna State, Nigeria); Department of Orthopedic Surgery, Keck School of Medicine, University of Southern California, Los Angeles (USA); Department of Plastic Surgery, College of Medicine, Armed Forces (Pune, India); Department of Burns, Hallym University Hangang Sacred Heart Hospital (Seoul, Republic of Korea); Department of Plastic and Maxillofacial Surgery, Uppsala University Hospital (Uppsala, Sweden); Clinic of Plastic and Reconstructive Surgery, Faculty of Neurology, University of Padova (Padova, Italy); Department of Orthopedics and Traumatology, Ankara Yildirim Bayazid University (Ankara, Turkey); Department of Global Public Health, Karolinska Institute, Stockholm (Sweden); Zaporozhye Military Hospital (Zaporozhye, Ukraine); Department of Orthopedic Surgery, Yerevan State University (Yerevan, Armenia); National Medical University named after OO Bogomolets (Kiev, Ukraine); Surgical Center of the Russian Federal State Unitary Enterprise "All-Russian Center of Emergency and Radiation Medicine named after AM Nikiforov"; Republican Scientific Center of Emergency Medicine (Uzbekistan), Republican Specialized Center of Surgery named after Academician V. Vohidov (Uzbekistan); Andijan State Medical Institute Clinic.

As a result of studies conducted around the world, a number of scientific results have been obtained on improving the diagnosis and treatment of gunshot wounds of the limbs, including: it has been established that in gunshot wounds, the possibility of sufficient penetration of antibiotics into the tissues of the molecular shock zone, bloodstream and regional lymph nodes is unclear (Ross Tilley Burn Center, Sunnybrook Health Sciences Center, Toronto, Ontario, Canada); today, the possibilities of stimulating regional lymphatic drainage and lymphotropic antibiotic therapy in gunshot wounds of the soft tissues of the limbs, the prevention

and treatment of purulent-septic complications have not been sufficiently studied (Clinic of Plastic and Reconstructive Surgery, Faculty of Neurology, University of Padova, Italy); it has been established that wound edema is aggravated by impaired microcirculation and the spread of infection mainly by the lymphogenous route (Sahlgrenska Academy, University of Gothenburg, Sweden); It has been proven that lymphostimulation and lymphotropic antibiotic therapy play an important role in the complex treatment of soft tissue gunshot wounds (Department of Plastic and Reconstructive Surgery, Peking Medical College Hospital, Peking Medical College and Chinese Academy of Medical Sciences, Beijing, China); the ineffectiveness of treatment for post-traumatic stress disorder associated with gunshot wounds was associated with a high frequency of chronic pain syndrome in 82.1% of cases, as well as resistance to treatment of post-traumatic stress disorder (National Medical University named after OO Bogomolets, Kiev); It has been shown that early closure of Gustilo-Anderson type IIIB fractures should be achieved using flaps rather than skin grafts, as skin grafts have the highest failure rate of soft tissue reconstruction in open fractures, and that prolonged antibiotic use has a significant impact not only on the rate of deep infection but also on the presence of drug-resistant bacteria (Department of Orthopaedic Surgery, Faculty of Surgical Sciences, Tokai University School of Medicine, Isehara, Kanagawa, Japan).

Currently, work is underway in the world to study the ultrastructure of a modern gunshot wound, identify microstructural changes in the zone of molecular shock, and investigate the possibilities of its resuscitation in conditions of parabiosis of damaged tissues. Also, work is underway to study the pharmacokinetics of antibiotics by lymphotropic administration and to investigate the possibilities of lymphostimulation in gunshot wounds. With the accumulation of experience in the treatment of gunshot wounds of the limbs, the need arose to objectively assess the long-term prognosis and the results of various treatment methods. This is reflected in multicenter studies. However, the uncertainty and inadequacy of scientific approaches to the issues of treatment and diagnostic tactics in various clinical situations, the increasing difference in approaches between

countries with a highly developed level of surgery and those at the initial stage of development, and ethnic and demographic regional characteristics require studying this problem from a new perspective.

The level of study of the problem. Fundamental research on the pathomorphological characteristics of gunshot wounds was conducted by specialists of the SM Kirov Military Medical Academy. The results obtained determined the basic principles of treatment when conducting hostilities in local wars and armed conflicts. However, publications on gunshot wounds in peacetime, as a rule, describe the experience of individual medical organizations. The lack of systematic analysis and multicenter studies makes it difficult to obtain information to identify patterns in the formation of the flow of wounded with gunshot wounds. Existing recommendations for the provision of surgical care when receiving a large number of victims often repeat the principles of military field surgery. However, many of the proposed methods require adaptation to the organizational characteristics of the work of specific medical organizations. Currently, guidelines for the use of multi-stage surgical treatment tactics have been developed in detail - damage control. However, the criteria for switching to this methodology based on medical and tactical indications require further study. In local armed conflicts and terrorist acts, hand and foot injuries predominate in 50-70% of cases. In many cases, gunshot wounds become infected, which leads to various complications. The spread of infection by the lymphogenous route and the development of lymphostasis in gunshot wounds lead to the formation of periwound abscesses, phlegmon, wound edema, and sepsis. Therefore, lymphotropic and endolymphatic antibiotic therapy methods, as well as stimulation of lymphatic drainage, are of particular importance in gunshot wounds. However, it is necessary to clarify the role of the pathomorphological characteristics of gunshot wounds in these processes, which is possible only in experimental conditions under strict control of the factors being analyzed. Currently, work is underway to actively introduce modern technologies into the complex treatment of gunshot wounds of the limbs. Lymphotropic antibiotic therapy with regional lymphostimulation is described in

the medical literature and is widely used, but the possibilities of their effective use in gunshot wounds of the limbs require clarification. The level of training of surgeons in the treatment of this type of wounds is of great importance in providing medical care to patients with gunshot pathology. Compliance with the basic principles of primary and secondary surgical treatment creates conditions for cleaning the wound from necrotic tissues and promotes its healing, reducing the likelihood of developing wound infection. The literature has repeatedly emphasized the need for knowledge of the treatment of gunshot wounds not only by military surgeons, but also by surgeons of all specialties. Paris (2015),In Brussels (2016) and other cities around the world, so many surgical errors were recorded in the provision of medical care to victims of terrorist attacks that special courses were required by military doctors. Gunshot wounds to the legs lead to significant morbidity in patients with orthopedic injuries. Critical neurovascular structures are at particular risk. Fractures are often comminuted and are accompanied by varying degrees of soft tissue damage. There is no consensus in the literature on the choice and duration of antibiotics, as well as indications for surgical treatment. Bullets and/or bullet fragments should be removed if they are lodged in a joint, compress a nerve, are embedded in a vessel, or are embedded subcutaneously in the palm and/or forearm. Gunshot fractures do not typically follow the common fracture pattern seen in blunt trauma, and the complexity of some gunshot fractures can often be a challenge for the treating orthopedic surgeon. Conventional plate and screw constructs may not adequately stabilize these injuries and may require innovative fixation techniques. Unfortunately, existing recommendations are largely outdated, having been written at a time when high-velocity weapons and deforming bullets were used primarily for military purposes. Advances in firearms and the increased availability of military-grade firearms to civilians have exacerbated the nature of firearm-related injuries and complicated clinical decision-making, as these weapons are associated with high tissue damage and often result in bullets becoming lodged in the skin.Conventional plate and screw constructs are not sufficient to stabilize these injuries and may

require innovative fixation techniques. Unfortunately, existing recommendations are largely outdated, having been written in an era when high-velocity weapons and deforming bullets were used primarily for military purposes. Advances in firearms and the increased availability of military-grade firearms to civilians have exacerbated the nature of firearm-related injuries in the home and have complicated clinical decision-making, as these weapons are associated with high tissue damage and often result in bullets becoming lodged in the body.Conventional plate and screw constructs are not sufficient to stabilize these injuries and may require innovative fixation techniques. Unfortunately, existing recommendations are largely outdated, having been written in an era when high-velocity weapons and deforming bullets were used primarily for military purposes. Advances in firearms and the increased availability of military-grade firearms to civilians have exacerbated the nature of firearm-related injuries in the home and have complicated clinical decision-making, as these weapons are associated with high tissue damage and often result in bullets becoming lodged in the body.

Many authors emphasize the importance of a multidisciplinary approach in the treatment of patients with gunshot wounds with extensive soft tissue damage to the limbs. Early surgical intervention with removal of non-viable tissue is necessary for good results. If the damage to major blood vessels is not life-threatening, it is necessary to re-supply the affected limb with blood.

An analysis of the literature on the algorithms for providing first medical and specialized surgical care, postoperative treatment of patients with gunshot wounds of the limbs shows the lack of aspects of the interdisciplinary approach. This complicates and slows down the process of fully understanding the structure of consistent treatment in the first week after injury and clarifying the complex of individually targeted rehabilitation measures in the long term. In the conditions of the increasing spread of local hostilities and the increasing energy potential of the traumatic factor, it is undoubtedly important to develop a modern approach to the rapid detection of injuries to the limbs in gunshot wounds and the provision of highly qualified surgical care on the same day of severe injury. All of the above

once again emphasizes the relevance of this topic and the need for further research in this direction.

The connection of the monograph research with the research plans of the higher educational institution where the work was carried out. The monograph work was carried out in accordance with the research plan of the Andijan State Medical Institute (№01870038189).

The aim of the study is to improve the results of comprehensive treatment of gunshot wounds of the limbs using lymphotropic therapy, as well as to improve the methods of providing medical care during mass arrivals of victims in peacetime.

Research objectives:

Experimental study of morphological changes in gunshot wounds of the limbs under regional lymphatic treatment using electron microscopy;

Experimental study of the distribution of an average therapeutic dose of an antibacterial drug in the blood, lymph nodes, and soft tissues of a gunshot wound, as well as a comparative analysis of pharmacokinetics with different routes of administration;

to study the clinical effectiveness of regional lymphatic therapy in the treatment of gunshot wounds of the soft tissues and bones of the limbs;

Analysis and improvement of the principles of emergency medical care in emergency situations in providing mass assistance to victims of gunshot wounds using the example of the activities of the reformed emergency medical care units of Uzbekistan (Andijan branch of the RSHTYOIM).

The object of the study was an analysis of the results of treatment of 169 victims with gunshot wounds to the limbs. The clinical part of the work was carried out at the Andijan branch of the RSHTYOIM on the events of the terrorist attack in Andijan on May 13, 2005, the events in Osh in 2010 and cases of gunshot wounds in the border districts of Andijan region. Experimental studies were conducted at the Andijan State Medical Institute MIL and the Department of Pathological Anatomy of the DM "RIXIATM named after VVVokhidov" under the leadership of Professor IM Baybekov, Ph.D.

The subject of the study is to analyze the effectiveness of improved medical-tactical aspects of treatment in providing mass assistance to victims of gunshot wounds of the limbs, as well as to determine the role of lymphotropic antibiotic therapy with regional lymphostimulation in this pathology.

Research methods. To achieve the research goal and solve the tasks set, general clinical, instrumental, experimental, histomorphological, pharmacokinetic and statistical research methods were used.

The scientific novelty of the study is as follows:

It has been proven that in armed conflicts involving firearms in peacetime, limbs are often injured, and the use of tourniquets to stop bleeding causes more complications than the use of pressure bandages;

Morphostructural changes in tissues, confirmed by electron microscopy, were detected, confirming the effectiveness of the use of lymphotropic therapy, which can be considered a pathogenetically based method in the treatment of gunshot wounds;

The morphological dynamics of ultrastructural cellular changes in soft tissues and lymphatic vessels in gunshot wounds were identified, which served as the basis for the development of new approaches to the treatment of this category of victims;

It has been experimentally proven that regional lymphotropic administration of antibiotics and stimulation of lymphatic drainage in gunshot wounds of the limbs can achieve a longer saturation of the blood, lymph nodes, and soft tissues with them;

A comprehensive method of preventive antibacterial therapy using endolymphatic administration of antibiotics in patients with gunshot wounds of the soft tissues of the limbs has been developed;

In gunshot wounds with bone damage to the soft tissues of the arms and legs, complex treatment methods were developed using primary immersion and extracorporeal osteosynthesis with the administration of lymphotropic antibiotics and stimulation of lymphatic drainage.

The practical results of the research are as follows:

It has been proven that there is no need to use high doses and multiple injections of antibiotics for the prevention and treatment of purulent-septic complications in gunshot wounds of the arms and legs, since easy-to-use lymphotropic antibiotic therapy is used, which is an important factor in the provision of medical care;

The effectiveness of the recommendations introduced into the clinic for the treatment of gunshot wounds of the arms and legs in the conditions of mass admission of victims has been proven, which allows choosing the right direction in complex emergency situations and making the right decision aimed at saving the life of the wounded and reducing the number of complications;

The high effectiveness of the developed algorithm of actions of medical personnel in case of gunshot wounds of the arms and legs in peacetime was revealed, which allows to come to a common opinion in the approach to surgical tactics and provide timely surgical assistance to the wounded;

The effectiveness of the tactical actions developed by the doctors of the emergency medical care system of Uzbekistan in the mass admission of victims of gunshot wounds in peacetime has been proven.

It has been proven that the proposed integrated approach to providing assistance to victims of gunshot wounds of the arms and legs in peacetime, adhering to the principles of military field surgery, and the use of primary immersion and extracorporeal osteosynthesis with lymphotropic administration of antibiotics and stimulation of lymphatic drainage, allows civilian surgeons, traumatologists and resuscitators to select the optimal criteria for the volume of medical care and operative care during the evacuation stages and improves treatment outcomes.

Reliability of research results. The reliability of research results is based on objective criteria for assessing the patient's condition, the use of modern diagnostic and treatment methods, the correct application of methodological approaches and statistical analysis kits.

Scientific and practical significance of the research results. The scientific significance of the research results is that the conclusions obtained make a significant contribution to expanding the existing ideas about the violation of lymph flow in the area of gunshot wounds of the arms and legs and the possibilities of its stimulation in lymphatic therapy. This was first determined experimentally at the level of electron microscopy, and it was experimentally shown that by administering regional lymphotropic antibiotics and stimulating lymphatic drainage, a longer saturation of blood, lymph nodes and soft tissues with antibiotics in the area of gunshot wounds of the arms and legs is achieved. In addition, the clinical features of the inflammatory process in soft tissues in gunshot wounds of the arms and legs were determined using lymphatic therapy in complex treatment.

The practical value of the work is that the analysis of the tactics and volume of surgical interventions during mass arrivals of gunshot wounds revealed the specific features of these injuries, assessed the tactics of their treatment, developed the actions of a surgeon, traumatologist and microsurgeon in emergency situations with gunshot wounds of the limbs. The use of lymphatic therapy made it possible to reduce the need for the use of critical doses and multiple courses of antibiotics for the prevention and treatment of purulent-septic complications in gunshot wounds of the limbs, and at the same time reduce the duration of hospitalization of the wounded.

Implementation of research results. Based on the results of scientific research on improving the results of complex treatment of gunshot wounds of the limbs and improving the methods of providing medical care during mass admission of the wounded in peacetime:

"Method for modeling an infected gunshot wound of soft tissues in an experiment" was developed (Utility model patent FAP 01724, 04.02.2021). The proposed method made it possible to study the characteristics of gunshot wounds of the limbs in experimental conditions, as well as the clinical characteristics of the inflammatory process in soft tissues during lymphatic therapy;

Methodological recommendations "Complex treatment of gunshot wounds of the limbs using lymphatic therapy" were developed (Conclusion of the Expert Council of the Andijan State Medical Institute No. 06/14 dated March 26, 2024). The developed recommendations made it possible to reduce the number of postoperative infectious complications, shorten the duration of patients' hospitalization and outpatient treatment.

Methodological recommendations "Methods of treating gunshot wounds of the limbs using new methods of basic medicine" have been developed (Conclusion of the Expert Council of the Andijan State Medical Institute dated March 26, 2024 No. 06/14). The use of RLS with extramedullary osteosynthesis and LTA in gunshot fractures of bones made it possible to reduce the frequency of postoperative wound suppuration by 13.8% (6.2% versus 20%), the frequency of osteomyelitis development by 7.1% (6.2% versus 13.3%), and in external fixation osteosynthesis by 10.8% (7.7% versus 18.5%) and 8.7% (3.8% versus 12.5%), respectively.

The obtained scientific results were introduced into healthcare practice, in particular, in the Namangan and Fergana branches of the Republican Scientific Center for Emergency Medical Care and the Fergana Military Hospital (Conclusion of the Expert Council of the Andijan State Medical Institute No. 06/14 dated March 26, 2024). The use of lymphotropic therapy, along with the early provision of specialized medical care for gunshot wounds of the soft tissues of the extremities, helped reduce postoperative wound suppuration to 2.5% compared to 10.5% in the control group.

Approbation of research results. The results of this research were discussed at 4 scientific and practical conferences, including 2 international and 2 national conferences.

Publication of research results. A total of 19 scientific works have been published on the topic of the monograph, 10 of which are journal articles, 8 of which are in republican and 2 in foreign journals, included in the list of

publications recommended by the Higher Attestation Commission of the Republic of Uzbekistan for publishing the main scientific results of doctoral monographs.

Structure and volume of the monograph. The monograph consists of an introduction, five chapters, a conclusion, practical recommendations and a list of used literature. The total volume of the work is 224 pages.

CHAPTER I. GUNSWOUND WOUND IN PEACETIME, ITS PATHOMORPHOLOGY, PRINCIPLES OF ASSISTANCE AND TREATMENT (LITERATURE ANALYSIS)

The use of firearms dates back to the 14th century, when they were first used at the Battle of Crécy in 1346. Although initially intended only for warfare, they were later used as hunting, sporting, and signaling weapons. Today, firearms are also used as various work tools. However, despite certain restrictions, the availability of firearms to certain segments of the population poses a risk of their illegal use. Hand-held firearms are extremely powerful and pose a serious threat to human life and health. Even a wound to any part of the body can be fatal. Automatic weapons, on the other hand, can cause many deaths, especially in a short period of time. This undoubtedly poses a social danger [54,74,75,113,124,241,327].

Conventional weapons come in a variety of forms, including firearms, fragmentation and high-explosive ammunition, close-range anti-personnel weapons and incendiary firearms. The most common types of firearm injuries are bullet, fragmentation, ball and fragmentation wounds. In modern combat surgical pathology, firearms cause the majority of single-injury injuries - 46.4%, and fragmentation wounds - 29.6%. During the 1992 fighting in Transnistria, patients with gunshot wounds predominated among those hospitalized (39.5%). The most common injuries were to the legs (63%), and injuries to the arms were recorded in 37% of cases. Amputation of arms and legs was 10%, confirming the severity of gunshot wounds [166] and particularly of gunshot wounds to the limbs.

In this regard, it can be assumed that gunshot wounds to the limbs still occupy a leading position in military field and military-urban surgery [188].

1.1. Modern views on the mechanism of formation and pathomorphology of gunshot wounds.

1.1.1. The mechanism of formation of a modern gunshot wound.

The effect of a shot on a biological target is mainly mechanical. At initial contact, the bullet pierces the skin and creates a cavity in the body, creating an explosive effect. This cavity is formed during the decay process and its dynamics are characterized by wave-like fluctuations in pressure. The initial surge of high pressure is called the shock wave and is associated with the traumatic effect of the firearm itself [42, 106, 110, 200, 241, 242].

As the bullet travels through the body, it creates a wedge-shaped airstream around it that causes tissue damage [42, 106, 110, 167, 200, 241, 247]. At high velocities, shock waves can affect intracellular processes, causing disruption of cellular structures and changes in blood clotting and protein coagulation [106].

The size and characteristics of a gunshot wound are influenced by various factors, including the mass and caliber of the bullet, its speed and stability, as well as its movement characteristics in the body. To understand the relationship between these dynamic properties, physical and mathematical modeling based on the principles of fundamental mechanics was used. In order to understand the interaction between these factors, physical and mathematical modeling methods were used to describe the formation of a gunshot wound. The concept of "damage zone" is used to describe the temporary pathological formation that occurs in the area of damage, which includes zones of primary necrosis and molecular shaking.

The structure of the wound area is such that it represents an imaginary line separating healthy and damaged tissue from the gunshot wound [241, 242].

Studies conducted by Soviet and Russian pathologists after the war showed a significant difference between gunshot wounds and those sustained in peacetime.

The diameter and shape of the primary wound channel are subject to significant changes depending on the physical properties of the projectile and the anatomical features of the tissues. It is noteworthy that only in gunshot wounds is there a primary deviation of the wound channel from a straight line. The wound channel can take on a more complex shape due to varying degrees of tissue contractility. This complexity is further enhanced by secondary deviations. The contusion zone occurs when the projectile hits the tissues surrounding the wound

channel. The contusion zone is adjacent to the contusion zone and is characterized by complete loss of vital capacity. Pressure waves created by the temporary pulsating cavity of the wound channel play a decisive role in the formation of the contusion zone. While the inner layer of the contusion zone undergoes a sharp shift, the outer layer undergoes relatively mild pathological changes. If the inner layer experiences a decrease in cell viability due to metabolic disorders, the outer layer undergoes functional changes that affect blood circulation and tissue nutrition. As microcirculatory disorders become more severe, dystrophic and necrobiotic processes develop, and secondary necrosis foci appear. [64, 100, 153, 233]. Proper wound treatment can lead to significant improvement of the outer layer of the wound, reducing necrosis. However, the characteristics of modern gunshot wounds differ from those of previous wars, as firearm technology has improved [94, 205, 214, 249].

Significant progress has been made through annual symposiums on wound ballistics, with a focus on developing proposals for testing the traumatic effects of new bullets.

The few studies on the effects of high-velocity projectiles on surrounding tissues are conflicting. Studies using gelatin blocks have shown that high-velocity projectiles cause more damage than low-velocity projectiles [276]. However, some studies have shown that both high-velocity and low-velocity projectiles cause similar damage to living tissue [294, 320]. Tissue destruction when fired from an M-16 rifle is explained by the high velocity of the bullet, cavitation, the formation of a large transient pulsating cavity, and fragmentation of the wounding projectile. Morphological studies have shown that gunshot wounds inflicted by high-velocity projectiles from modern firearms lead to more severe inflammatory, degenerative, and necrotic processes, as well as disruption of the microcirculation system [25]. [25].

From a medical point of view, it is very important to take into account the potential spread of tissue damage in gunshot wounds. Although there is information that tissue damage does not spread in dogs, studies in rabbits show that

the damage zone can expand. However, there is not enough information about the volume of tissue damaged by high-speed projectiles. To address this problem, GA Kesyan conducted a series of experiments in the field of gunshot wounds and found that by the fifth day after a gunshot wound, primary and secondary necrosis and contusion significantly increase in the middle part of the entrance wound and wound channel. According to Kesyan, this is due to the transfer of kinetic energy from the bullet to the tissues, which leads to impaired microcirculation and increased hypoxia.

1.1.2 Pathomorphology of modern gunshot wounds.

The problem of influencing wounds to ensure their faster healing has its roots in times before medicine, science in general, and surgery in particular.

Since the emergence of medicine and its most important component, surgery, as a science, the problem of wound healing has become one of the most pressing issues.

One of the founders of the modern direction in the field of organ and tissue regeneration, LD Liozner [152], touching upon the issue of wound healing, emphasized the special importance of this problem for surgery. He said: "Wound healing is only one type of regeneration, in which the formation of a form is not expressed, that is, the organ does not reappear, but there are other characteristic signs of regeneration..."

Assessing the wound process as a whole, modern pathologists believe that wound healing is ensured by three interrelated mechanisms: contraction, repair, and regeneration [286, 341, 358]. Wound healing is a complex but strictly sequential process that consists of several stages. These stages can overlap, but never break the sequence. The following stages are distinguished:

1) Acute inflammation induction caused by initial tissue damage;

2) Parenchymal cell regeneration;

3) Migration and proliferation of parenchymal cells and connective tissue cells;

4) Synthesis of extracellular matrix proteins;

5) Regeneration of connective tissue and parenchymal components;

6) Increased collagenization and wound strength.

Gunshot wounds are a complex process involving injury, inflammation, and repair. The wound healing process can be divided into several phases: the inflammatory phase, the regeneration phase, the scar formation phase, and the remodeling phase [202]. However, it is not easy to separate the injury and inflammatory phases in terms of time and morphology. However, the wound healing process is generally divided into three overlapping phases: inflammation, connective tissue formation, and epithelial regeneration. Scar formation and remodeling occur during the proliferative phase [205]. It should be noted that the phases of wound healing cannot be strictly defined, and the only constant factor is the consistent alternation of the stages of the wound process [29].

Wound healing has been studied experimentally, often using mechanical skin wounds created with a surgical scalpel. The healing process of linear surgical wounds has been studied over hours [19, 286, 325, 358].

Within the first 24 hours, neutrophils appear at the edges of the incision and migrate toward the blood clot in the center of the wound defect.

For 24-48 hours, the mitotic activity of basal epidermocytes increases significantly, during which time increased fibroblast proliferation contributes to the formation of a basement membrane for epidermocyte migration.

On the 3rd day, neutrophil leukocytes are replaced by macrophages. Granulation tissue is actively formed in the wound defect. At the same time, collagen fibers are intensively produced by fibroblasts. They, like fibroblasts, acquire a vertical orientation at this time. Active proliferation of the epithelium and thickening of the epidermal layer continue.

On day 5, the defect area is completely covered by granulation tissue. The level of neovasculogenesis is at its highest. There is a significant increase in collagen fibers, which form bridges in the tissue defect.

After 7 days, collagen deposition and fibroblast proliferation continue. Leukocyte infiltration, edema, and severe vascularization are significantly reduced. During this period, the scar becomes discolored and vascularization slows down.

By the end of the month, the scar is tightened, the connective tissue is free from inflammatory infiltrate, and the scar is covered with healthy epithelium [19, 286, 325, 358].

When there is a lot of tissue loss, inflammatory wounds appear, and abscesses form, the wound healing process becomes much more complicated.

A common feature of such injuries is significant tissue defects that need to be filled.

Parenchymal cell regeneration cannot fill these defects. In this case, granulation tissue grows from the edges of the wound to fill the defect.

1. A large tissue defect is accompanied by the formation of large amounts of fibrin, necrotic detritus, and exudate, which provokes a more intense inflammatory reaction.

2. A large amount of granulation tissue forms

3. The main difference between primary and secondary closure is the slower narrowing of wounds due to the presence of a larger wound surface.

Initially, the body's local reactions to injury may cause impaired local blood circulation, the release of chemical mediators that cause inflammation, and disruption of metabolic processes in tissues [83, 84].

As a result of tissue damage, microcirculatory disorders develop in arterioles, capillaries, and venules, which are associated with damage to the blood vessels themselves and their course. After a short-term spasm, vascular integrity and permeability are impaired, changes occur within the vessels, perivascular edema and tissue infiltration, mast cell degranulation, and changes in the interstitial

space are observed. Disturbances in local hemodynamics can lead to tissue hypoxia and accumulation of tissue metabolic products [135, 147, 316].

Despite the recognition of the important role of the microcirculatory system in the course of the wound process, the state of the lymphatic system in gunshot wounds has been studied very little. Today, the decisive role of the lymphatic system in inflammatory processes, maintenance of local immunological homeostasis and wound regeneration has been proven. From the point of view of the pathomorphology of gunshot wounds, the study of the state of the lymphatic system is very relevant.

Chemical substances such as histamine, serotonin, and prostaglandins are actively involved in the inflammatory process. Various cellular elements interact with each other, with blood vessels, and with components of the extracellular matrix. As the inflammatory-reparative reaction progresses through different stages, the leading role shifts from one type of cell to another. Neutrophils play an important role in the exudative phase of the inflammatory process, and their main function is phagocytosis, which involves engulfing microorganisms and breaking down dead tissue using an acid-protease chemical reaction [163]. Neutrophils also secrete bioactive substances and enzymes that affect the intensity and duration of the inflammatory reaction and the transition to the proliferative phase. Severe inflammation leads to a slowdown in the recovery process. According to the results of recent studies, the decomposition of devitalized tissues occurs not only under the influence of cellular-enzymatic elements, but also under the influence of the properties of the microflora in this complex process [147, 186].

It is known that in the early stages of the inflammatory reaction, microorganisms cause the migration of white blood cells to the site of infection. They then break down the necrotic substrate with the help of enzymes, eliminating everything that has not been mechanically removed from the wound. Therefore, despite the negative clinical effect on the patient due to the absorption of toxic decomposition products, the presence of microorganisms is considered desirable from a biological point of view. Microorganisms in the wound become clinically

significant six hours after the injury. Monocytes replace neutrophil leukocytes and develop into macrophages, which play an important role in the specific and nonspecific functions of immunity, as well as in initiating the phase of connective tissue formation. Macrophages are universal cells that play an important role in inflammation and regeneration. They appear as the main cells responsible for wound cleansing during the inflammatory phase. During the proliferative phase of wound healing, macrophages control fibroblast proliferation, connective tissue formation, and new blood vessel formation. They are also capable of synthesizing up to 1000 substances in response to various stimuli [29, 129, 186, 295]. In the later stages of wound healing, fibroblastic elements take responsibility for tissue growth, contraction, and involution, producing fibrous collagen, elastin, fibronectin, glycosaminoglycans, and proteases [207, 208, 307]. This is the basic scheme of the wound healing process, which recognizes the generality of the biological laws of wound healing of wounds of any origin. However, in gunshot wounds, wound healing processes have their own characteristics, which determine the tactics of treating patients. This is a basic scheme of the wound healing process, which recognizes the generality of the biological laws of wound healing of any genesis. However, the wound healing processes in gunshot wounds have their own characteristics, which determine the tactics of treating patients.

Gunshot wounds can cause severe tissue damage, leading to primary and secondary necrosis. Failure to remove necrotic tissue by modern and proper surgical methods can lead to long-term inflammation, which in turn hinders the body's natural healing process [27, 28]. This prolonged phase of inflammation can lead to various negative consequences for the body, such as impaired macrophage infiltration, changes in the microcirculatory system, and inhibition of fibrinogenesis. The microcirculatory system may show signs of malfunction, such as hemorrhage, edema, and neutrophil infiltration of tissues. In severe cases, non-healing gunshot wounds can lead to productive-infiltrative vasculitis and impaired fibrinogenesis, which further complicate the healing process [26, 30].

The view on the mechanism of wound healing has undergone significant changes in the last 1.5-2 decades. The role of intercellular and cell-matrix interactions, several types of collagen [26], the importance of fibronectin or laminin, integrin in the healing process has been established [278, 285, 299, 309]. The role of many factors that stimulate and inhibit cell proliferation and growth factors has been studied. Growth factors include peptides and glycopeptides belonging to the cytokine group. Cells also produce keloid, which was discovered before all regulators and stops mitotic activity [286, 324, 340, 341, 356].

The producers of peptide regulatory factors are monocytes. There are also growth factors produced by platelets. Fibroblast growth factor, transforming growth factors, interleukin-1 and tumor necrosis factor, which activates blood vessel growth, are also important in wound healing [269, 304, 328, 341, 354]. The discovery of these macromolecules has changed the view on the possibilities of promoting wound healing [283, 284, 324].

It has become important to determine the role of free oxygen radicals generated in tissues as a result of increased lipid peroxidation in wound healing [261, 303, 307].

Experts recommend the use of antihypoxants and antioxidants in the treatment of gunshot wounds to restore tissue viability, metabolic processes and membrane functions, as well as to increase resistance to hypoxia [219, 226, 303, 308]. [219, 226, 303, 308].

Currently, in all treatment interventions, significant attention is paid to the body's detoxification processes in response to various effects of endogenous and exogenous toxins.

As Yu.G. Shaposhnikov [248] noted, primary and secondary necrosis of the wound, impaired microcirculation, severe edema, as well as the presence of foreign bodies, including microorganisms, in the wound lead to significant endogenous and exogenous poisoning of the wound itself and the whole organism.

One of the most effective means of local and general detoxification of the body is lymphatic therapy.

However, until recently, lymphatic therapy has not been widely used to influence the wound process, especially the healing process of gunshot wounds. It is worth noting that the processes of lymphatic flow in gunshot wounds have not been sufficiently studied using the light-optical, electron-microscopic, and especially scanning electron microscopy complex. The effect of lymphatic therapy on the healing process of gunshot wounds using the above morphological research methods has not been evaluated.

1.2. Specific features of surgical treatment and modern methods of antibiotic therapy.

1.2.1. The importance of surgical debridement and antibacterial therapy in the treatment of gunshot wounds.

To predict objective criteria for microbial contamination, it is necessary to follow the principles of a unified military field medical doctrine from the moment of gunshot wound - all gunshot wounds should be considered to be contaminated with primary microbes and should be treated surgically [42, 74, 113].

The current doctrine of treating patients with musculoskeletal injuries from firearms has been confirmed in recent years by the results of studies of the ballistic parameters of various wounding projectiles.

Timely and correct surgical treatment of the wound helps to prevent wound infection and successful wound healing. This operation is specific in each case, complex, laborious, requires good knowledge of topographic anatomy and certain skills. The quality of its implementation has a decisive impact on the entire wound healing process.

The success of a surgical procedure depends largely on the surgeon's understanding of the specific characteristics of different types of wounding projectiles and the injuries they cause [241, 242].

Gunshot wounds are divided into two categories: those requiring surgical intervention and those not requiring surgical intervention. Surgical intervention is not required for superficial wounds that are shallow, have narrow entry and exit holes, do not significantly damage major blood vessels, or are multiple, shallow wounds [199, 249].

Since the First World War, limb injuries have been the most common form of combat pathology, accounting for 50-70%. Moreover, it is precisely to the limbs that the basic principles of primary surgical treatment are almost completely applied, which can be the only and sufficient method of surgical treatment of injuries in this area.

Treatment of gunshot wounds of the limbs includes three main elements. These are general treatment, which consists of eliminating pain syndrome, restoring homeostasis and impaired body functions, and combating shock and infection. The second element is surgical treatment, which includes surgical treatment of the wound and appropriate methods of stable fixation of the bones. Local treatment is also part of the treatment process [142, 153, 246].

The main therapeutic measure in the treatment of gunshot wounds is surgical treatment. It consists in excision of necrotic tissues in order to reduce the focus of infection, prevent the development of purulent processes, reduce intoxication and shorten the inflammatory phase [61, 83, 106]. However, it is impossible to completely remove non-viable tissues during primary surgical treatment. In some cases, it is necessary to perform repeated operations. Therefore, some military researchers recommend a cautious approach to primary surgical treatment. Treatment tactics should be focused on intensive therapy aimed at improving the functional state of the injured tissues. This allows surgery to be postponed for several hours or days after the injury.

According to the method described by I. Burke (1961) and later recommended by the American Society of Surgical Infections Committee, antibacterial drugs should be administered before the wound becomes

contaminated with microbes. Antibacterial prophylaxis can be used after surgery until clinical signs of surgical infection appear [146, 229, 289, 290].

Various schemes for the prevention of surgical site infection have been proposed [147, 231, 296, 346].

The National Research Council classifies surgical interventions into four categories based on the potential level of contamination of the surgical site [25, 194, 272].

In "dirty" operations on previously infected tissues, it is recommended to administer antibiotics preoperatively, intraoperatively, and postoperatively until the inflammatory process has resolved. When determining the duration of prophylactic antibiotic use in the postoperative period, it is necessary to take into account risk factors for the development of wound infection [147, 231, 287, 289].

Intensive care measures are of crucial importance in preventing severe complications resulting from combat injuries. This process begins with the arrival of the wounded person to the department of qualified surgical care and continues throughout the entire treatment and after surgical intervention. Rational prophylactic antibacterial therapy is necessary for intensive care, but the preferred methods of administering antibiotics differ among different authors. AN Berkutov believes that the best method is to inject antibiotics into the surrounding tissues. Other authors do not agree with this due to the low permeability of tissues and the resistance of microorganisms. Various methods have also been proposed, such as antegrade endolymphatic administration of antibiotics, electrophoresis, and implantation of antibiotics immobilized in special cement. Drugs used to prevent infectious complications in gunshot wounds should meet the following criteria:

1) have a broad spectrum of action, affecting most pathogens;

2) have a high ability to accumulate in the tissues of the surgical area throughout the entire surgical intervention;

3) have minimal toxicity, bactericidal effects, and minimal side effects;

4) be cost-effective in terms of price and application [146, 231, 291].

Surgical infections can be caused by a large group of pathogens, each of which may have natural or acquired resistance to antibacterial drugs. Accordingly, it is impossible to choose an “ideal” antibiotic that would be able to effectively combat all the listed types of pathogens [16, 282, 291, 312]. Therefore, for effective prevention of septic complications, it is necessary to adhere to the principle of “reasonable sufficiency”. This means that the antibiotic used should be able to combat the most common groups of microorganisms. The list of drugs used to prevent surgical infections is often limited to penicillins, cephalosporins, aminoglycosides, lincosamides and imidazoles, the frequency of their use in clinical practice varies widely [16, 220, 229, 231, 267].

Cephalosporins are the main group of antibiotics used for prophylactic purposes. These antibiotics are known for their broad spectrum of activity against bacteria, low incidence of allergic reactions, and high cost-benefit ratio. The most commonly used are first- and second-generation cephalosporins, which are effective against streptococci, some strains of staphylococci, many species of enterobacteria, and clostridial and nonclostridial anaerobes. However, they are not effective against enterococci, oxacillin-resistant staphylococci, and non-fermenting bacteria. Second-generation cephalosporins, such as cefoxitin, cefmetazole, and cefotetan, have significant antianaerobic activity, including against Bacteroides fragilis, and are used for the sole prophylaxis of mixed aerobic-anaerobic infections of various sites [16, 267, 281].

The World Health Organization does not recommend the use of third-generation cephalosporins, such as ceftriaxone, ceftazidime, and cefotaxime, for the prevention of surgical site infections. The use of these antibiotics, even in short courses, can lead to the development of multidrug-resistant strains of bacteria and adversely affect the body's microflora. In addition, third-generation cephalosporins are not effective against important pathogens such as staphylococci, enterococci, and non-spore-forming anaerobes. The cost of treatment with these antibiotics is also high, so they are 2-4 times more expensive than first- and second-generation cephalosporins. The widespread use of third-generation cephalosporins has led to a

decrease in the effectiveness of other antibiotics, such as natural and semi-synthetic penicillins and first- and second-generation cephalosporins [16, 229, 217].

Given the spectrum of action, "protected" penicillins are used to prevent mixed aerobic-anaerobic infections of the skin and soft tissues, urinary tract, bones and joints, in maxillofacial, thoracic, abdominal and gynecological surgeries. When the risk of developing infection is high, which is determined individually for each patient, they are used in combination with aminoglycoside antibiotics (gentamicin, etc.) to obtain a synergistic effect and enhance activity against gram-negative bacteria [266, 267, 316, 347].

In some cases, benzylpenicillin and semi-synthetic penicillins (aminopenicillins and ureidopenicillins), which are active against streptococci, clostridia, and non-spore-forming anaerobes (except Bacteroides fragilis), are used to prevent surgical infections of gunshot wounds. Their spectrum of action includes, in addition to the above-mentioned bacteria, some gram-negative bacteria (Escherichia coli, Proteus mirabilis, etc.). One of the most important indications for the use of natural and semi-synthetic penicillins is the prevention of infectious complications of wounds at the prehospital stage of medical care, since pathogens of non-hospital infections (staphylococci, streptococci, enterobacteria, clostridia, etc.) retain sensitivity to first-generation antibiotics. The main disadvantages of penicillins include allergenicity and poor activity against pathogens of hospital purulent-septic complications [266, 316].

As noted above, surgical wound management is a powerful factor in reducing the incidence of purulent-septic complications in gunshot wounds. Today, there are many antibacterial drugs used to prevent and treat purulent-septic complications of gunshot wounds, but their methods of use are still controversial.

1.2.2. The importance of the lymphatic system and lymphotropic therapy in the treatment of gunshot wounds to the limbs.

When tissues become inflamed and suppurative, the first barrier for microorganisms to enter the bloodstream is the lymph nodes. Prolonged

inflammation weakens the protective function of the lymphatic system, and microbes easily enter the bloodstream [32, 36]. In addition to bacteria, metabolic waste products and toxins also enter the bloodstream from damaged tissues through the lymphatic system during purulent processes [151, 154, 263].

Attempts to prevent and treat many diseases, including surgical diseases, by influencing the lymphatic system have been made many times and are still ongoing, but its involvement in the mechanisms of pathogenesis and cyanogenesis has not been sufficiently substantiated [87].

Lymphotropic therapy in purulent-septic diseases is pathogenetically based in terms of suppressing local and disseminated infection [48, 87].

Although it has been shown to be effective in the treatment of surgical site infections, there is a lack of research on the use of lymphotropic therapy for the prevention and treatment of wound infections in gunshot wounds [274]. It should be noted that gunshot wounds can damage the lymphatic system even when major lymphatic vessels are not directly damaged. This can lead to decreased lymphatic drainage and tissue swelling, which can be detected by lymphograms. It can take up to several months for the lymphatic system to fully recover after a gunshot wound.

In the field surgery clinic of the Military Medical Academy [72], lymphographic examinations are performed to assess the state of regional lymphatic circulation after gunshot wounds. In the first 2-3 hours after the injury, a significant decrease in the diameter of the afferent lymphatic vessels is observed on the lymphograms. In addition, a decrease in the movement of contrast along the primary vessels and an uneven distribution of the contrast in all structures of the lymphatic system are noted. In general, the changes occurring during these periods resemble a state of functional spasm. Over the next 3 days, signs of impaired lymph outflow from the injured limb persist. Some additional lymphatic vessels located more distal to the wound are observed on the radiographs. The first signs of varicose veins of the afferent lymphatic vessels appear, the tortuosity of the vessels increases. 5-7 days after the injury, in the uncomplicated process of the

wound, increased varicose veins of the afferent vessels are noted on the lymphograms. The tortuosity of large lymphatic vessels increases, and a very fine network of collaterals appears. During this period, the rate of diffusion of contrast through the vessels is lower than in previous periods, but higher than in the initial period after injury. 5-10 days after injury, lymphograms reveal varicose expansion of the afferent and efferent vessels of the regional lymph nodes, a fine-pore network of collateral pathways develops, and large additional main vessels appear. Usually, by the end of the 2nd week, decompensation of lymph flow from the injured limb develops.

The regional lymphotropic therapy method proposed by SU Jumabayev in 1982 is still in the development stage. This method can be improved by: identifying new lymphotropic drugs, determining the routes of drug transport through the lymphatic system in various pathological conditions, understanding how drug exchange occurs between blood and lymph in lymph nodes, as well as solving other issues related to improving the method [259, 280].

Despite the fact that endolymphatic therapy is an effective method of treating critically ill patients, its slow introduction into healthcare practice is mainly due to the need to perform microsurgical procedures. However, in order to control homeostasis disorders in many diseases and different age groups of patients, it is necessary to saturate the lymphatic system with drugs [21]. Thus, experimental and clinical studies have shown the important role of the lymphatic system in the pathogenesis of purulent-septic diseases, in the treatment and prevention of infectious complications. However, there are no studies on the study of the lymphatic ultrastructure of gunshot wounds at the electron microscopic level, including lymphotropic therapy. The pharmacokinetics of antibiotics in gunshot wounds have not been studied when lymphotropic injections are administered.

We have not found any studies in the available literature on the clinical use of lymphotropic therapy in gunshot wounds of the limbs. Given the frequency of gunshot wounds of the limbs (55-70%) and the pathogenetic justification of

lymphotropic therapy, the need for a deeper study of lymphatic system disorders and the clinical correction of these changes is obvious.

1.3. Organization and structure of medical care during evacuation stages in armed conflicts.

The methods of providing medical care to the wounded in war situations are constantly improving with the development of modern weapons, combat strategies and tactics. Military medicine can no longer sacrifice perfection for simplicity in the treatment of the wounded. It is extremely important to develop and implement new approaches to the reorganization of military and civilian health care in order to fully meet the requirements of today [54, 124].

During the period 1984-1995, local wars and conflicts were recognized as a serious threat to global stability in the military doctrines of many countries. As a result, attempts were made to create a system of medical care for military personnel during these operations. Over the years, the organization of medical services has been improved, taking into account modern achievements in the field of medical and technical support for military and civilian health care [54].

The main directions of reorganization are necessary for the provision of medical care in combat zones. These directions include increasing the mobility of medical service structures, bringing specialized care closer to combat zones, and using specialized support groups to strengthen medical and preventive institutions. The holistic process of providing medical care in armed conflict is divided into types of medical care that are provided sequentially at different stages of medical evacuation. The ultimate goal of this process is to provide comprehensive treatment that is close to the care provided in a multidisciplinary medical and preventive institution [54, 113, 174].

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Several studies have been conducted on the treatment of soldiers wounded in counter-terrorist operations in the North Caucasus. These studies have shown that those who were evacuated immediately after receiving primary medical care had better outcomes than those who went through all stages of evacuation [73, 104, 112, 162, 209, 211, 228]. According to V.I. Rudenko, the worst outcomes were observed in those who went through a four-stage evacuation process. The main reason for the development of complications was the delay between the injury and the start of comprehensive treatment [73, 104, 112, 204]. A comparison of the medical care of Russian servicemen in Afghanistan and Chechnya showed that the remoteness of medical facilities caused the delay in providing assistance to servicemen. This led to high rates of complications (38%). In Chechnya, mobile medical aid stations were used, located as close as possible to the sites of combat.

During the counter-terrorist operation in Chechnya, medical care was accelerated by deploying medical personnel and equipment closer to the combat zones. This was achieved by deploying reinforcement teams in garrison hospitals

located on the border of Chechnya. The main task was to provide specialized care at the earliest possible stages, but it was also important to introduce the "biological" principle of step-by-step treatment. This principle synchronized the biological processes of the injury, thereby ensuring maximum effectiveness of the medical care provided [82, 246].

Unlike Afghanistan, where anaerobic infection is rare, its incidence in Chechnya reached 11.4%, which requires serious analysis. Anaerobic infection was observed much more often among the wounded who underwent primary surgery in the MOSH (87.5%) than among the wounded who were brought directly to the hospital and operated on with the participation of angiosurgeons (12.5%).

There are several reasons why anaerobic infections occur in wounded patients. These include postoperative thrombosis and necrotic changes in the muscles of the limbs, as well as technical errors in the provision of skilled care. Surgeons may not adequately decompress bones and fascia, do not remove necrotic tissue during initial wound care, or use ineffective methods of suturing or drainage. In addition, inappropriate antibiotic therapy may be used during emergency postoperative evacuation [24].

Of the 36.4% of amputations (in the MOSH), 9.1% of servicemen underwent surgery due to ischemic gangrene. The frequency of amputations reached 46.7% when the wounded were brought to the stage of specialized care, and their number doubled due to ischemia, reaching 20%. The amputation rate was high due to the late arrival of the wounded to the stage of specialized medical care.

However, a high percentage of postoperative complications was observed in the wounded who underwent surgery at the stage of skilled medical care. Reamputations were 22%, and mortality was recorded in 10.3% of cases. At the same time, these figures were significantly lower at the stage of specialized care, with 10.5% of repeated operations in the field and 7.4% of deaths, respectively. Evacuation of wounded people, bypassing the MOSH, to medical institutions providing specialized care directly led to the best results [54, 246]. However, the

frequency of ischemic necrosis of the limbs increased correspondingly due to the lengthening of the evacuation time at the stage of emergency care [54].

Currently, as a result of the introduction of modern medical technologies into military medical and preventive institutions, there is a significant increase in specialized treatment methods for victims of bullet fractures of the long bones of the legs. Despite these achievements, there are still a number of organizational and orthopedic-traumatological standards that need to be improved, especially in medical evacuation in conditions of local wars and armed conflicts.

The experience of treating 236 wounded with injuries of large blood vessels was analyzed. The best results were achieved by tamping the wound with a pressure bandage, and the worst results were achieved by applying a tourniquet, which led to increased ischemia. Modern methods of transporting the wounded to qualified (3.2 ± 0.4 hours) and specialized (5.5 ± 0.7 hours) stages of care allowed to significantly improve the results of treatment. The installation of a temporary endoprosthesis, which could delay the evacuation of the wounded to specialized care, was used only in cases where there was a risk of gangrene and other methods of stopping bleeding were impossible.

Taking into account the subsequent results of the treatment of victims at the stage of qualified and specialized care, the authors prefer the use of a pressure bandage and dense tamponade of the wound as methods of temporary stopping of bleeding. In particular, the use of a hemostatic tourniquet in injuries of the leg vessels below the knee joint is considered practically inexpedient.

One of the effective conditions for providing qualified and specialized care to victims of major vascular injuries is to reduce the time it takes to transport the injured to the appropriate stages as much as possible [53].

The results of the treatment of the wounded in the Tiraspol city hospital showed that the success of the treatment largely depended on the timely delivery of the wounded from the battlefield to the hospital and the adequacy of the assistance provided at the previous stages. The main mistakes made in the provision of medical care before admission to the TGO were in many cases the lack of transport

immobilization, the imposition of a hemostatic tourniquet without the necessary indications, dense suturing of wounds during PXO, and other circumstances, which often led to complications. An analysis of the work done and its effectiveness showed that primary surgical treatment is of particular importance in the treatment of gunshot wounds, and it is important to carry it out as early as possible. At the same time, it should be noted that in conditions of mass arrival, primary surgical treatment can be abandoned in the following cases: in the presence of a point penetrating wound of soft tissues without external bleeding, hematoma and signs of developing infection; Incomplete fractures, fractures with satisfactory fracture alignment, and avulsed fractures; radiographic evidence of absence of bone fragments in soft tissues [165].

Thus, reducing the number of medical evacuation stages is an urgent issue that requires solving medical, humanitarian, and economic problems.

According to Gaidar BV [54], the structure of the medical evacuation system in local wars and armed conflicts can be organized as follows.

First aid is provided on the battlefield either by self-help and mutual aid, or by doctors and paramedics. Medical units and companies provide first aid to reduce the effects of injuries and prepare for further evacuation. Finally, the wounded and injured are evacuated to the SMP stage by military aviation vehicles or helicopters [54].

In modern combat surgical pathology, there is an increase in the number of severe multi-joint injuries and traumas. As a result, there is a need to reduce the time between injury and the provision of emergency medical care. This should be achieved not by bringing medical care closer to the wounded, but by rapid and efficient transportation to the place of specialized care [55].

The concept of rapid and early specialized care has been proposed to achieve better outcomes than general practice surgeons in the forward zone [73, 104, 174, 243]. The US military medical service has been successfully using the concept of “Forward Force Reinforcement” for the past 40 years. This approach ensures that the best medical resources are concentrated within 30 miles (50 km) of the conflict

zone. The concept is based on the experience of the Vietnam War, when evacuation trends prevailed.

The idea of improving and creating mobile medical facilities to operate near combat operations was recognized as a reliable solution. To support this concept, the US Army replaced its MUST-type modular mobile hospitals with DERMEDS mobile hospital systems. It was found that in combat conditions, relying solely on the territorial infrastructure of medical services was not enough. Therefore, it is advisable to follow the positive experience of placing medical facilities in the immediate vicinity of a military multidisciplinary hospital. The wounded and injured should be directed to the 1st echelon DPMs of the SMA, located on the main evacuation routes and equipped with helipads. This will ensure the provision of urgent medical care to those in need, and after triage, the separation of the flow of wounded and injured.

Wounded soldiers are transported to the appropriate hospital depending on the severity of their injuries. Lightly wounded are sent to hospitals in areas close to the battlefield. After treatment, they undergo rehabilitation, as they are the main source of replenishment for the army on the move. Moderately and seriously wounded soldiers are evacuated to district military clinical hospitals for surgical treatment. After treatment, they are sent to military sanatoriums for rehabilitation. Those in need of specialized medical care are stabilized before being airlifted to 3rd echelon hospitals for necessary assistance [54]. The proposed treatment-evacuation process is largely based on the 1st echelon LRS. This requires the participation of highly qualified specialists provided with the necessary tools and equipment. The most experienced and well-trained specialists in this field should work in the medical reinforcement teams formed from the DPM of the center and district military hospitals. It is also necessary to encourage military doctors to improve their knowledge and skills, as this has always been accepted in national medicine [54]. It is also necessary to encourage military doctors to improve their knowledge and skills, as this has always been accepted in national medicine [54].

VA Oppel formulated the basic concept of organizing medical care in local armed conflicts during the First World War. He believed that staged treatment should not be interrupted by evacuation and should include necessary surgical care. The wounded should be evacuated as soon as their health permits [54].

Especially during local wars and armed conflicts, the main principle of organizing medical care is to ensure that all victims return to the front lines as much as possible or preserve their life and health. Even if the injuries received are severe and the likelihood of recovery is low, medical care is provided using all available means and resources. NN Burdenko's opinion that in army conditions it is better to postpone the operation and carry it out with caution is more relevant now than ever.

Thus, reducing the stages of medical evacuation during counter-terrorism operations will help to provide qualified and specialized care to the wounded more quickly, which will have an impact on improving treatment outcomes.

However, all the above-described methods of organizing medical care for patients with gunshot wounds mainly concern victims of local military conflicts. It is generally accepted that the nature of medical care for gunshot wounds in peacetime differs from that in wartime. The civilian population does not have the skills and means to provide first aid, and evacuation schemes and means are not sufficiently developed. Despite the increasing number of terrorist acts in the world (Beslan, Moscow, Madrid, Baghdad, etc.) [411], there are very few studies on this topic, despite the fact that there are many wounded among civilians. Information about victims of terrorist attacks is available only in isolated cases, and the methods of providing medical care have not been thoroughly analyzed and systematically studied. The literature, as a rule, only provides information about household, single gunshot wounds of civilians. The literature, as a rule, contains only reports of domestic, single-shot injuries of civilians.

The reformed emergency medical care system of the Republic of Uzbekistan, due to its widespread distribution, the ubiquitous location of emergency medical departments and centers, the “03” ambulance service, and

sanitary aviation (as a component of the system), ensures the provision of qualified and specialized care in a short time after injury [85].

However, the organization and structure of medical care during mass admission of the wounded in peacetime, the nature and volume of interventions during the evacuation stages require systematization. It is also necessary to develop new pathogenetically based methods of treating gunshot wounds in modern conditions.

CHAPTER II. DESCRIPTION OF CLINICAL AND EXPERIMENTAL STUDIES.

The monograph work is based on experimental and clinical research and includes the following areas:

Experimental studies:

• Development of an experimental model of gunshot wound in the soft tissues of the limbs;

• Pathomorphological study of the healing process of soft tissue gunshot wounds at the level of light and electron microscopy;

• Study of the pharmacokinetics of gentamicin in lymphotropic and conventional routes of administration.

Clinical studies:

• Study the characteristics of gunshot wounds in armed conflicts in peacetime

• Study the features of surgical treatment of gunshot wounds in conditions of mass admission of victims;

• Development and evaluation of the effectiveness of lymphotropic administration of antibiotics and stimulation of lymph flow in gunshot wounds of the extremities;

• Development of treatment tactics for victims with combined injuries of the soft tissues and bones of the foot

• Development of algorithms for providing first aid in the emergency medical system in the event of a mass influx of firearms victims.

2.1. Analysis of clinical material.

The clinical part of the study was carried out at the Andijan branch of the RSHTYOIM on the terrorist attack in Andijan on May 13, 2005, the Osh events in 2010, and cases of gunshot wounds in the border districts of Andijan region. During this period, 169 victims with gunshot wounds to the limbs were analyzed.

The distribution of injured persons by gender, age, and nature of surgical intervention is presented in Tables 2.1 and 2.2.

All patients (169) with gunshot wounds to the arms and legs were divided into 4 groups according to the nature of the injuries and complications. Each group consisted of the main and control groups, in which lymphatic therapy methods were used in the complex of treatment measures in the main group, and in the control group, treatment was carried out using traditional methods. The main group consisted of the wounded who were initially admitted to the Andijan branch of the RSHTYOIM, where lymphatic therapy was included in the protocol of treatment measures. The control group consisted of victims who received first aid in other treatment and prevention institutions of the city. Antibacterial therapy was started in the traditional way for them and then continued in the Andijan branch of the RSHTYOIM.

Description of victim groups:

Group I. Gunshot wounds of soft tissues of the extremities (59):

Main – 40 wounded. Control – 19 wounded.

Group II. Bullet fractures of bones, without extensive defect and extensive soft tissue damage (31):

Main – 16 wounded. Control – 15 wounded.

Group III. Bullet fractures of bones with extensive soft tissue damage (42):

Main – 26 wounded. Control – 16 wounded.

Group IV. Infectious complications of gunshot wounds of the limbs (37):

Main – 25 wounded. Control – 12 wounded.

All patients were divided into two groups: the control group - 62 wounded, in whom the postoperative period was carried out in the traditional way, and the main group - 107 wounded, to whom the RLAT method with RLS was introduced in the postoperative period in accordance with the protocol for the treatment of wounds adopted at the Andijan branch of the RSHTYOIM. Among the analyzed patients, 59 had gunshot wounds of the soft tissues of the arms and legs, 73 had gunshot wounds of the arms and legs and bone injuries, and 37 had infectious complications of gunshot wounds.

Primary surgical treatment of soft tissues of the limbs with primary sutures was performed in 50 wounded, primary-delayed sutures - in 38. Skin grafting was performed in 8 patients to close the wound defect. Primary extramedullary osteosynthesis was used in 31 cases for fixation of gunshot fractures, and extramedullary osteosynthesis in 42 cases.

The distribution of the wounded according to the timing of the provision of first qualified specialized aid is presented in Table 2.3.

During the "Golden Hour", 73.4% of the injured were provided with first aid. 70.4% of patients were provided with specialized surgical care in the first 2 hours of gunshot wounds. 21.8% of the wounded were provided with emergency qualified surgical care and resuscitation measures in the sub-branches of the Andijan branch of the RSHTYOIM.

The development of purulent-septic complications in gunshot wounds of the limbs, depending on the type of surgical intervention, is presented in Table 2.4.

Table 2.1.

Distribution of injured by gender and age (n=169)

Wounded groups	Gender				Age									
	Male		Woman		Under 20 years old		21 - 30		31 - 40		41 - 50		51 - 60	
	oh	k	oh	k	oh	k	Oh	k	oh	k	oh	k	oh	k
I (n=59)	39	18	1	1	4	3	18	8	5	-	10	7	2	2
II (n=31)	16	15	-	-	4	3	6	5	5	5	1	2	-	-
III (n=42)	26	16	-	-	5	3	10	6	8	5	3	2	-	-
IV (n=37)	25	12	-	-	4	2	8	3	8	4	4	2	1	1
Total:	106	61	1	1	17	11	42	22	26	14	18	13	3	3

Note: o is the main group; k is the control group.

Table 2.2

Distribution of the wounded according to the type of surgical intervention

Type of operation	Group I (n=59)		Group II (n=31)		Group III (n=42)		Group IV (n=37)		Total:
	oh (n=40)	k (n=19)	oh (n=16)	K (n=15)	oh (n=26)	k (n=16)	oh (n=25)	k (n=12)	(n=169)
PXO, primary suture	33	15	-	-	-	-	-	-	48
Primary delayed stitch	4	2	-	-	8	3	19	7	43
Plastic with local fabrics	-	-	-	-	8	5	-	-	13
Autodermoplasty with a free split cover	3	2	-	-	10	8	6	5	34
Primary extramedullary osteosynthesis (BEMO):	-	-			-	-	-	-	
- without bone autoplasty	-	-	10	10	-	-	-	-	20
- with bone grafting	-	-	6	5	-	-	-	-	11
External osteosynthesis (TO)									
- without bone autoplasty	-	-	-	-	22	13	-	-	35
- with bone grafting	-	-	-	-	4	3	-	-	7
Total Transactions:									
Total Transactions:									211

Note: o is the main group; k is the control group.

Table 2.3.

Distribution of the wounded according to the duration of first qualified and specialized medical care (in RShTYoIM OF and its sub-branches).

Acceptance periods	First Aid (n = 169)		Qualified assistance (sub-branches and other treatment and prevention facilities) (n=37) DPM) (n=37)		Specialized assistance - RSHTYM AF (n=169)	
	Abs.	%	Abs.	%	Abs.	%
Up to 1 hour	124	73.4	24	64.8	100	59.2
Up to 2 hours	24	14.2	8	21.6	19	11.2
Up to 3 hours	21	12.4	5	13.6	13	7.8
* From 3 hours to 2 days	-	-	-	-	37	21.8
Total:	169	100	37	100	169	100

*** - patients brought to RShTYoIM OF from sub-branches and other treatment-prophylactic institutions.**

Table 2.4.

Purulent-septic complications of gunshot wounds of the limbs (initially performed at the Andijan branch of RShTTM)

Type of operation	All wounded		Complications							
			suppuration of the wound				osteomyelitis			
	oh	k	oh		k		oh		k	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Primary surgical treatment of soft tissue injuries with suturing	40	19	1	2.5	2	10.5	-	-	-	-
Primary extramedullary bone fusion	16	15	1	6.2	3	20	1	6.2	2	13.3
Out of focus osteosynthesis	26	16	2	7.7	3	18.5	1	3.8	2	12.5

Note: o is the main group; k is the control group.

The location of acute wounds and the structure of injuries by nature are presented in Table 2.5. Isolated injuries were observed most often, accounting for 81.6 percent. Combined injuries, which posed the greatest danger and led to a serious condition of the wounded, accounted for 9.5 percent.

Table 2.5

Location and nature of damage

The nature of the injury	High heels (78)				Low leg (91)				Total	
	shoulder		wrist		number		it is a calf			
	abs	%	abs	%	abs	%	abs	%	abs	%
Soft tissue injuries -isolated Injuries with bone damage -isolated -many -compound	17 10 3 5	10 5.9 1.8 2.9	11 9 4 4	6.5 5.3 2.4 2.4	22 18 3 2	13.0 10.6 1.8 1.1	15 36 5 5	8.9 21.4 2.9 3.0	65 73 15 16	38.4 43.2 8.9 9.5

Total:	35	20.7	28	16.6	45	26.6	61	36.1	169	100

Table 2.6 shows the structure of joint gunshot wounds of the arms and legs.

Table 2.6.

The structure of joint gunshot wounds of the arms and legs according to their location.

Localization of injuries	Abs.	%
Hands + head	3	1.8
Arms + chest	6	3.5
Arms + stomach	3	1.8
Legs + pelvis	2	1.2
Hands + spine	2	1.2
Total:	16	9.5

When studying the distribution of injuries by severity (Table 2.7), it was found that the majority of injuries were mild - 58.6%, 27.2% of moderate injuries, 13% of severe injuries, and 1.2% of severe injuries. The group of severe injuries included patients with combined and penetrating injuries of the abdomen and chest (2). The contingent of extremely severe injuries was made up of those with combined injuries of the abdomen and chest (2).

Table 2.7

Severity of injuries

Assessing the severity of the injury	Main group	Control group
Mild degree	68	37
Intermediate level	26	16
Severe level	12	8
Very heavy	1	1
Total: (n - 169)	107	62

Method of conducting lymphotropic therapy in patients with gunshot wounds of the limbs.

Lymphotropic therapy involves stimulating lymphatic drainage function and antibacterial treatment.

Regional lymphotropic therapy was performed according to the developed generally accepted method. Lidase in a dose of 64 units in a 0.5% novocaine solution (5.0 ml) was injected subcutaneously into the thigh, at the border of the lower and middle thirds of the anterior surface or into the I interdigital space. Its introduction is due to the need to increase tissue permeability and enhance the passage of interstitial fluid into the lymphatic system.

Stimulation of lymphatic drainage function was achieved by administering heparin at a dose of 70 units/kg without removing the needle. The use of heparin is due to its anticoagulant, blood-thinning properties, and lymph flow-stimulating effects.

As an antibacterial treatment, in the third stage, cefazolin (ceftriaxone) was used, administered lymphotropically through the above needle at a dose of 1000 mg. From an economic point of view, the advantage of regional lymphotherapy is the possibility of a single administration of the antibiotic, which allows to reduce the dosage of the drug and free the nursing staff from additional injections.

2.2. Analysis of experimental materials.

Experimental studies were conducted at the Central Research Laboratory of the Andijan State Medical Institute. Morphological studies were conducted at the Republican Specialized Scientific and Practical Medical Center of Surgery named after Academician V.Vohidov in 2015-2017. The experiments were conducted in several series of studies on outbred rabbits in compliance with international standards for the humane treatment of laboratory animals (Strasbourg 1986).

Based on the tasks set, 2 series of experiments were conducted in the work. In the first series (50 animals), the effect of local lymphotropic antibacterial therapy with regional lymphostimulation on the functional morphology of limb wounds was studied. In the second series (30 rabbits), the pharmacokinetics of the antibiotic in the blood, lymph nodes and soft tissues of the gunshot wound were

comparatively evaluated with different methods of administration of the drug: lymphotropic, intravenous, intramuscular.

Soft tissue gunshot wound model. The combat wound model was an infected gunshot wound in the soft tissues of the rabbit thigh. Analgesia was performed using collypsol anesthesia before the gunshot wound was inflicted. The animals were fixed on the tablets using special devices. Gunshot wounds were inflicted along the inner surface of the right hind thigh of the rabbit using a Makarov automatic pistol (9 mm caliber) with an initial bullet velocity of 315 m/s. To create an infected gunshot wound, a sterile paralon sponge was placed in a Petri dish. Before inflicting the gunshot wound, the sponge was moistened with a microbial suspension and fixed to the intended shooting site with a plaster. During the shooting, the bullet, along with the paralon sponge and microbes, passed through the tissues and infected the gunshot wound. This method of experimentally inflicting gunshot wounds in the soft tissues of the rabbit thigh provided a similar combat wound model. A patent of the Republic of Uzbekistan was obtained for a method for modeling an infected gunshot wound in an experiment (FAP 01724, priority date 04.02.2021).

2.2.1. Description of experimental material for studying the functional morphology of a gunshot wound.

The experimental studies conducted by us, based on the tasks set, were divided into 2 groups (Table 2.8). 2.8)

Table 2.8

Distribution of experimental animals into groups (rabbits).

Experimental groups	The treatment being carried out	Number of animals
Control	Traditional methods of introducing antibiotics (intramuscular)	25
Main	Lymphotropic antibiotic treatment and stimulation of the local lymphatic system	25

Regional lymphatic therapy (RLT) was performed as follows. Under the skin of the right thigh, on the border of the lower and middle third of the back surface, 16 units of lidase solution, previously dissolved in 5.0 ml of 0.5% novocaine solution, were injected. After 4-5 minutes, without removing the needle, an antibiotic (gentamicin at a dose of 1 mg/kg) was injected. Heparin at a dose of 70 units/kg was injected into the same place. Antibiotics were administered with RLT once a day.

Animals in the control group (25) received gentamicin (1 mg/kg) intramuscularly into the posterior surface of the left thigh 3 times a day.

Surgical treatment of gunshot wounds in animals consisted of opening the wound defect along the entire wound channel, removing crushed tissues and remnants of the used infected sponge, washing the wound with antiseptic solutions. Then an aseptic dressing was applied. The healing process of gunshot wounds in experimental animals was studied using light and scanning electron microscopy.

Histological methods of research.

In experimental animals, tissue samples from the wound canal and adjacent areas were studied under ether anesthesia on days 1, 3, 5, 7, and 9 after gunshot wound.

For light microscopy, samples were fixed in 1-2% formalin in Lilly phosphate buffer. Paraffin-embedded sections were stained with hematoxylin-eosin.

For transmission electron microscopy (TEM), tissue samples were fixed in 2.5% glutaraldehyde in phosphate or cacodylate buffer, hydrolyzed in alcohol-acetone, and embedded in epono-araldite. Ultrathin sections obtained with an Ultracut ultratome were contrasted in an Ultrostainer and examined with a Hitachi H-600 electron microscope.

For scanning electron microscopy, the preparations were dehydrated in alcohol-acetone after fixation as described above, then dried by the critical point method in an HCP-2 device and coated with gold in an IB-2 device. They were examined on a Hitachi S405A electron microscope.

Semi-thin epoxy sections stained with methylene blue and fuchsin were also examined under light microscopy.

Stereomorphometric studies were conducted according to the method of GG Avtandilov (1982).

Micrographs were taken on an Axioscope (Zeizz) microscope using a Sony digital camera and then processed on a computer.

2.2.2. Description of experimental studies on the pharmacokinetics of gentamicin when administered by lymphotropic and conventional methods.

The experimental studies consisted of 2 stages. The first stage consisted of modeling a standard gunshot wound in the right leg of a rabbit according to the method described above (Chapter 2.1), as well as blood sampling, inguinal lymph nodes, and soft tissue extraction in the area of the gunshot wound. This part of the experiments was conducted in the Central Research Laboratory of the Andijan State Medical Institute.

The second stage was to determine the concentration of the antibiotic when administered to biological fluids and tissues by various methods and to study the pharmacokinetic effectiveness of the lymphotropic method of antibiotic therapy. The study was conducted at the Center for Genome Technologies of the Institute of Genetics and Experimental Biology of Plants of the Academy of Sciences of the Republic of Uzbekistan (under the leadership of leading researcher, candidate of chemical sciences G. Mavlonov). G. Mavlonov).

Thirty rabbits of both sexes, weighing 5-6 kg, were subjected to a gunshot wound to the right leg under collysin anesthesia and a series of experiments were conducted. Gentamicin was used to study the pharmacokinetics. The animals were

administered gentamicin once at a dose of 1 mg/kg, which corresponds to the average therapeutic dose for an adult.

In the first series of experiments, 10 rabbits were administered gentamicin lymphotropically (LT) according to the method described above.

In the second series (10 rabbits), gentamicin was injected intramuscularly (m/o) into the thigh area.

In the third series of experiments (10 rabbits), gentamicin was administered into a peripheral vein (iv).

To determine the antibiotic concentration, blood serum was taken in a volume of 1-4 ml 0.5, 1, 3, 6 and 24 hours after the administration of gentamicin. After 6 hours, part of the animals were deliberately withdrawn from the experiment by administering increasing doses of collysol after m/o (5 rabbits), v/i (5 rabbits), and also l/t (5 rabbits). The other part of the animals was withdrawn from the experiment after 24 hours after l/t (5 rabbits) and m/o, v/i (5 rabbits in each series) methods. This allowed the extraction of inguinal lymph nodes and soft tissue fragments from the gunshot wound within the specified time periods. The tissues were homogenized by grinding with quartz sand. Distilled water was added to the homogenate. The resulting suspension was centrifuged at 2500 rpm for 30 minutes. The concentration of gentamicin was determined in the supernatant.

Description of the methods used for the quantitative determination of gentamicin.

Extraction of gentamicin from blood.

Heparinized or citrated blood samples were mixed with an equal volume of 0.1M sulfuric acid solution and mixed vigorously using a vibratory stirrer. The suspension was centrifuged at 12,000 rpm for 5 minutes in a benchtop centrifuge (Eppendorf, USA). The supernatant was transferred to a clean test tube and the precipitate was resuspended in 0.05M sulfuric acid by adding acid solution to the original volume of the blood sample under study. The resulting suspension was

also centrifuged and the supernatant was combined with the precipitate from the first centrifugation. The precipitated extracts thus obtained, containing gentamicin sulfate, were cooled in an ice bath and gentamicin was precipitated from the extract by adding cooled (-20°C) acetone in a ratio of 1 ml extract: 3 ml acetone. The mixture of the acid extract with acetone was kept at -20°C for 1 hour and the precipitate was collected by centrifugation under the above conditions. The precipitate, containing gentamicin sulfate and other acetone-insoluble substances, was washed once with chilled acetone and dried at 40°C using a rotary vacuum evaporator (Speed-Vac, USA). The dried extracts were stored at -20°C until further experiments.

Gentamicin extraction from solid clotted blood samples was performed as described below for tissues.

Isolation of gentamicin from soft tissues (lymph nodes, muscles, and subcutaneous fat).

Tissue samples were ground in a mortar with a small amount of quartz sand washed with 1M hydrochloric acid, and 0.1M sulfuric acid solution was gradually added until a ratio of 1 g tissue: 1 ml sulfuric acid solution was reached. The homogeneous tissue suspension thus obtained was centrifuged under the conditions described above for blood. The precipitate was further extracted with 0.05M sulfuric acid, the extracts were combined, precipitated in a gentamicin-acetone solution, and dried as described for blood extracts.

Precolumn derivatization and quantitative determination of gentamicin.

Gentamicin in biomaterial extracts was determined by high-performance liquid chromatography (HPLC) after pre-preparation of the phenyl derivative of gentamicin with phenylisothiocyanate - FITS (Sigma, USA). The method is similar to that used for the preparation of dinitrophenyl- and o-phthalate-derivatives of

gentamicin [References 1 and 2]. A dry extract sample corresponding to 1 g of starting material was suspended in 0.5 ml of acetonitrile:water:triethylamine (7:2:1) to convert gentamicin sulfate to the free base and dried again at 40°C using a rotary evaporator (Speed-Vac, USA). The extract was suspended in another 0.5 ml of acetonitrile:water:triethylamine:FITS (7:1:2:0.05), stirred at room temperature for 15 min and dried using a rotary evaporator. The gentamicin derivative was stored in a vacuum desiccator for several hours until it reached the USSX.

Identification and quantification of the phenyl derivative of gentamicin was performed using reversed-phase chromatography on a 25 x 0.46 cm Ultrasphere C8 column. Mobile phase: 30% acetonitrile and 70% buffer solution (20 mM Na-acetate pH 6.4); flow rate 1 ml/min; detection was performed at a wavelength of 278 nm; analysis time 20 minutes. Chromatography was performed using a YUSSX "System Gold" (Beckman, USA); "Gold" V.3.11 software was used.

The determination of gentamicin concentration was performed by comparing the peak areas corresponding to components S1, S1a, and S2 in the standard gentamicin chromatogram with the corresponding peak areas in the chromatograms of the samples under study.

The calculation of the amount of gentamicin was performed using the following formula:

Amount (μg/g) = (STNO x Cst x SD) / (SSNO),

here

STNO - the area of the gentamicin peak in the chromatogram of the sample solution under investigation;

Cst is the concentration of gentamicin in the standard sample solution;

SSNO is the area of the GA (or GT and ASA, respectively) peak in the chromatogram of the standard sample solution;

SD - dilution factor for recalculating data for 1 g of examined tissue;

Note: SNE - standard sample solution; TNE - test sample solution;

2.2.3. Immunological methods of research.

Evaluation of the immune status before and after surgical treatment in patients with gunshot wounds was carried out based on the methodological recommendations of RVPetrov and co-authors (180). It included the determination of the following indicators in peripheral blood: leukocytes, lymphocyte count, T-lymphocytes, theophylline-sensitive and theophylline-resistant lymphocytes, V-lymphocytes, the amount of serum immunoglobulins of classes A, M, G. It included the determination of the following indicators in peripheral blood: leukocytes, lymphocyte count, T-lymphocytes, theophylline-sensitive and theophylline-resistant lymphocytes, V-lymphocytes, the amount of serum immunoglobulins of classes A, M, G.

Heparinized venous blood from the elbow vein was used to isolate lymphocytes. Lymphocytes were isolated from peripheral blood using a phycocyanin gradient (solution density 1.077 g/ml). The cell concentration was adjusted to 2 x 10 per ml (Boyum, 1965).

The number of circulating T-lymphocytes in the peripheral blood was determined using the spontaneous rosette formation (S-ROK) test proposed by Condal et al. (1972). The principle of the method is based on the binding of T-lymphocytes to sheep erythrocytes with the help of appropriate receptors over the entire surface. In this case, a rosette is formed, consisting of a lymphocyte located in the center and three or more erythrocytes attached to it. 0.1 ml of the suspension was mixed with an equal volume of a 1% solution of erythrocytes. The mixture was incubated at 37 ° C for 5 minutes, centrifuged at 1000 rpm for 5 minutes and stored at +4 ° C for one hour. Then the cells were fixed with glutaraldehyde (0.05 ml of a 2% solution in phosphate buffer) for 5 minutes, washed, smeared and stained with azure-eosin. The number of lymphocytes forming a rosette was expressed as a percentage of the total number of lymphocytes. Subpopulations of T lymphocytes with helper (theophylline-resistant T lymphocytes - Tfr) and suppressor (theophylline-sensitive T lymphocytes - Tfch) functions were

determined according to the method of M. Rucheton et al. (1981). To determine theophylline-resistant lymphocytes, 100 μl of lymphocyte suspension was incubated for one hour at 37°C in an equal volume of theophylline solution in medium 199 (2.0 mg/ml). The reaction without incubation with theophylline was carried out in parallel. It was found that some lymphocytes lost their ability to form rosettes with sheep erythrocytes when incubated with theophylline solution.

When the rosette formation reaction is performed with erythrocytes after incubation with theophylline, the number of rosette-forming cells is the number of theophylline-resistant T-lymphocytes with helper properties. The number of theophylline-sensitive lymphocytes was determined by the difference between the total number of T-lymphocytes and the number of theophylline-resistant T-lymphocytes using the following formula:

$$Òô÷ = \frac{À - Â \times 100}{À}$$

where A is the total amount of E-ROC, V is the amount of E-ROC formed after incubation with theophylline (Tfr).

V-lymphocytesEAC was determined by the spontaneous rosette formation method (G/Bianco, 1970). For this purpose, 2.0 ml of a 2.5% suspension of bovine erythrocytes was added with 2.0 ml of rabbit antiserum of the appropriate titer and incubated at 37°C for 30 minutes. Then 400 μl of complement (1:10) was added and incubated for another 30 minutes at 37°C. After washing, a 0.5% suspension of sensitized erythrocytes was prepared. An equal amount of 0.5% suspension of sensitized erythrocytes was added to 100 μl of a suspension of mononuclear cells, centrifuged at 2000 rpm for 3 minutes, fixed with glutaraldehyde, centrifuged again, and a smear was prepared from the sediment.

E and EAK - when counting cells that spontaneously form rosettes, up to 400 mononuclear cells are counted in smears, from which cells with 3 or more erythrocytes attached are selected. The percentage of lymphocytes is calculated.

The content of immunoglobulins A, M, G in blood serum is determined by the radial immunodiffusion method according to Mancini (1965). Antisera to various classes of immunoglobulins (produced by the Central Research Institute of Vaccines and Serums named after IIMechnikov) are dissolved in molten agar and poured onto glass plates. After the agar solidifies, holes are made in it for pouring human serum. Serum immunoglobulins diffuse into the agar, where a precipitation ring appears, the diameter of which corresponds to the content of immunoglobulin in the serum under investigation. The quantitative content of immunoglobulins is expressed in g/l.

The studies were conducted in the ADTI immunology laboratory.

2.2.4. Study of the quantitative composition of wound microflora.

The determination of the amount of bacteria in purulent wounds was carried out according to the Gould method /Feldman Yu.M. et al., 1984/. The essence of the sectoral sowing method is as follows: before taking a sample to eliminate microflora from the wound surface, the wound cavity is treated with sterile physiological sodium chloride solution and ethyl alcohol. Under local anesthesia with 3% dicaine solution, a piece of wound tissue is taken using sterile ear polyp forceps (the mass of the piece is 4.5±0.5 mg), placed in a test tube with an equal amount of sterile isotonic sodium chloride solution. The piece of tissue is crushed with a glass rod. The contents of the test tube are thoroughly mixed and planted in a Petri dish with a nutrient medium (blood agar) according to the Gould method. The dishes are incubated at 37°C for 18-24 hours, after which the number of colonies grown in different sectors is counted. The number of microorganisms in 1 g of tissue is calculated using the following formula:

$$K = \frac{V \times 10n}{m}$$

where K is the number of microbes in 1 g of tissue (mt/g), 10n is the concentration of microorganisms in the suspension (mt/ml), m is the mass of the sample piece (g), and V is the volume of the suspension (ml).

2.2.5. Determination of the pH level of the wound environment.

The pH level of the wound environment was determined using the "Universal ionometer EV-74" device, using pH probes used in the study of gastric secretion.

After removal of purulent material, the olive-shaped part of the pH probe was inserted into the wound and pressed firmly against the wall. Large wounds were examined in 2-3 places. Different pH values were taken in different parts of the wound and the average was calculated. The probe was sterilized in a 0.2% solution of chlorhexidine in alcohol and rinsed in a sterile isotonic solution of sodium chloride before direct examination. The probe was calibrated using standard buffer solutions.

The criteria for assessing the pH level of the wound environment were as follows: mild acidosis - pH from 7.0 to 6.6, moderate - from 6.5 to 6.0, severe - from 5.9 to 5.2. The pH of the wound environment is considered normal if it is in the range of 7.1-7.4. Examinations were performed after surgical treatment of the wound, as well as on days 1, 3, 5 and 9 after the start of surgical treatment.

2.2.6. Cytological studies.

In this study, we used the method of obtaining smears from the wound surface, developed and recommended by MP Pokrovskaya and MS Makarova (1992). In the study, smears were taken 3 times in a row from wounds and drains. This allowed obtaining layered cytological data for an objective analysis of the studied material. Cytological studies were conducted in all groups. Cellular material from smears and drains was taken on the 1st, 3rd, 5th and 10th days of

treatment when the dressings were changed. As indicators for the study, unchanged and changed neutrophil leukocytes, immature mononuclear macrophages, young and mature fibroblasts, fibrocytes were selected and monitored during the treatment process. Cellular elements were counted and studied under oil immersion, 400 cells were counted in each smear.

2.2.7. Statistical processing of the material

The statistical data of the studied material were processed on a Pentium-IV computer using the "Microsoft Excel" program. The average M, relative P values and their errors m were determined using variational statistical methods. The Student's t-coefficient was used to determine the reliability of the results obtained. The results were considered reliable if the difference in frequencies for the studied characteristic did not exceed $P<0.05$.

Conclusion

The clinical study involved 196 patients with gunshot wounds who were massively hospitalized in the medical institutions of the emergency medical care system of the Republic of Uzbekistan after the 2005 Andijan events. They applied to the Andijan branch of the RSHTYOIM and its subbranches. All patients were conditionally divided into two groups: the main group - those who initially applied to the Andijan branch of the RSHTYOIM, and the control group - those who applied to other treatment and prevention institutions of the region. The patients of the main group underwent endolymphatic administration of antibiotics and stimulation of lymphatic drainage, while the control group received antibiotics in the traditional way as part of the treatment.

A unique model of gunshot wound in experimental animals was developed in experimental studies. The healing processes of gunshot wounds of the limbs in 90 non-breeding sexually mature rabbits in the main and control groups were studied at the optical and electron-optical levels. The pharmacokinetics of

endolymphatic, intravenous and intramuscularly administered antibiotics were studied. A method of endolymphatic administration of antibiotics with stimulation of lymphatic drainage in gunshot wounds of the limbs was developed.

The complex of studies included laboratory blood tests, immunological tests, wound canal cytology, as well as bacteriological studies.

CHAPTER III. EXPERIMENTAL SUBSTITUTION OF THE METHOD OF LYMPHOTROPIC ANTIBIOTICAL THERAPY WITH REGIONAL LYMPHOSTIMULATION

3.1. Morphology of the wound process and pathomorphosis in promoting wound healing.

A characteristic feature of the gunshot wound was the uneven mosaic appearance of the wounds at all observation periods (days 1, 3, 7, and 9).

On the first day, a strong exudation was observed in the clearly formed wound canal.

Light-optical examination revealed fragments of adipose tissue, hair and follicle fragments, burn pigment, and detritus in the exudate of the same composition (Fig. 3.1). The tissue fragments adjacent to the wound canal formed the first zone, the so-called primary necrosis. This zone contains tissues that have completely lost their viability (Fig. 3.2). Most often, this zone consists of cellular detritus, in which individual fragments of cells can be isolated (Fig. 3.3).

The second zone consists of tissues, the changes of which are very diverse - from necrotic and necrobiotic changes to barely visible lesions. This is called the zone of commissure or secondary necrosis. It is characterized by a strong reaction of blood vessels that are preserved even in the early stages of observation. The vessels are dilated, characterized by extensive hemorrhages, polymorphous cellular infiltration and foci of edema (Fig. 3.4-3.6). In this area, necrotic myocytes and fragmented muscle fibers alternate with myocytes and muscle fibers that have retained their structure and even transverse striation (Fig. 3.4-3.7).

Transmission electron microscopy during these observation periods reveals areas of necrosis of fibrin bundles, fat cell fragments, electron-dense particles, and electron-opaque sheet-like masses on the surface. These masses are likely to be fragments of exudative fluid (Fig. 3.8).

Scanning electron microscopy of the inner surface of the wound canal reveals fibrin fibers and discrete particles of various sizes and shapes (Figure 3.9).

In the early stages of follow-up, no significant differences were observed in the gunshot wound group that underwent lymphatic therapy compared to the control group.

The wound canal space was also filled with exudate, fragments of hair follicle fibers, and dense discrete particles (Figure 3.10).

The necrotic zone is not very extensive. It appears as detritus. In the adjacent areas, edema and hemorrhage zones are observed (Fig. 3.11). Some myocytes that have preserved their characteristic architectonics are also found (Fig. 3.12).

Transmission electron microscopy did not reveal any significant differences from the control group. Fibrin bundles, fragments of nuclei and cell detritus, fat droplets, and some cocci-like microorganisms were detected on the inner surface of the wound canal.

Scanning electron microscopy also showed no significant differences from the control group. Numerous fibrin fibers and discrete particles of various shapes and sizes were located on the surface (Figure 3.13).

3 days after the injury, the most significant changes are detected in the area of commosis (secondary necrosis). Necrotic myocytes are disintegrated and surrounded by structureless areas. In relatively preserved parts of the tissue, intense infiltration with polymorphic cellular elements is observed, foci of hemorrhage between muscle fibers are preserved (Fig. 3.14, 3.15). In the preserved muscle fibers, swelling of the interfibrous spaces is observed (Fig. 3.15).

Transmission electron microscopy reveals fibrin strands, fragments of nuclei and cellular detritus, oil droplets, and some cocci-like microorganisms on the surface of the wound canal (Figure 3.16).

Scanning electron microscopy of the wound canal surface shows accumulations of detrital masses, fibrin tufts, and individual round cellular elements (Fig. 3.17).

In the lymphatic stimulation group, light microscopy revealed significant differences from the control group at this time. In the area of secondary necrosis, the necrotic muscles were significantly resorbed. In this area, there were large multinucleated cells and numerous blood and lymphatic vessels (Fig. 3.18). This was accompanied by moderate polymorphous cellular infiltration of these areas (Fig. 3.19). In the area of primary necrosis, individual round cell elements appeared among the fibrin bundles (Fig. 3.20). Scanning electron microscopy revealed fibrin fibers, in some places round cell elements and fibroblast-like cells on the surface of the wound channel (Fig. 3.21).

On the 5th day of observation, round cell elements with some fibroblasts appear in the wound canal cavity among fibrin tufts (Fig. 3.22). In the area of primary necrosis, areas of accumulation of infiltrate consisting of polymorphous cells, including macrophages, are found (Fig. 3.23). In some parts of the secondary necrosis zone, significant gaps are detected between the preserved muscle fibers, which indicates the presence of severe edema (Fig. 3.24). In other places, dense polymorphous cell infiltrates are located between the preserved fibers (Fig. 3.25).

Scanning electron microscopy showed the presence of round cell elements and individual fibroblast-like cells among fibrin fibers in the wound channel (Fig. 3.26).

In the lymphostimulated group, the fibrin-filled wound canal cavity is dominated by fibroblasts, not round cell elements, as in the control group (Fig. 3.27). In some parts of the wound canal, along with fibroblasts, new microvessels, including lymphatic vessels, appear (Fig. 3.28).

In the area of compression under the influence of lymphostimulation, a large number of dilated lymphatic capillaries appear (Fig. 3.29). They are usually located in the zone of accumulation of blood microvessels. In some areas of the commissure zone, polymorphic cellular infiltration remains.

Thus, despite the fact that the morphological picture indicates a clear mosaicity of the wound process during this observation period, the comparative

description gives reason to argue that lymphatic therapy helps to significantly stimulate the course of the wound process.

Transmission electron microscopy in the stimulated group shows that the ultrastructure of macrophages reflects their pronounced functional activity. The surface of the cells with numerous cytoplasmic protrusions indicates the activation of phagocytosis. Phagosomes and primary lysosomes are present in large numbers in the cytoplasm (Fig. 3.30). The ultrastructure of mast cells (labrocytes) also indicates their high functional activity. Their cytoplasm contains many characteristic secretory granules, many of which are secreted from the cells (Fig. 3.31). Most of them are extruded from the cells (Fig. 3.31).

Comparison of light-optical examination of semi-thin sections with transmission electron microscopy data shows that, in addition to endothelial cells, fibroblasts are actively involved in the processes of neovasculogenesis, which are especially pronounced during this period in the lymphatic stimulation group.

Elongated endotheliocytes connect with their progenitors to form a microvascular pathway (Fig. 3.32). Endotheliocytes optically differ from fibroblasts in that they have a narrower cytoplasm and a flattened nucleus.

TEM studies allow us to more clearly demonstrate the differences between endotheliocytes and fibroblasts. In the narrow elongated cytoplasm of endothelial cells, cytoplasmic structures for heterosynthesis - the rough endoplasmic reticulum and the Golgi complex - are present in small quantities. In the cytoplasm of fibroblasts, these structures are well developed, along with large elongated but not flattened nuclei. The profiles of the rough endoplasmic reticulum contain protein flocculates of moderate electron density, and a small number of vacuoles. The cytoplasmic membrane of fibroblasts and their growths are tightly connected to the adjacent collagen fibers (Fig. 3.33, 3.34). Lymphatic therapy leads to a significant stimulation of neovasculogenesis. This process applies to both blood vessels and, in particular, to lymphatic capillaries.

Transmission electron microscopy allows us to clearly distinguish between blood and lymphatic capillaries. The endothelial cells of blood capillaries have a

thicker cytoplasm and are more closely connected to each other, and there are a certain number of microvilli on their inner (vascular) surface. The main difference between blood capillaries and lymphatic capillaries is the presence of pericytes densely attached to their walls, as well as a structure called the basement membrane or basal lamina located between the endotheliocytes and pericytes (Fig. 3.34).

Lymphatic capillaries do not contain pericytes and a basement membrane. Endotheliocytes have a thin layer of cytoplasm, and their intercellular connections are not very dense (Fig. 3.33). Fibroblasts, similar to pericytes, are located around the lymphatic capillaries, at a certain distance from their walls and are in direct contact with the main intercellular substance (Fig. 3.33). The spaces of the lymphatic capillaries are usually slit-like, which can also be observed under light microscopy.

Scanning electron microscopy also reveals actively secreting mast cells among fibroblasts and their progenitors (Fig. 3.35).

Thus, during these periods of observation, a significant difference is observed in the morphological state of the wound in the lymphatic therapy and control groups.

Despite the obvious mosaicism of the structural state in both groups, the first group showed a greater expression of neovasculogenesis and repair of damaged structures. Neovasculogenesis processes affect both blood and lymphatic vessels.

On the 7th day of observation, light microscopy studies showed that in the wound canal of the control group, young granulation tissue fragments containing numerous sinusoidal-type capillaries and fibroblasts were formed (Fig. 3.36). Other types of soft connective tissue cells were also found.

In the zone of commissure, there is an outgrowth of young connective tissue with numerous microvessels, fibroblasts, and collagen fibers between the damaged muscle fibers (Fig. 3.37).

Scanning electron microscopy reveals a large number of macrophages, large and much smaller mast cells in the wound canal during this period, which are in a state of intensive granule secretion (Fig. 3.38).

In the group receiving lymphatic stimulation, a decrease in the number of microvessels in the granulation tissue filling the wound canal and some of them becoming loose were observed during this period (Fig. 3.39), which indicates the beginning of the process of granulation tissue remodeling and devascularization. The intermuscular connective tissue layers are characterized by a moderate amount of fibrous material and a large number of microvessels. This is accompanied by a clear restoration of the architectonics of muscle fibers (Fig. 3.40).

At the same time, TEM reveals dilated, spaced lymphatic capillaries in the granulation tissue. Their walls are formed by a single layer of endotheliocytes with very thin cytoplasm, numerous free polysomes and small vesicles. It is also characterized by the absence of a basement membrane (Fig. 3.41).

The expansion of the spaces of the lymphatic capillaries, the thinning of the endotheliocyte cytoplasm with small vesicles, indicates an increase in transport processes through the lymphatic capillary wall. This is a structural expression of their stimulation under the influence of lymphatic therapy.

On the 9th day of observation, the number of vessels in the granulation tissue of the wound canal tends to decrease, and some of them become empty (Fig. 3.42). This is a sign of the beginning of devascularization and re-formation of the granulation tissue. In the zone of commissure, along with the restored muscle fibers, there are areas of growth of fibrous connective tissue (Fig. 3.43). This indicates the replacement of muscle tissue with scar tissue.

In the lymphatic therapy group, dilated lymphatic capillaries and blood vessels continue to be detected in the commissure area during this period (Figure 3.44). However, a large part of this zone is occupied by areas with muscle fibers of normal architecture (Figure 3.45).

Morphological studies have shown that the course of wound healing in gunshot wounds is characterized by a clear gradual progression.

Morphological changes in wound healing under the influence of lymphatic therapy are manifested on the 3rd day of exposure. They are characterized by a significant decrease in tissue swelling and increased absorption of necrotic and detrital masses.

Subsequently, stimulation of neovasculogenesis is observed both in blood and especially in lymphatic capillaries. Ultrastructural signs of mast cell activation under the influence of lymphatic therapy indicate a significant increase in their secretion of biologically active substances that play an important role in the wound healing process.

Under the influence of lymphatic therapy, the activation of fibroblasts and the increased synthesis of collagen and basic intercellular substance by these cells are morphologically clearly manifested.

All this contributes to the acceleration of the wound healing process, the absorption of necrotic masses, the removal of foreign particles and the early detoxification of the wound, and therefore of the entire organism. It also leads to scarring of the wound canal and complete restoration of muscle fibers in the area of compression.

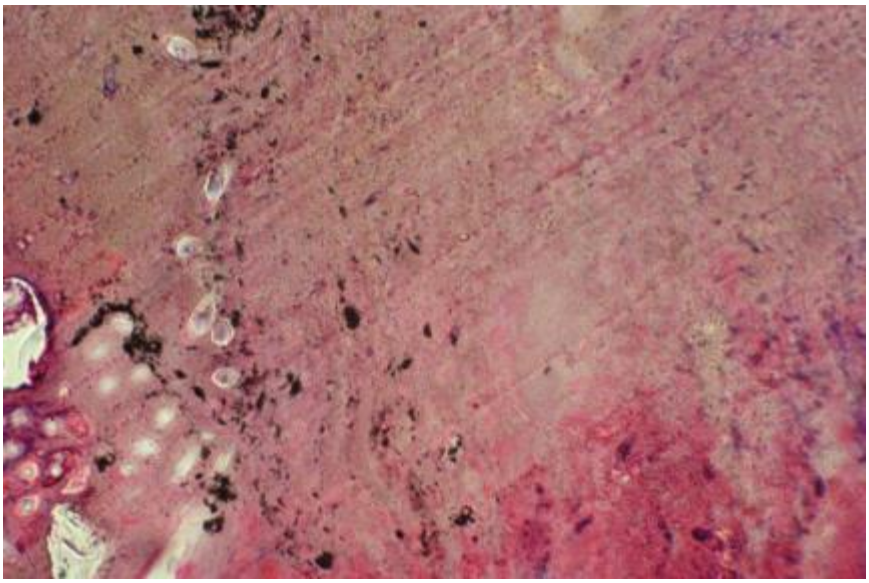

Figure 3.1. Exudate, hair fragments, and dense particles in the wound canal. Day 1 of the wound, control. GE 10x10.

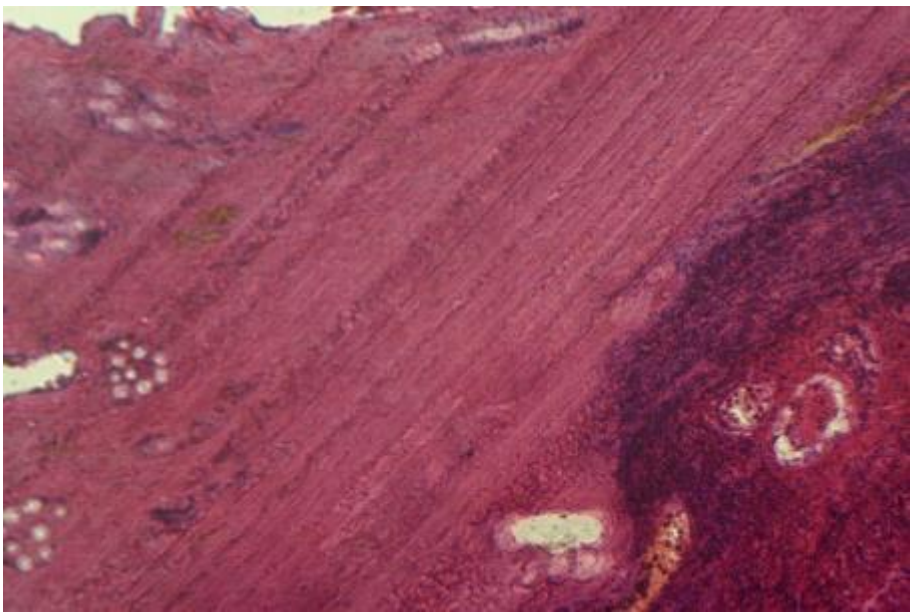

Figure 3.2. Wound canal and area of primary necrosis. Day 1 of wound, control. GE 10x10.

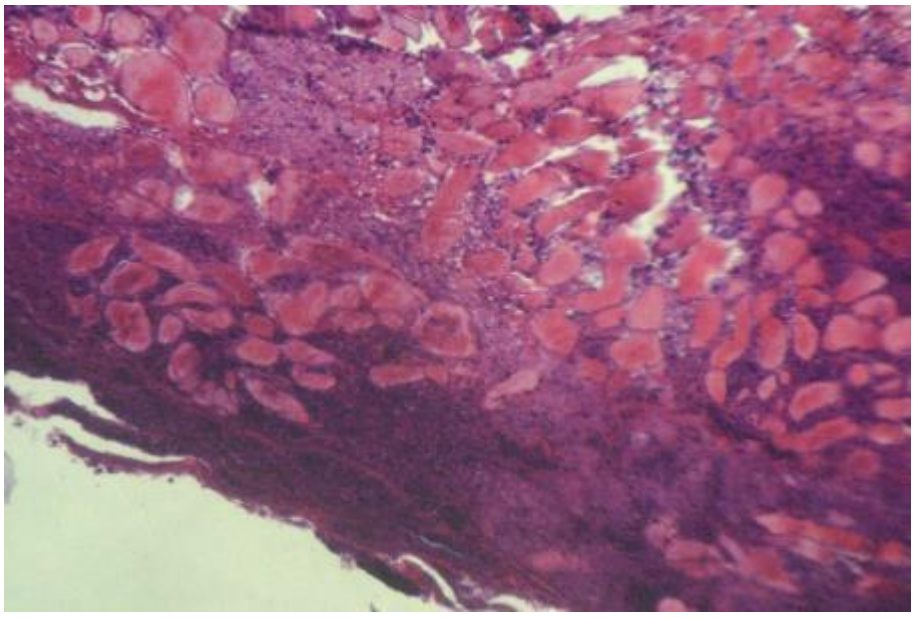

Figure 3.3. Primary and secondary necrosis (commosis) zone on day 1 of wound control. GE 10x10.

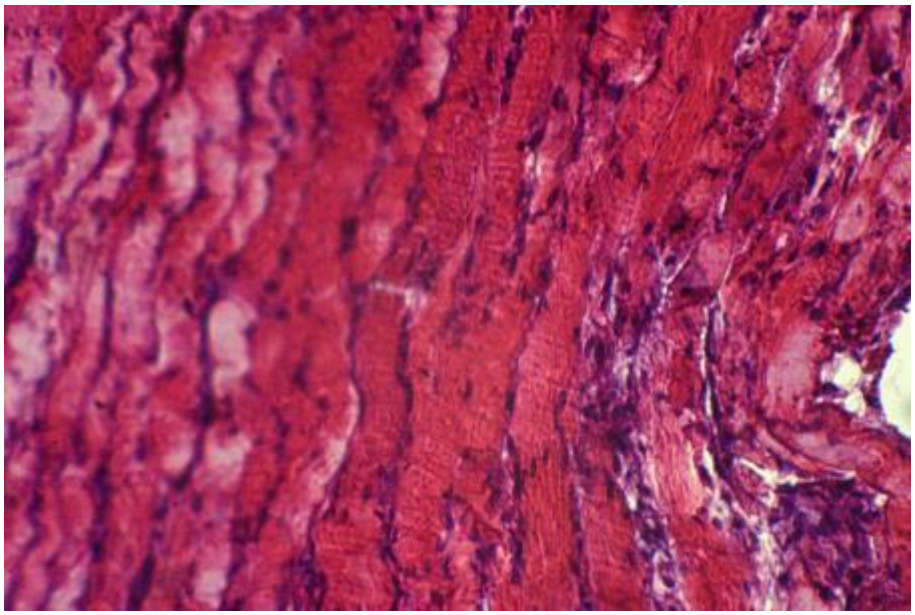

Figure 3.4. Swelling and infiltration of the area of secondary necrosis and adjacent tissues. 1 day after injury, control. GE 10x16.

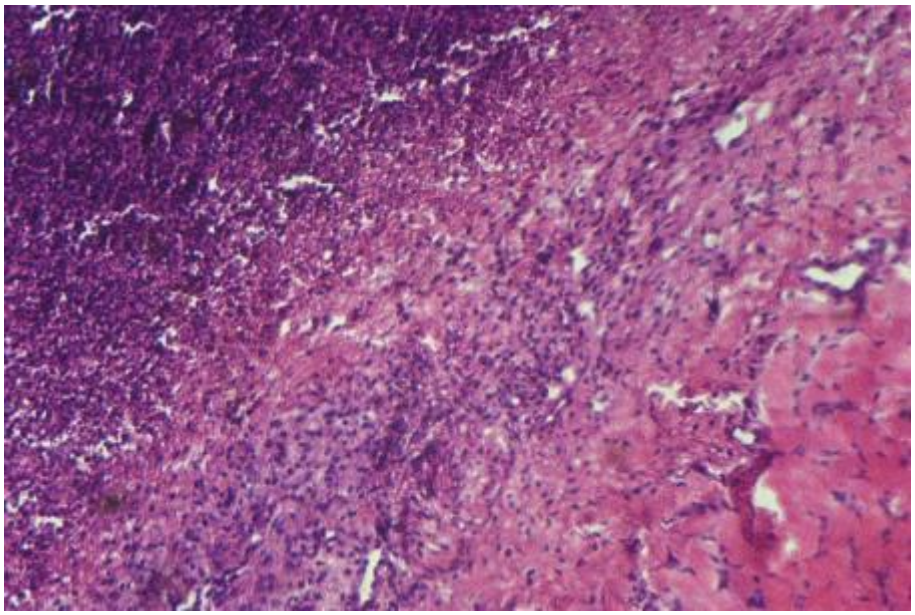

Figure 3.5. Severe infiltration and hemorrhage of the commissure area 1 day after injury, GE 10x10.

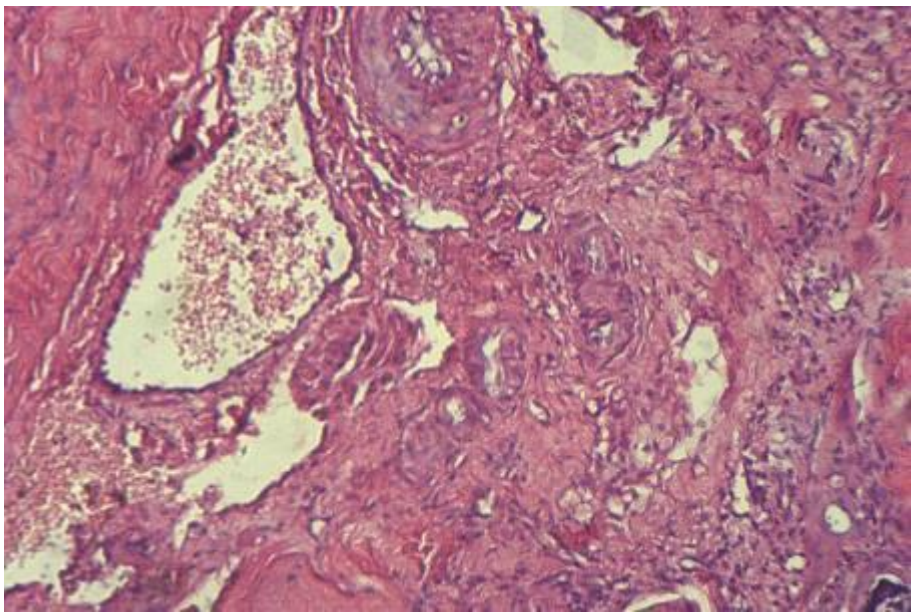

Figure 3.6. Dilated microvessels and areas of hemorrhage in the area of the commissure. 1 day after injury. GE 10x16. GE 10x16.

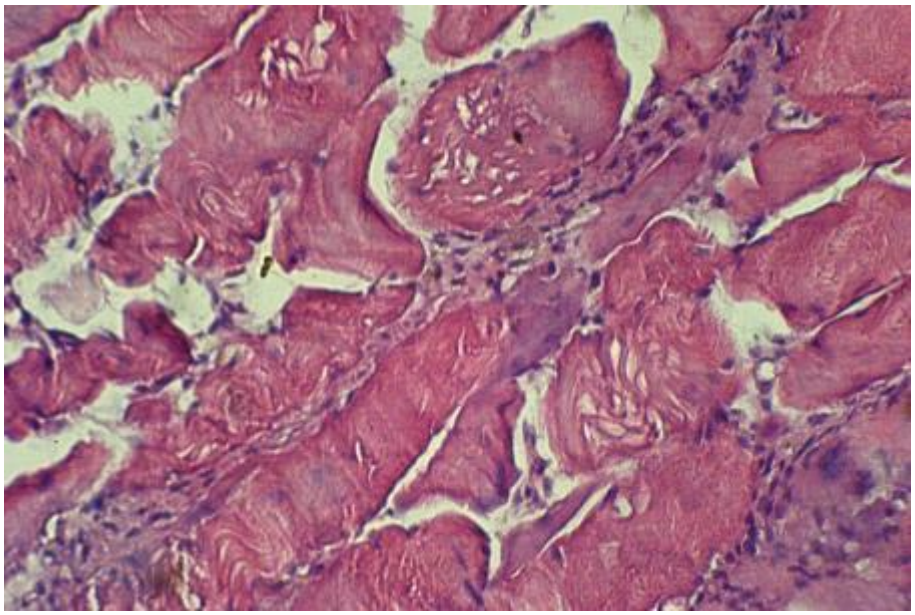

Figure 3.7. Muscle fibers

Polymorphism between the border of the commissure zone and the surrounding tissues. 1st day of injury. GE 10x16.

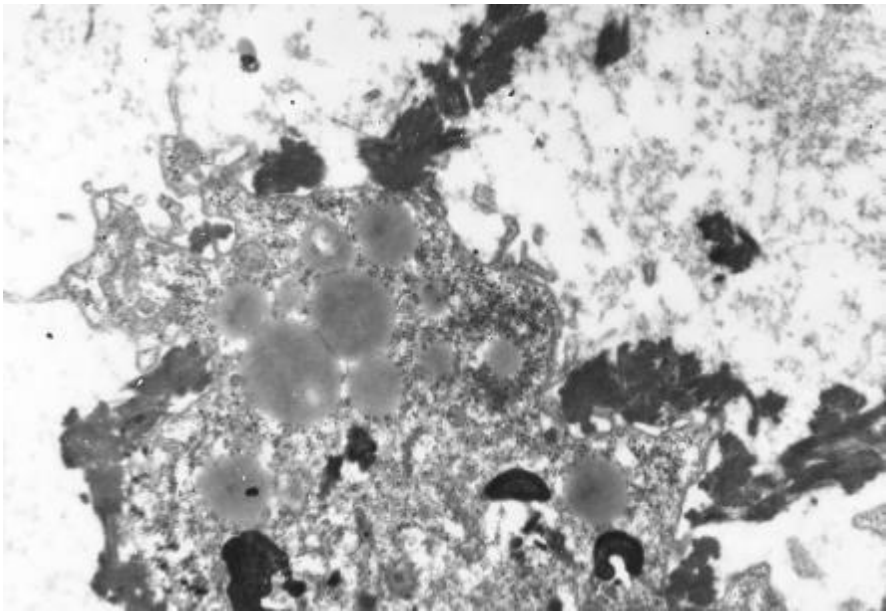

Figure 3.8. Fat cell fragments, detritus, and electron-dense corpuscles. 1 day after injury. TEM at x7500 magnification.

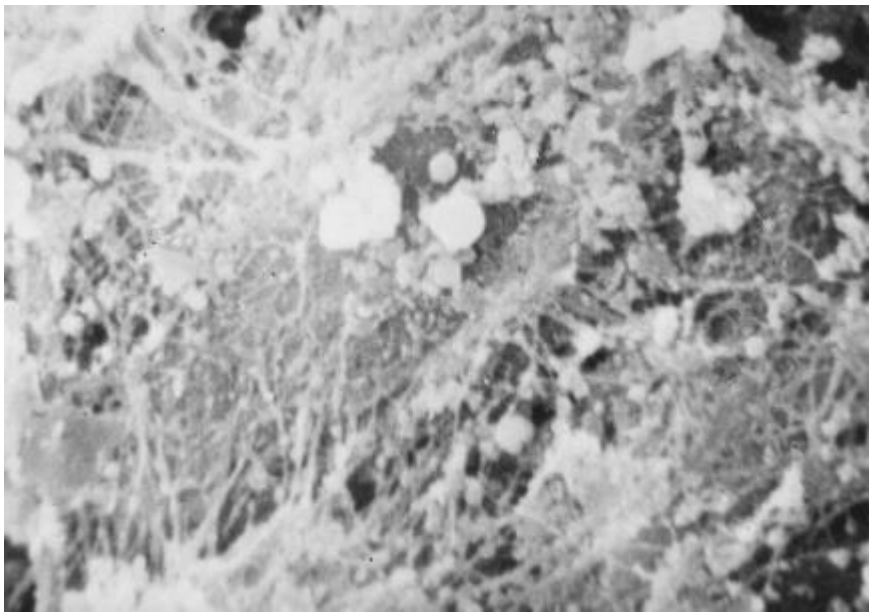

Figure 3.9. Fibrin fibers, discrete particles on the surface of the wound canal wall. Day 1 of injury. Control.
SEM x400. Control. SEMx400.

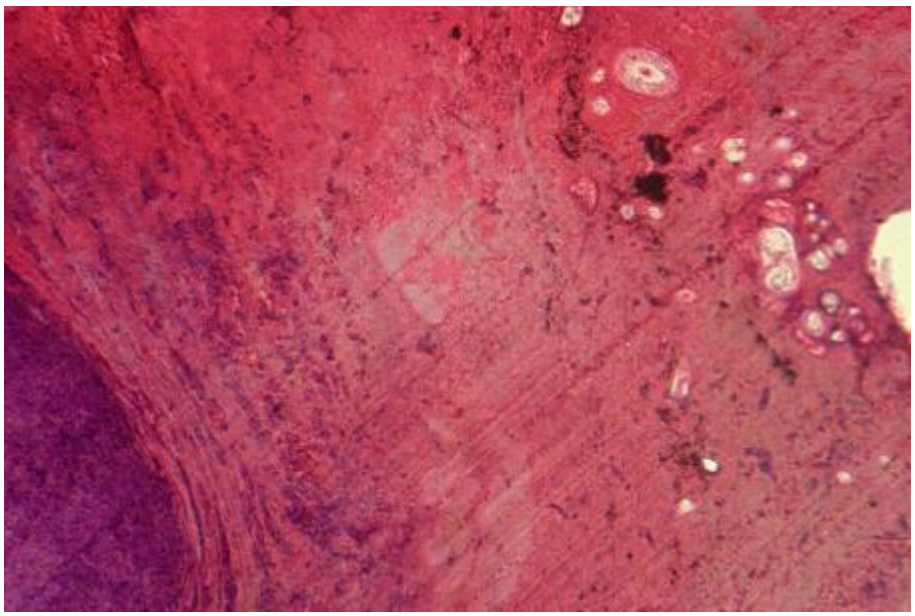

Figure 3.10. Exudate, hair fragments, and dense particles in the wound canal. 1 day after injury. LT. GE 10x10.

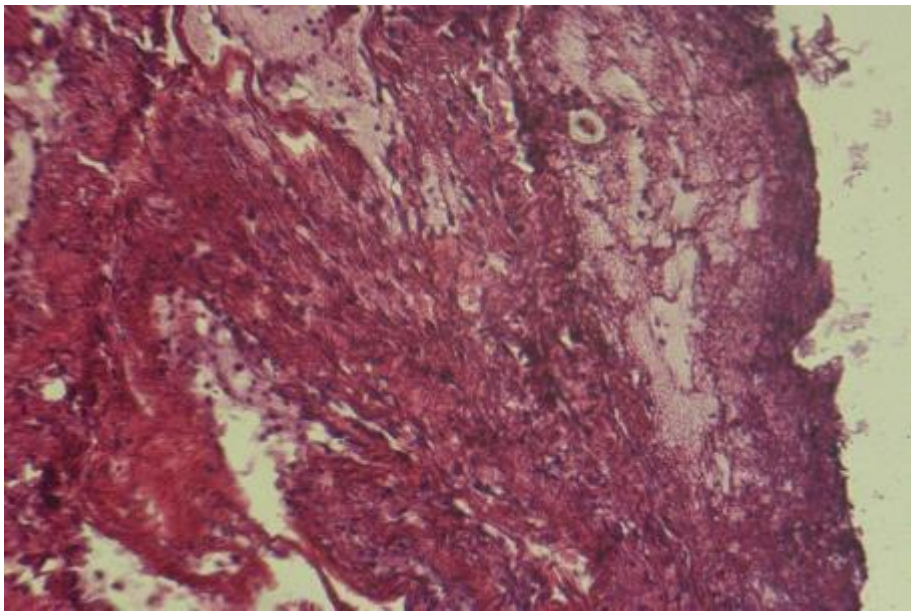

Figure 3.11. Primary and secondary necrosis zone (contusion) 1 day after injury, LT. GE 10x10.

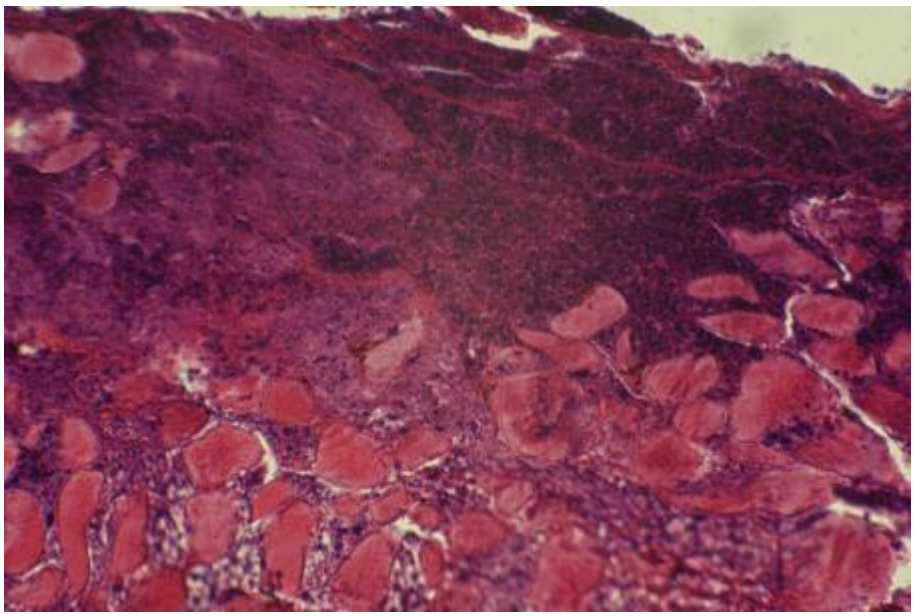

Figure 3.12. Primary and secondary necrosis (commosis) zone in the first day after injury, LT. GE 10x10.

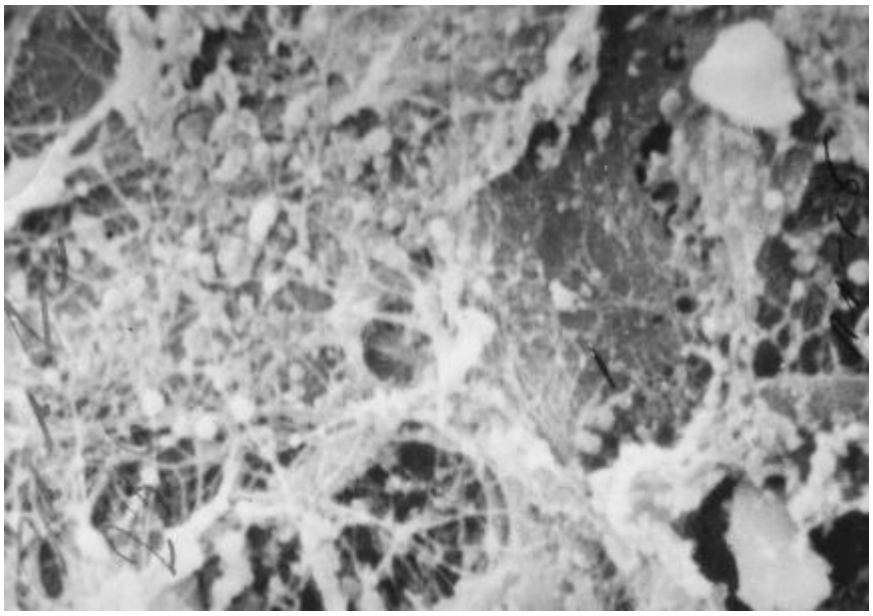

Figure 3.13. Fibrin, individual particles on the surface of the wound canal wall. 1 day after wounding. LT. SEM x 400.

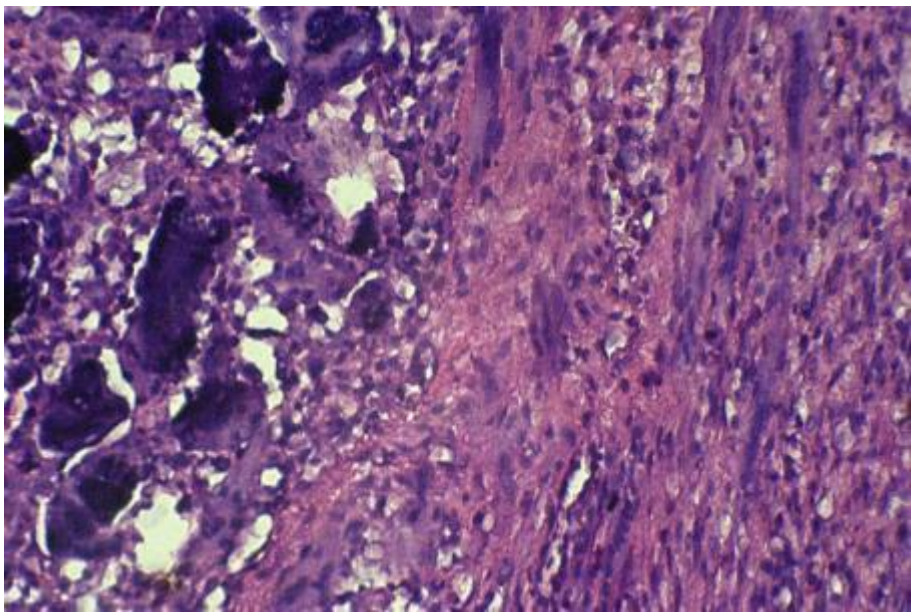

Figure 3.14. Infiltration at the border of the primary and secondary necrosis zone. 3 days after injury. Control. Hematoxylin-eosin stained, 10x16 magnification.

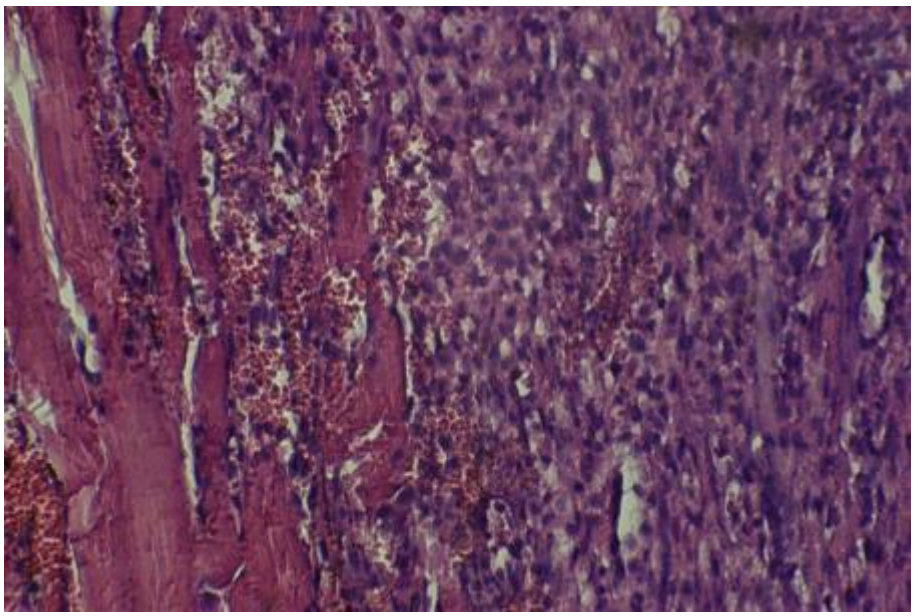

Figure 3.15. Swelling. Fibrin fibers and individual particles on the surface of the wound canal wall. 3 days after injury. Control. GE 10x16.

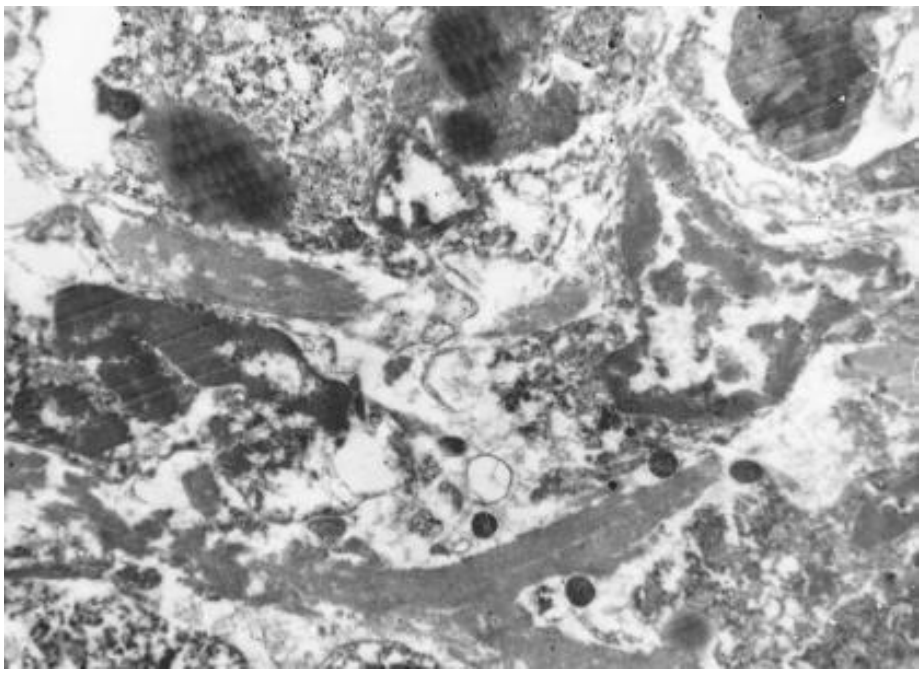

Figure 3.16. Fibrin, cell debris, and microorganisms in the wound canal cavity. Day 3 of the wound. Control. TEM x 7500.

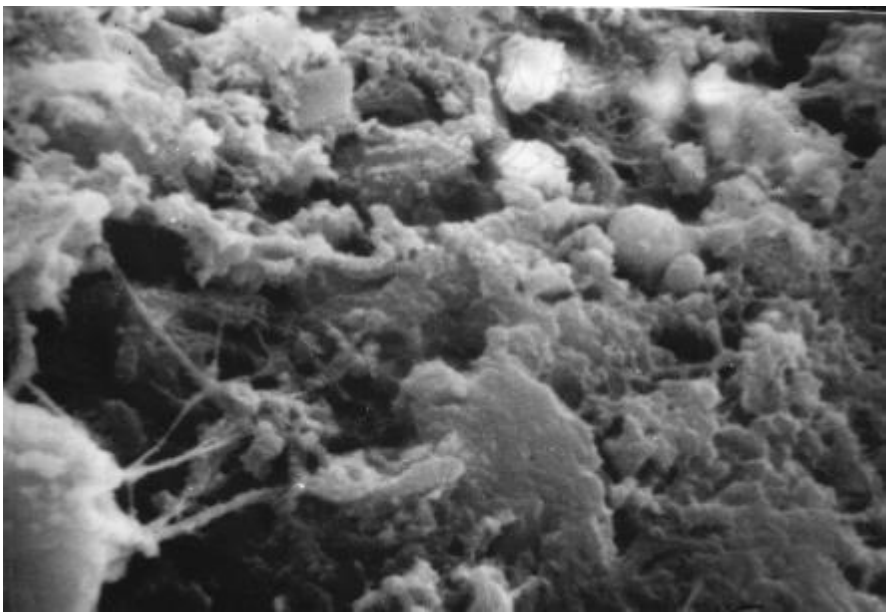

Figure 3.17. Cellular detritus and some round cell elements. Day 3 post-wound. Control. SEM x 600.

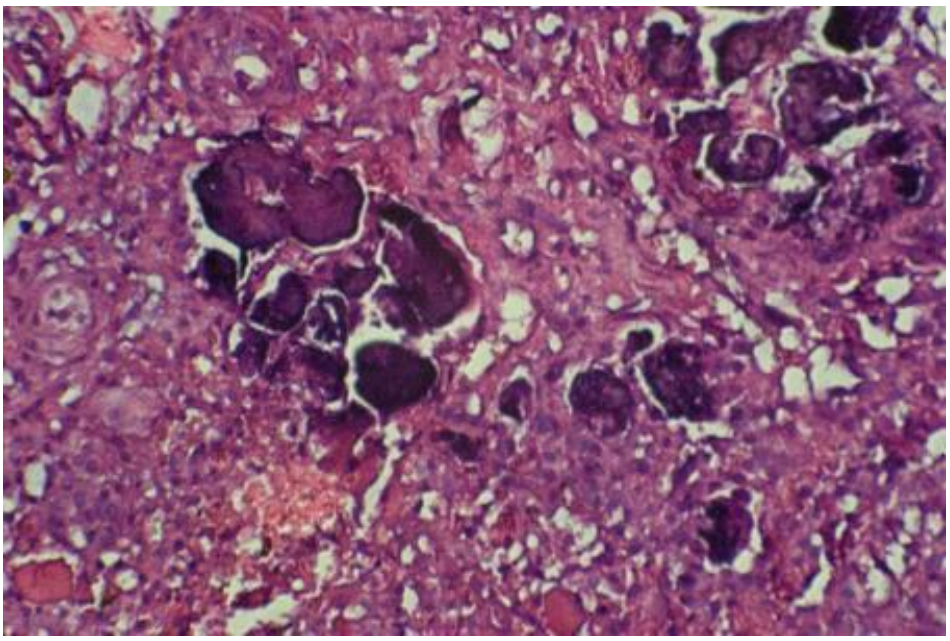

Figure 3.18. Necrotic myocytes, foreign body giant cells, and small blood vessels in the area of commissure. 3rd day of injury, LT. GE 10x16.

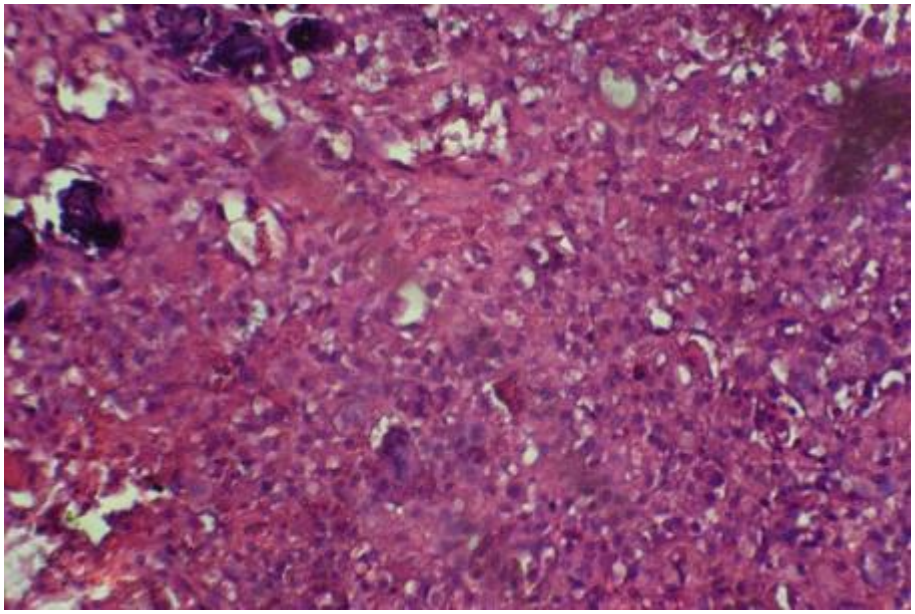

Fig. 3.19. Infiltration of the commissure zone. 3 days after injury, LT. GE 10x16.

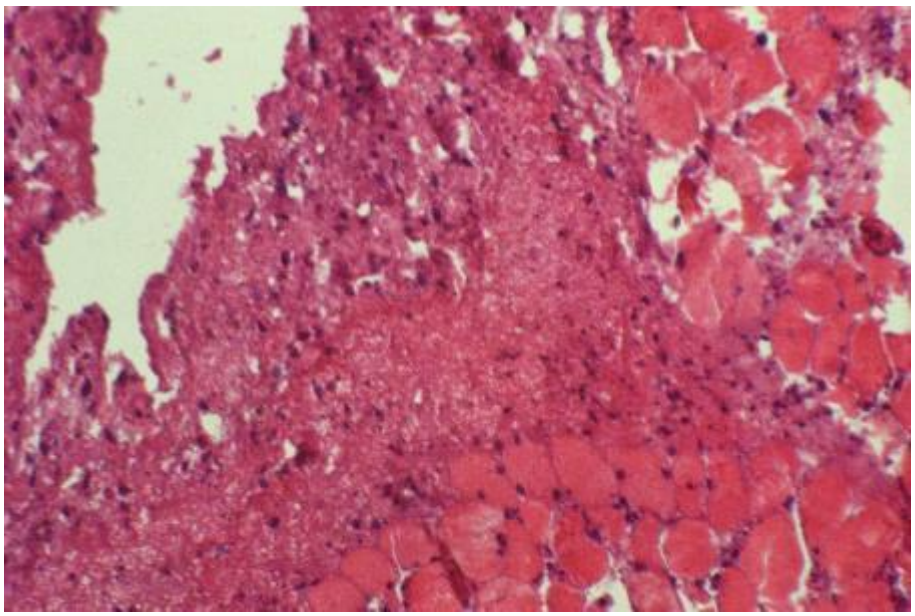

Figure 3.20. Appearance of some round cell elements in the area of initial necrosis. 3rd day of injury. LT. GE 10x16.

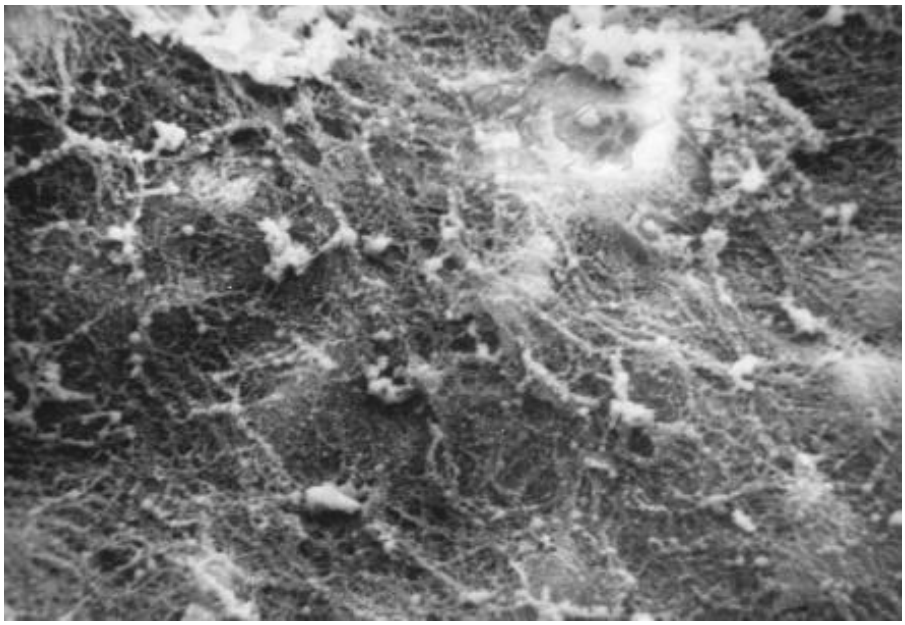

Figure 3.21. Fibrin fibers in the wall of the wound canal at 3 days, LT. SEM x400.

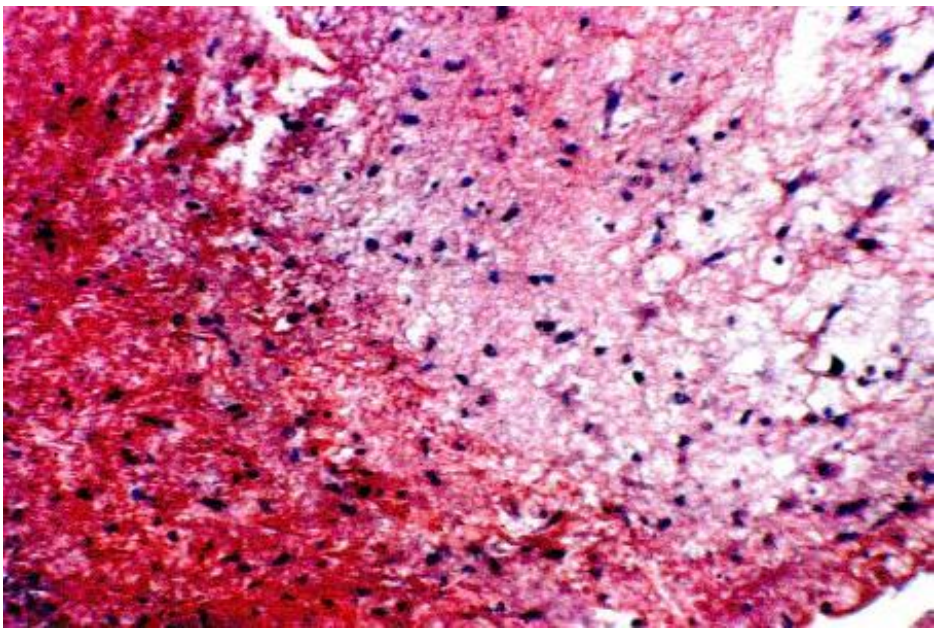

Figure 3.22. Fibrin and round cell elements in the wound canal. After injury 5 days later. Control. Hematoxylin-eosin, 10x16.

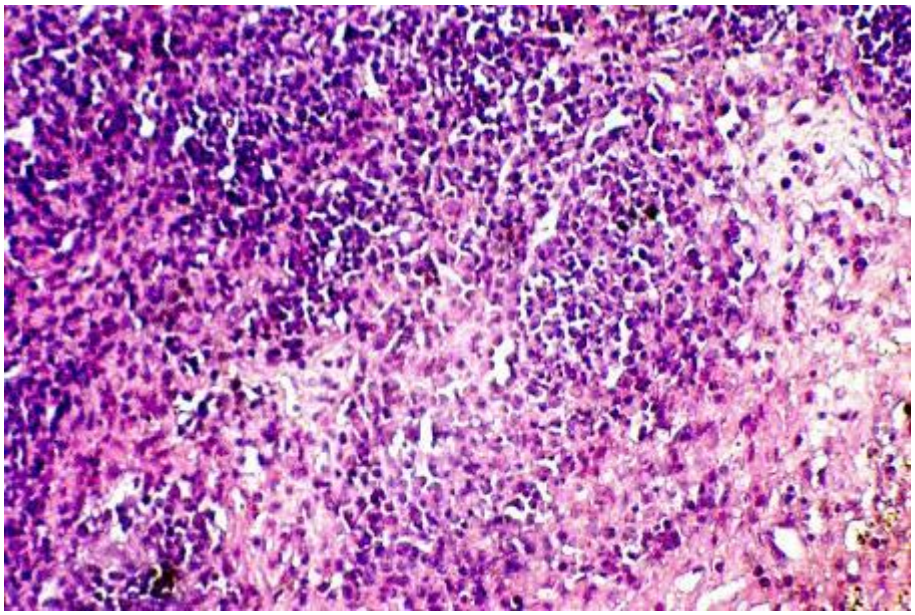

Figure 3.23. Polymorphic cell accumulation of infiltrate in the area of primary necrosis. Day 5 of injury. Control. GE 10x16.

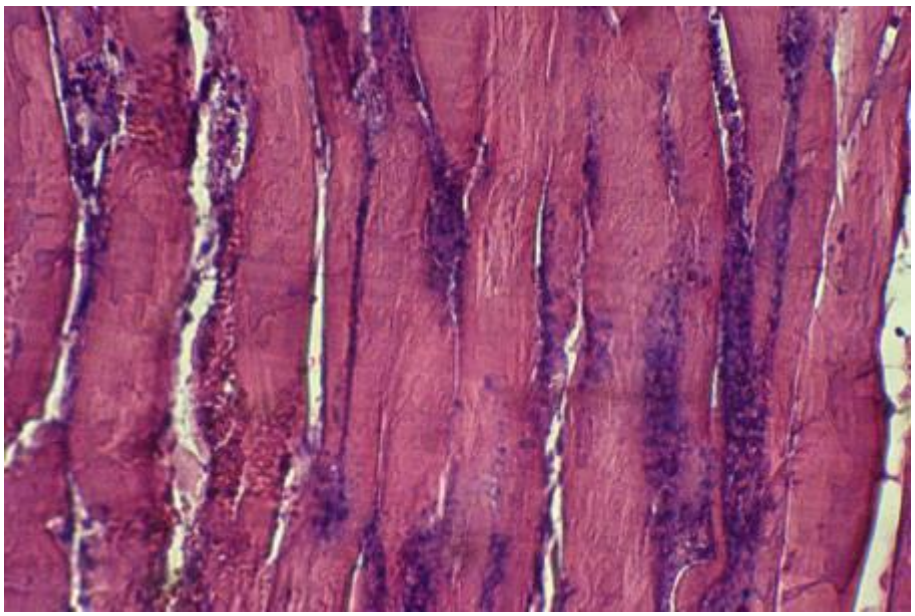

Figure 3.24. Swelling of muscle fibers and interfiber spaces in the area of commissure. 5th day after injury. Control. GE 10x16.

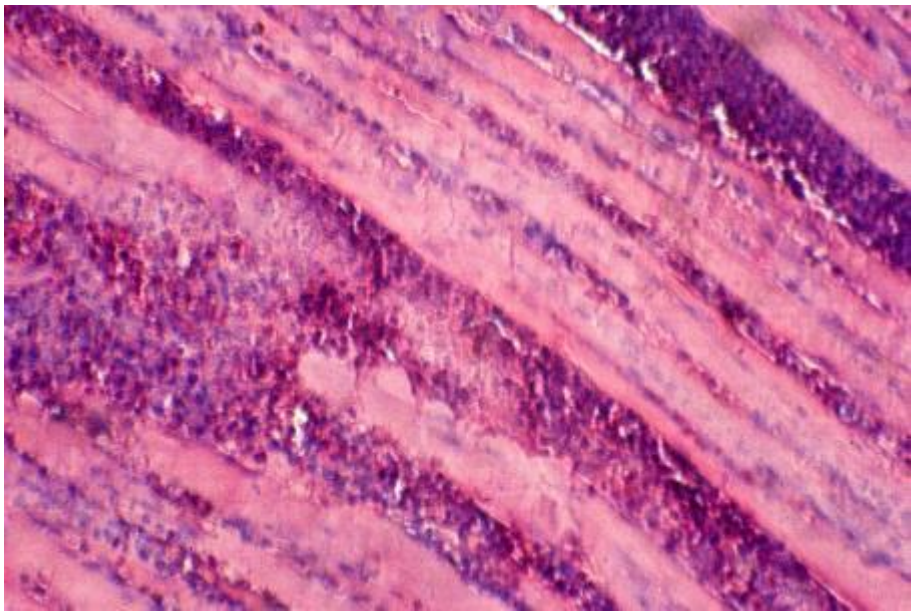

Figure 3.25. Marked infiltration at the border of the area of less damaged tissue and commissure. 5th day after injury. Control. GE 10x16.

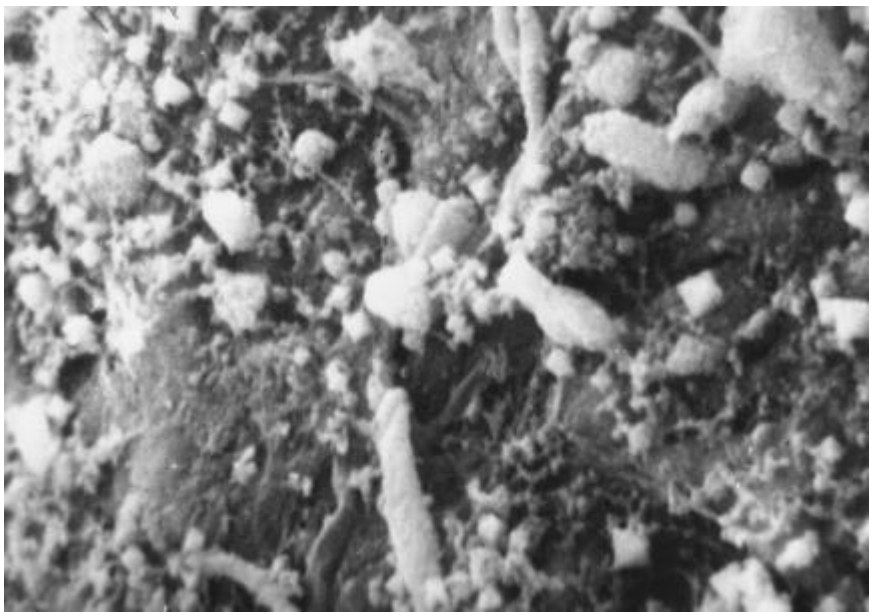

Figure 3.26. Round cells and fibroblasts in the wound channel. Control, 5 days after wounding. Magnified x400 in SEM.

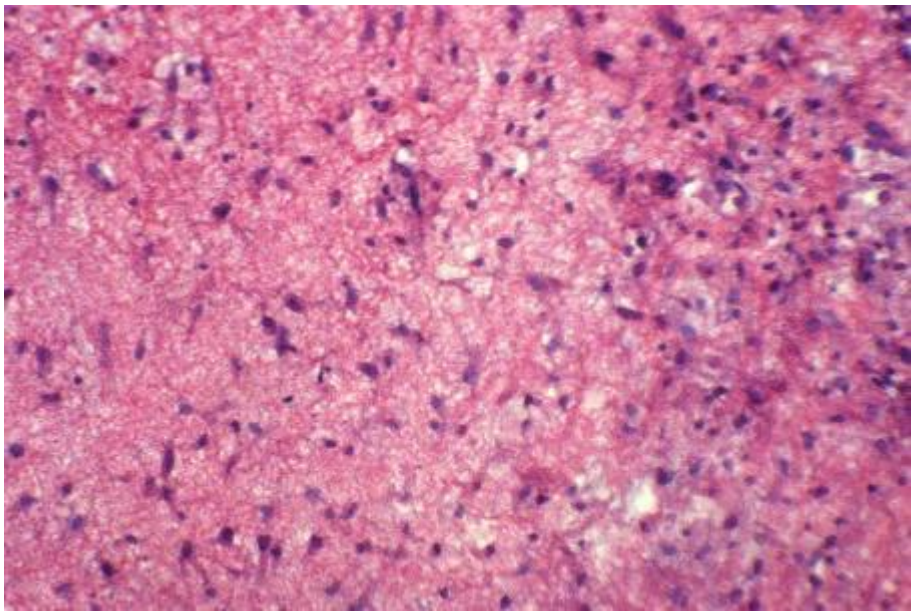

Figure 3.27. Predominance of fibroblasts in the wound canal. Day 5 of the wound, LT. GE 10x16.

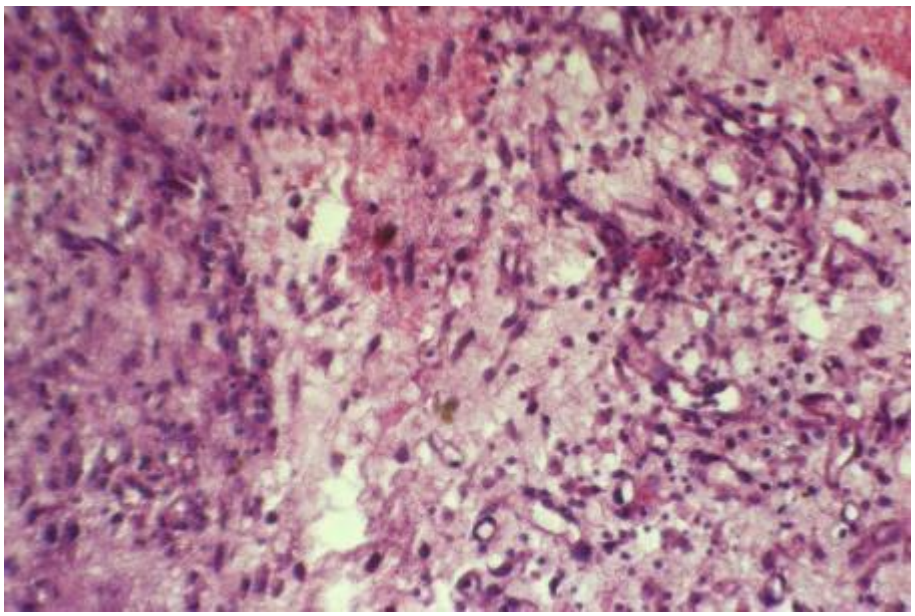

Figure 3.28. Fibroblasts and neovasculogenesis in the wound channel. Day 5 of the wound, LT. GE 10x16.

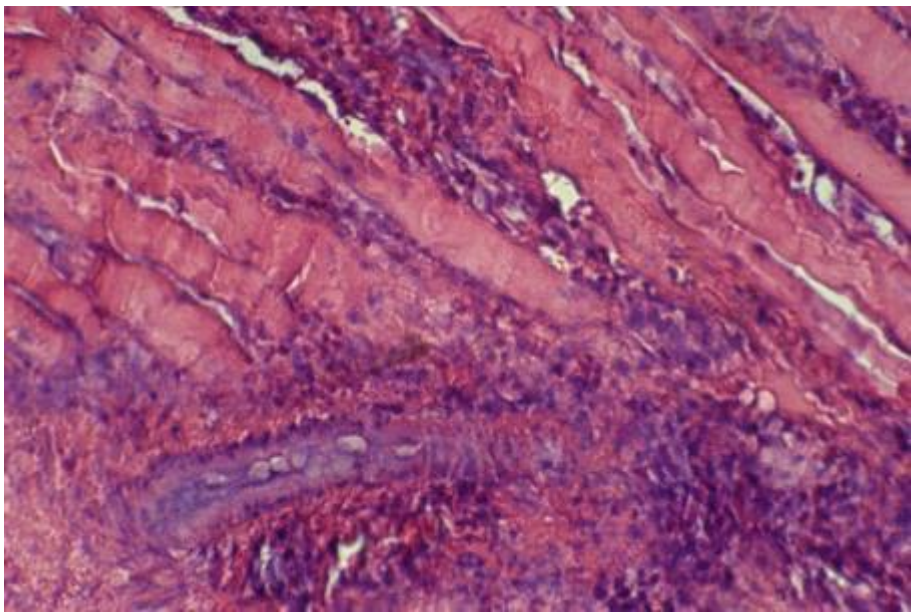

Figure 3.29. Dilated lymphatic capillaries at the border of the contusion zone and uninjured tissue. 5th day of injury. LT. GE 10x16.

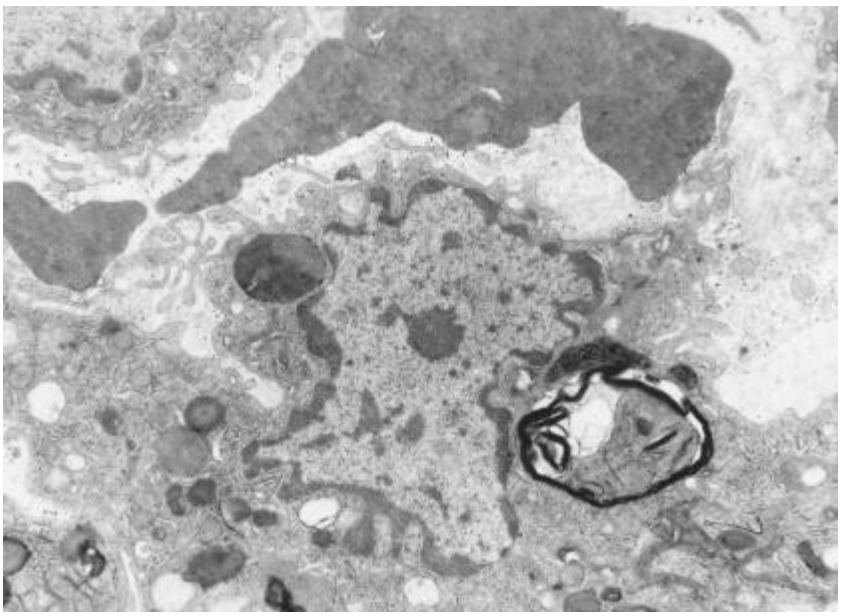

Figure 3.30. Active macrophage in the area of commissure. 5 days after injury. LT. TEM x15000.

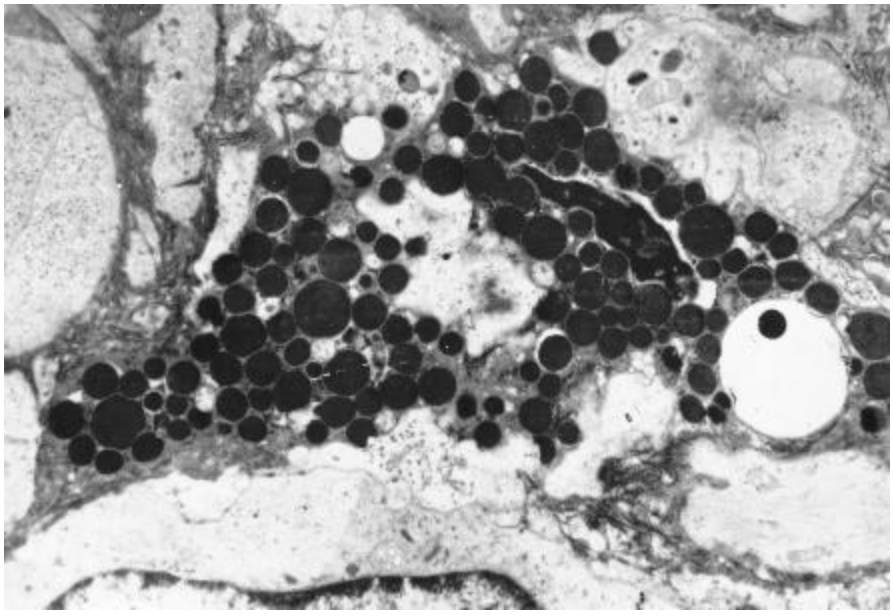

Figure 3.31. Increased secretion production by mast cells. Day 5 of injury, LT. TEM x 15,000.

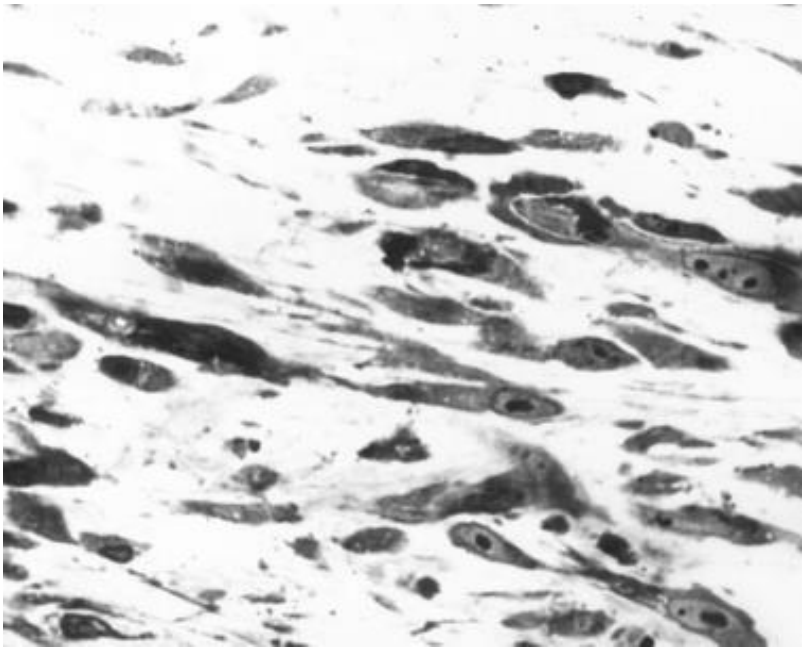

Figure 3.32. Neovascularization of the area of commissure. 5th day after injury. LT. PTS10x40.

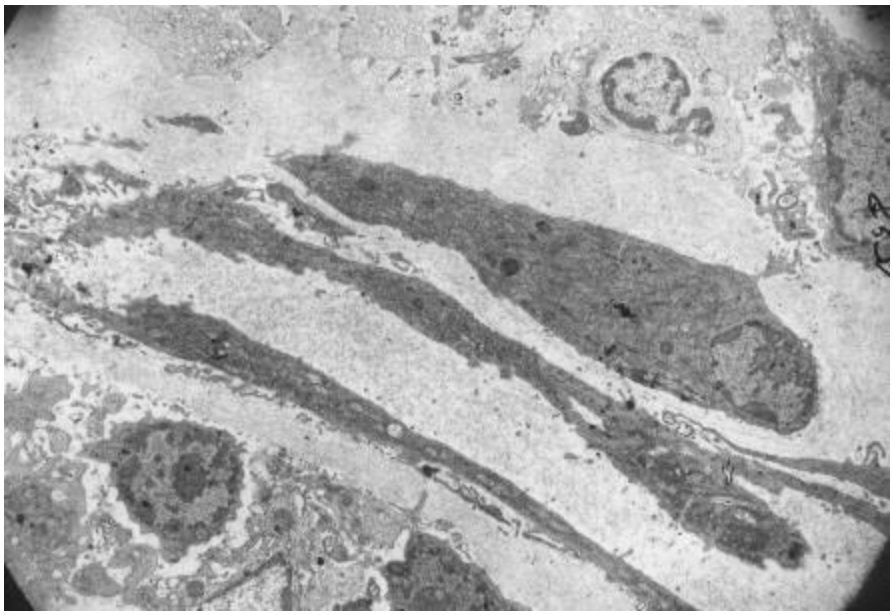

Figure 3.33. Endotheliocytes and fibroblasts. Neovasculogenesis. Day 5 of injury. LT TEM. Magnified X 7500 times.

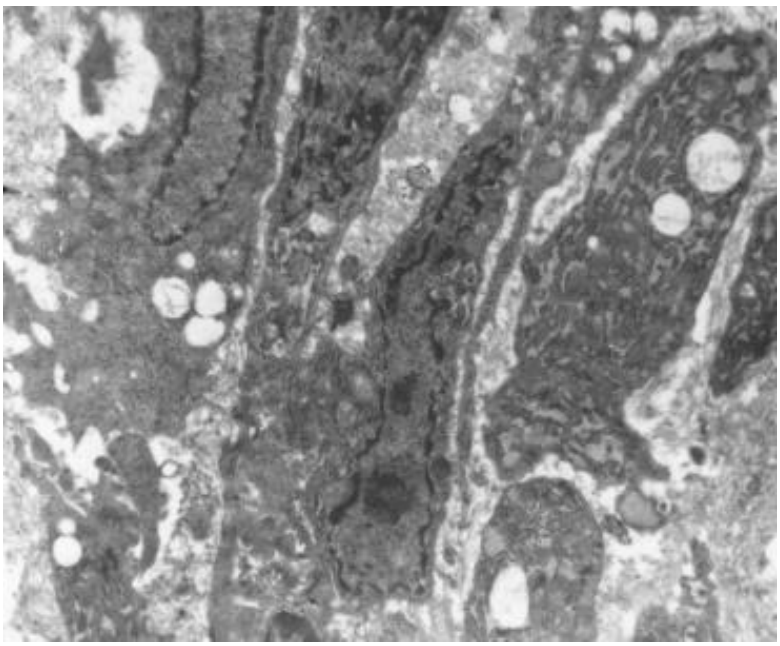

Figure 3.34. Fibroblasts in the area of neovasculogenesis. Day 5 of injury. LT TEM. x 7500.

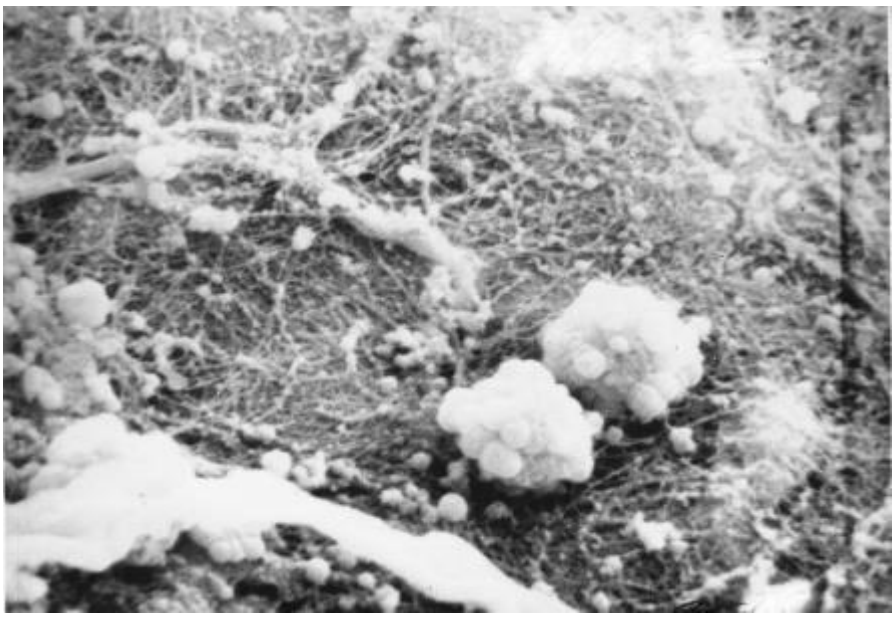

Figure 3.35. Active fat cells between fibroblasts. 5 days after wounding. LT SEM. Magnified X 1500 times.

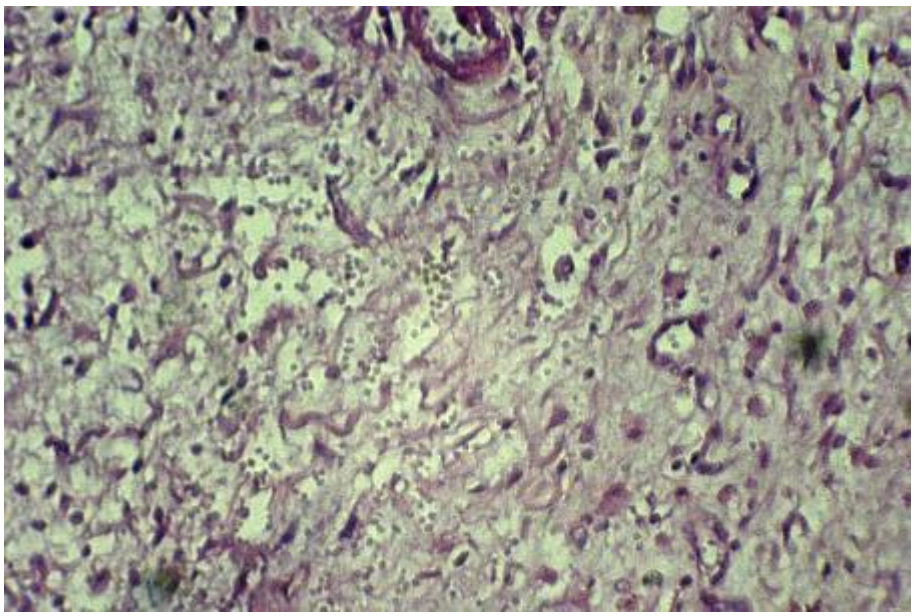

Figure 3.36. Granulation tissue of the wound canal. Day 7 of the wound. Control. Hematoxylin-eosin stain, 10x16 magnification.

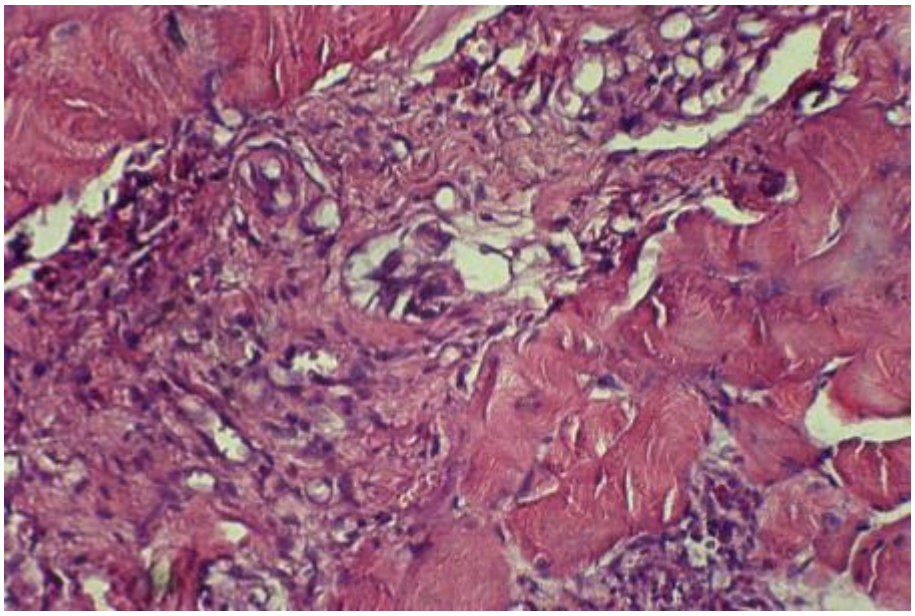

Figure 3.37. Growth of fibrous connective tissue between muscle fibers in the contusion zone. 7th day after injury. Control GE 10x40.

Figure 3.38. Fat cells and macrophages. 7 days after injury. Control. SEM 1500.

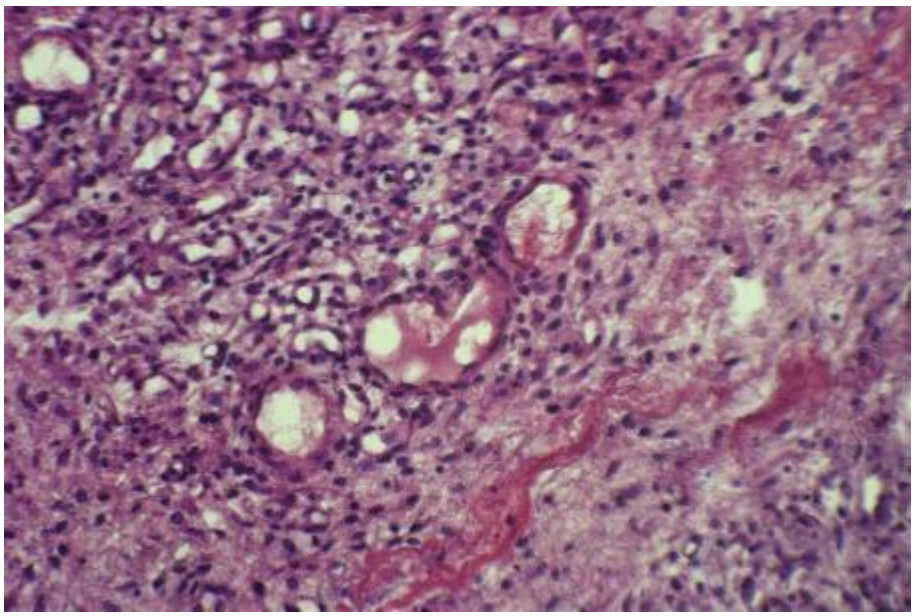

Fig. 3.39. The beginning of the formation of granulation tissue of the wound canal - on the 7th day of the wound. LT. GE 10 X 16.

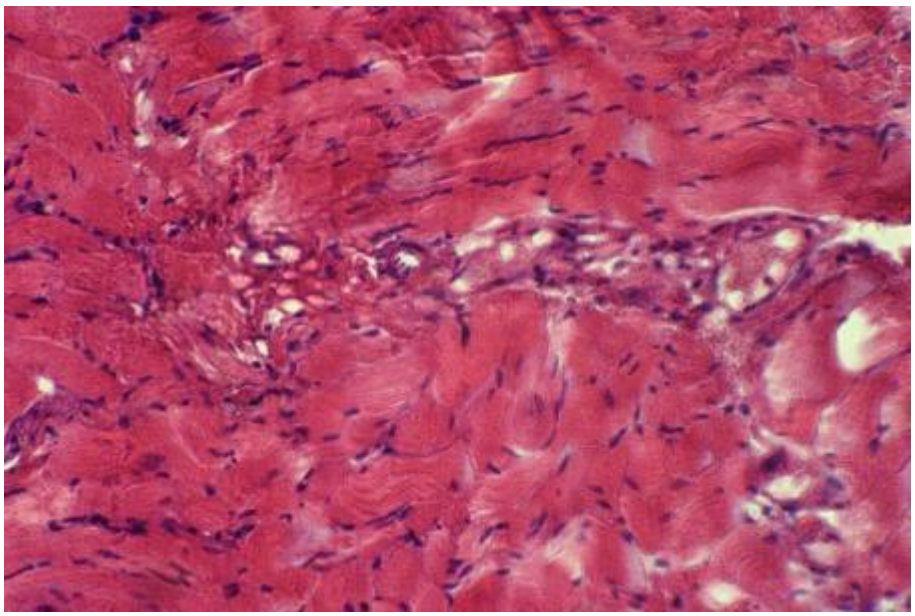

Figure 3.40. Thin layers of connective tissue, muscle fiber regeneration. Day 7 of injury. LT. Hematoxylin-eosin stain, 10 x 16 magnification.

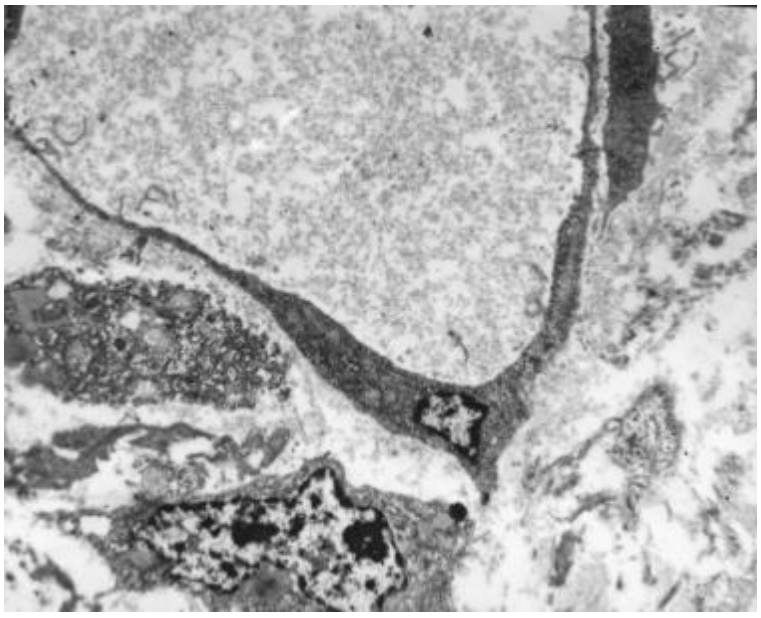

Figure 3.41. Dilated luminal lymphatic capillary. Day 7 of injury. LT TEM. X 7500.

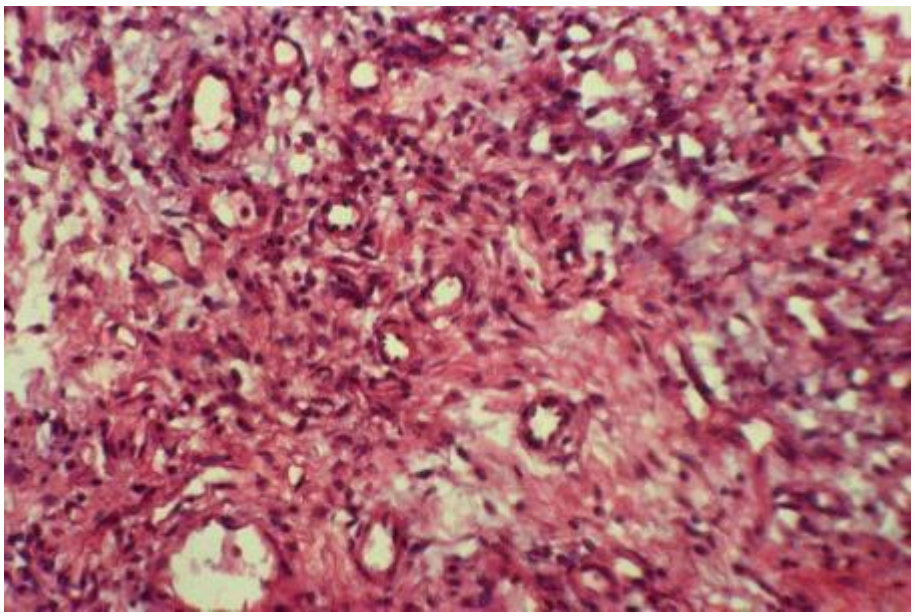

Figure 3.42. Beginning of granulation tissue remodeling. Day 9 of injury. Control GE 10 x 16.

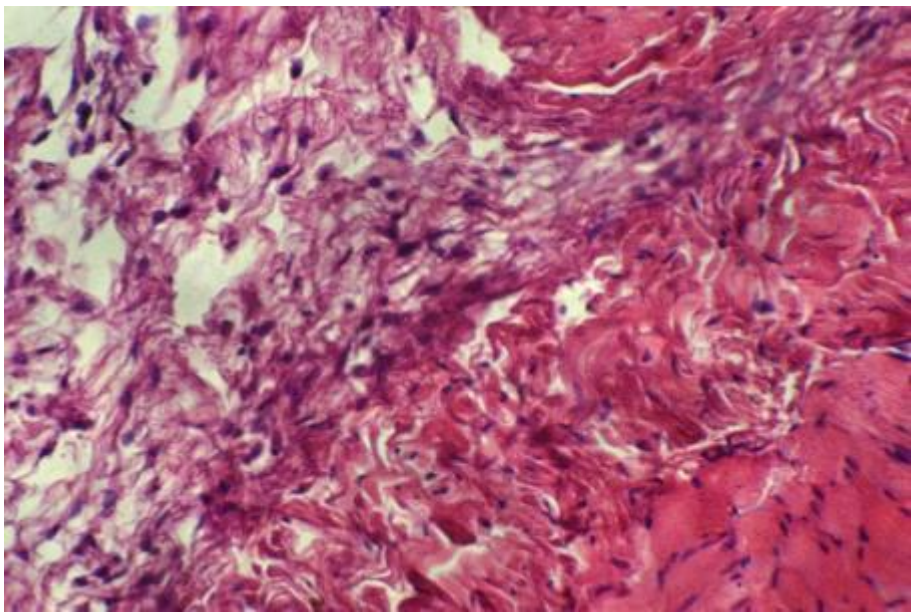

Figure 3.43. Increased connective tissue in the area of the commissure on day 9 of the injury. Control GE 10 x 16.

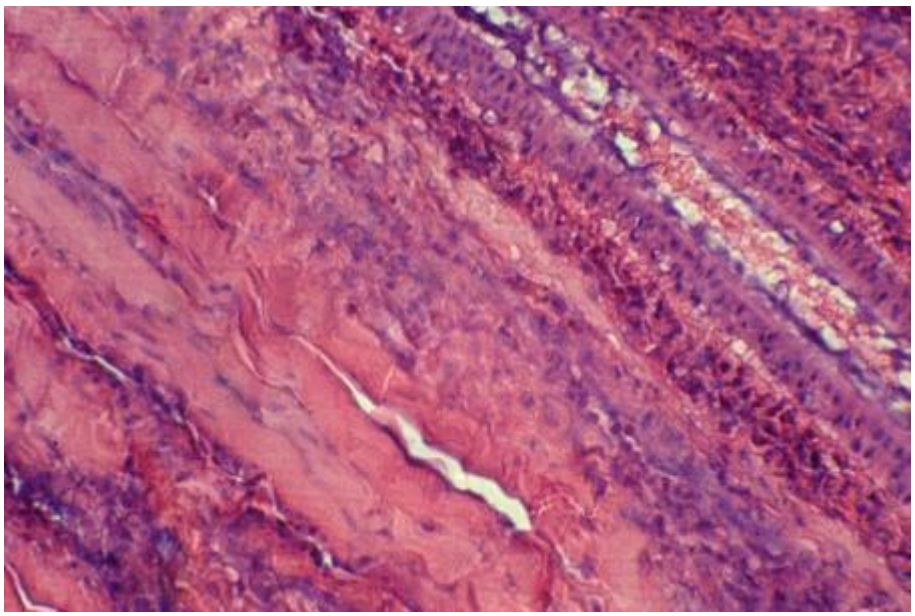

Figure 3.44. Normal architectonics of muscle fibers with dilated lymphatic capillaries. 9 days after injury. LT. GE 10x16.

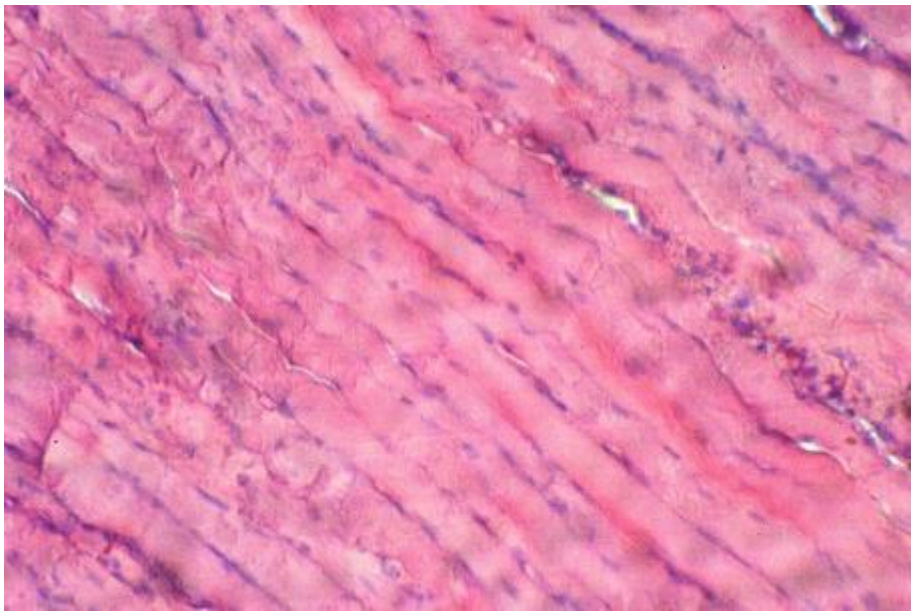

Figure 3.45. Normal architecture of muscle fibers. Day 9 of injury. LT. GE 10x16.

3.2. Results of an experimental study of the pharmacokinetics of gentamicin in gunshot wounds to the limbs.

3.2.1. Intramuscular administration of gentamicin in the blood, lymph nodes and soft tissues of the limbs (wound area) spread.

When administered intramuscularly, the highest concentration of gentamicin in the blood serum was observed half an hour after the injection and was 6.22 + 0.7 μg / ml. After an hour, it decreased by half, and after 3 hours the antibiotic concentration was half the one-hour concentration. After 6 hours, the concentration was found to be insufficient to provide optimal inhibitory effect on most of the most common "surgical" strains (Table 3.3). After 24 hours, the antibiotic was not detected in the blood (Table 3.1). Figure 3.46 shows the curve of gentamicin concentration in the blood after intramuscular injection.

Table 3.1

The amount of gentamicin in the blood serum (μg/ml) after a single intramuscular injection of the drug at a dose of 1 mg/kg

Examples	Time since input (hours)				
	0.5	1	3	6	24
Blood	6.22 + 0.7	3.87 + 0.95	1.65 + 0.58	0.53 + 0.14	no

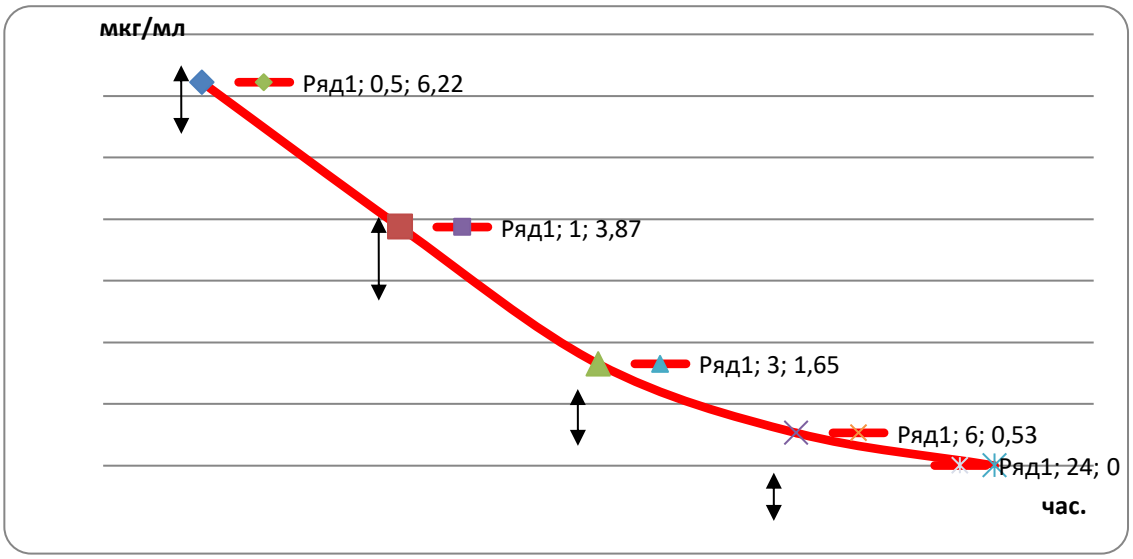

Figure 3.46. Dynamics of gentamicin concentration in the blood after intramuscular administration of the antibiotic at a dose of 1 mg/kg

In the process of studying the distribution of gentamicin in the lymph nodes of the groin and soft tissues around the leg ulcer (Table 3.2), we found that the amount of the drug in the tissues under study was very low. 6 hours after the drug was administered, "traces" of the antibiotic were found in the groin nodes, muscles and subcutaneous fat. 24 hours after the drug was administered, the antibiotic was not detected at all in the substrates under study. 24 hours after the antibiotic was administered, it was not detected in the substrates under study.

Table 3.2.

After a single intramuscular injection of the drug at a dose of 1 mg/kg, the amount of gentamicin in the lymph nodes and soft tissues of the limbs (µg/g)

Biological substrate	Time after insertion	
	6	24
Chow lymph nodes Muscles Cellulite under the skin	Traces Traces Traces	No No No

Table 3.3.

Antimicrobial spectrum of gentamicin.

Activity of gentamicin against gram-positive	Activity of gentamicin against gram-negative

microorganisms	microorganisms
MPK microorganisms mcg/ml	MPK microorganisms mcg/ml
Bac. anthracis 0, 2 "cereus var mycoides" 0.5-0.7 Bac. Megatherium 0.06-0.1 Cl. Welchii 0, 08-5, 0 Corynebacterium dipterial 0.2 Sartina lutea 0.2-2.0 Diplococcus pneumoniae 1.0-5.0 *Staphylococcus aureus 0.03-1.0 *St. epidermidis 0, 4 Streptococcus falcalis 10-12.0 St. pyogenes 1, 0-6, 0	Enterobact aerogenes 0.6-2.0 Brucella abortus 0.25 *Escherichia coli 0.08-6.0 Klebsiella pneumonia 0.15-0.2 Haemophilus influenzae 1.6-3.2 Nesseria gonorrhoeae 1, 5-6, 0 *Proteus mirabilis 0.8-6.0 *Pr.rettgeri 0, 8-1, 0 *Pr. vulgaris 1, 0-5, 0 Pseudomonas aeruginosa 0.08-1.2 Salmonella 0.36-1.5 Shigella flexneri 1, 0 Shigella sonne 3-10

Note: 1. Data taken from the "Guide to Antibiotics" and "Antibiotica-Fibel"2. *- the most common strains in surgical patients with abdominal pathology (according to V.I. Struchkova et al., 1984; A.Kh. Huseynova, G.K. Vandzhaeva and E.P. Khlebnikova, 2006).

3.2.2. Pharmacokinetics of gentamicin in blood, lymph nodes and soft tissues of the extremities (in the wound area) after intravenous administration.

The blood concentration of gentamicin after intravenous administration differed from that after intramuscular administration. After 0.5 hours, the concentration of gentamicin after intravenous administration was higher than after intramuscular administration (Tables 3.4 and 3.1). After 1 hour, the concentration of gentamicin in the blood after intravenous administration was also higher than after intramuscular administration. After 1 hour, the concentration of gentamicin in the blood after intravenous administration was even higher than after intramuscular administration.

Table 3.4.

Concentration of gentamicin in the blood after a single intravenous injection of the drug at a dose of 1 mg/kg (μg/ml)

Tests	Time since input (hours)				
	0.5	1	3	6	24
Blood	10.34 + 0.8	7.81 + 1.06	1.89 + 0.46	0.55 + 0.18	no

After 6 hours, the concentration of the antibiotic in the blood was approximately equal after intravenous and intramuscular administration, and after a day it was not detected at all by either method, respectively.

Figure 3.47 shows the ratio of gentamicin concentrations in the blood when administered intravenously as curves.

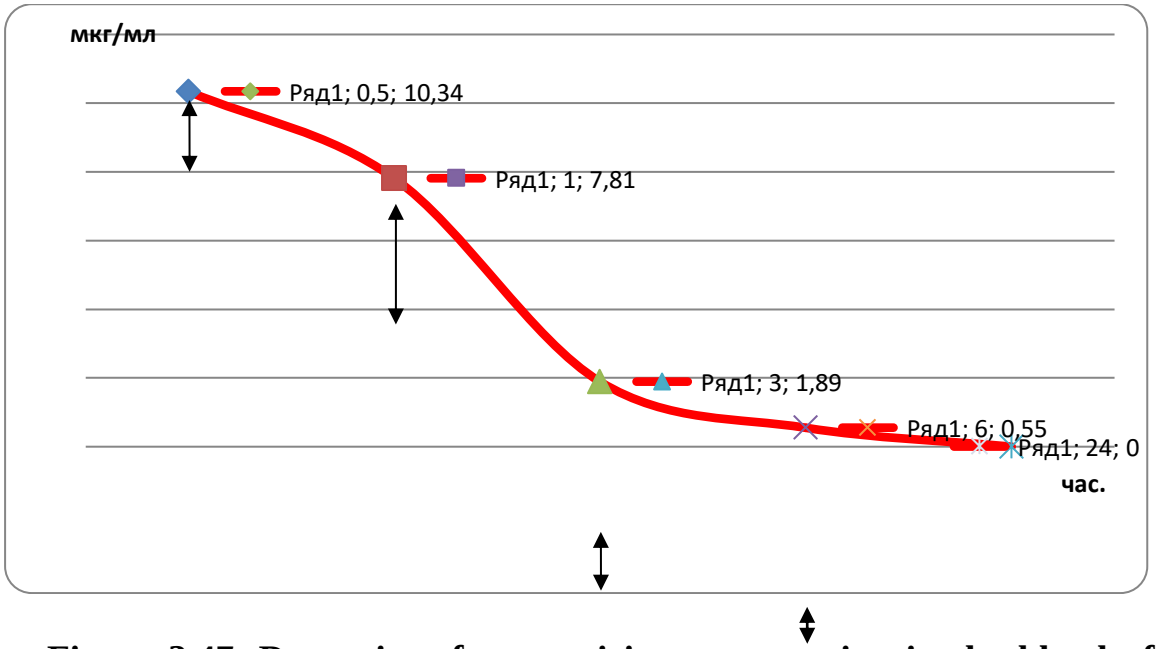

Figure 3.47. Dynamics of gentamicin concentration in the blood after intravenous administration of the antibiotic at a dose of 1 mg/kg.

Table 3.5.

Gentamicin concentrations in lymph nodes and soft tissues (μg/g) after a single intravenous injection of the drug at a dose of 1 mg/kg

Biological substrate	Time since entry	
	6	24
Chow lymph nodes	0.15 + 0.03	No
Muscles	0.12 + 0.06	No
Subcutaneous tissue	0.11 + 0.04	No

Six hours after intravenous administration, the concentration of gentamicin in the lymph nodes and soft tissues of the limbs at the site of the injury (Tables 3.5 and 3.2) was higher than after intramuscular administration. However, even in these observations, the concentration was below the amount necessary for treatment, and after 24 hours, the antibiotic was not detected in the tissues at all. However, even in these observations, the concentration was below the therapeutic concentration, and after 24 hours, the antibiotic was not present in the tissues.

3.2.3. Pharmacokinetics of gentamicin in blood, lymph nodes and soft tissues of the leg (wound area) after lymphotropic administration.

When gentamicin is administered lymphotropically, its peak blood concentration is observed within 0.5-1 hour after administration (Table 3.6), indicating that gentamicin penetrates the blood relatively quickly.

Table 3.6.

Serum gentamicin concentration (μg/ml) after a single lymphotropic injection of the antibiotic at a dose of 1 mg/kg.

Tests	**Time since entry (hours)**				
	0.5	**1**	**3**	**6**	**24**
Blood	9.61 + 0.01	11.75 + 2.18	6.46 + 1.45	1.88 + 0.4	1.07 + 0.23

After one hour, the concentration of gentamicin in the blood continued to rise. After 3 hours, the level of gentamicin in the blood was even higher in lymphotropic therapy. It is worth noting that 6 hours after the administration of lymphotropic, gentamicin was present in the blood in the amount necessary for treatment. After 24 hours, the concentration of the antibiotic in the blood remained below the amount necessary for treatment.

The change in blood gentamicin concentration upon lymphotrope administration is shown in Figure 3.48.

The pharmacokinetics of gentamicin in the lymph nodes of the groin when administered lymphotropically (Table 3.7) showed that after 6 hours its peak concentration (2.25 + 0.26 μg / g) was slightly higher than the concentration of gentamicin in the blood. After 24 hours, the concentration of gentamicin in the examined lymph nodes was lower than in the blood (Tables 3.7 and 3.6). In the soft tissues of the limbs, in the wound area, during lymphotropic therapy, the concentration of the antibiotic was slightly lower than in the lymph nodes (Table 3.7). However, the level of antibiotic availability in these organs was significantly higher than after intramuscular and intravenous administration (Tables 3.7, 3.5 and 3.2). In the soft tissues of the limbs, in the wound area, during lymphotropic therapy, the concentration of the antibiotic was slightly lower than in the lymph nodes (Table 2). 3.7), however, the antibiotic availability in these organs is much higher than with intramuscular and intravenous administration (Table 3). 3.7,3.5,3.2).

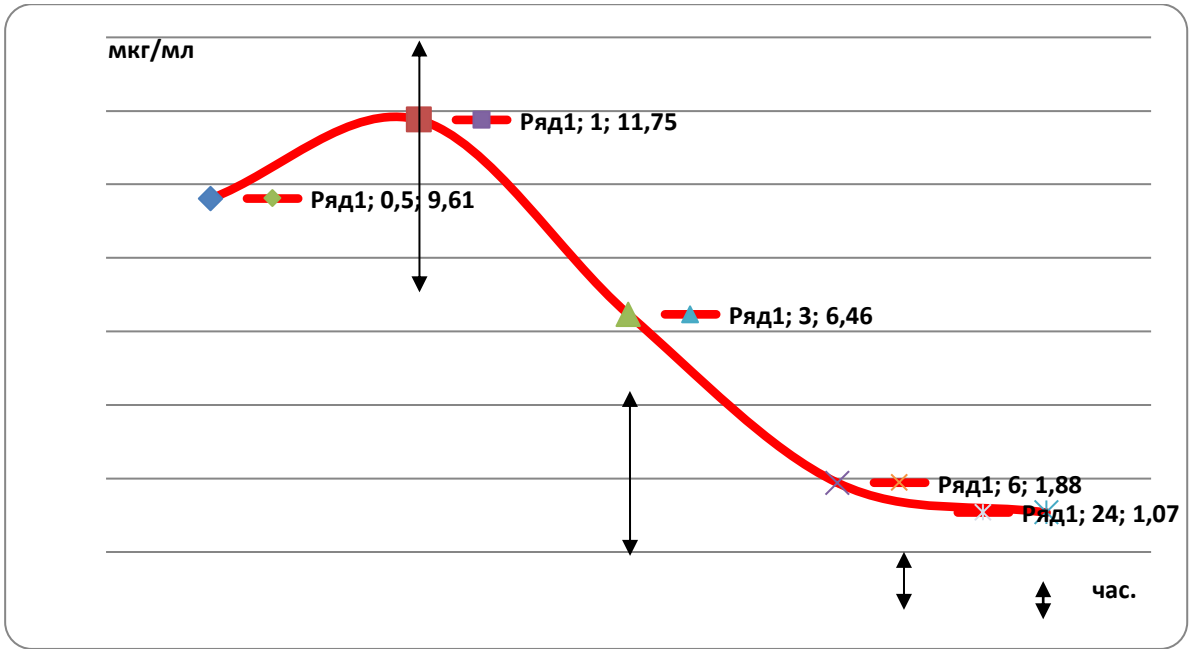

Figure 3.48. Dynamics of gentamicin concentration in the blood after lymphotropic administration of the antibiotic at a dose of 1 mg/kg.

Table 3.7.
Gentamicin concentration in lymph nodes and soft tissues of the leg (μg/g)
At a dose of 1 mg/kg.

Biological substrate	Time since entry	
	6	24
Chow lymph nodes Muscles Subcutaneous tissue	2.25 + 0.26 0.55 + 0.13 0.03 + 0.4	1.02 + 0.22 0.2 + 0.06 0.1 + 0.03

3.2.4. Pharmacokinetic properties of gentamicin in blood, lymph nodes and soft tissues of gunshot wounds of the limbs after different routes of administration.

To get a clearer picture, it is advisable to compare the pharmacokinetic properties of lymphotropic and traditional (intramuscular and intravenous) methods of administration of gentamicin. Analysis of the kinetics of gentamicin in the blood shows that traditional methods produce a peak concentration in the interval of 0.5-1 hour. Then the concentration decreases rapidly and after 6 hours from the time of administration of the drug, the antibiotic is present in different animals from "traces" to 1.6 μg / ml. The average concentration values do not reach the therapeutic level. When lymphotropic administration, the highest concentration occurs in the interval of 1 hour, which indicates a relatively rapid penetration of the drug into the blood. Then the curve (Fig. 3.45, 3.47) decreases more slowly than when administered intramuscularly and intravenously (Fig. 3.43, 3.44). After 6 hours, the concentration of the antibiotic in the blood is 1.8-3.4 times higher than in experiments with intramuscular and intravenous administration of the drug. After 24 hours, when administered by conventional methods, gentamicin is not detected in the blood of any animal. Lymphotropic administration, on the other hand, produces gentamicin concentrations close to therapeutic values, on average 1.07±0.23 μg/ml. These concentrations have an inhibitory effect on most microorganisms most commonly encountered in surgical practice (Table 3.3). 3.3)

It should be noted that subtherapeutic concentrations formed in the blood 24 hours after a single lymphotropic administration of the drug at an average therapeutic dose allow for once-daily lymphotropic antibiotic therapy.

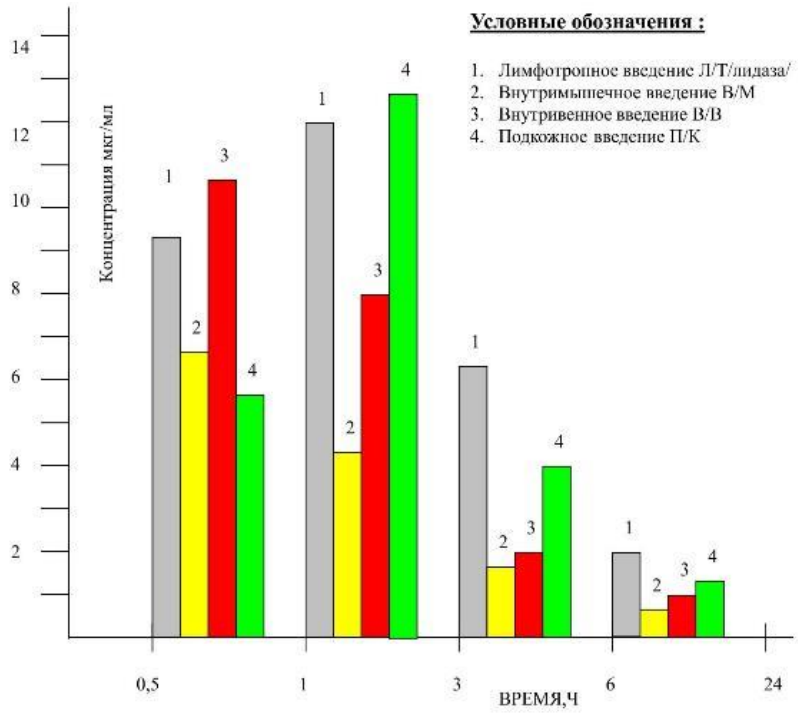

Figure 3.50. Dynamics of gentamicin concentration in the blood after different methods of administration of the antibiotic at a dose of 1 mg/kg

Summarizing the results of experimental studies on the content of gentamicin in the blood, it can be noted that the method of lymphotropic antibiotic therapy, which is carried out by a single administration of an average therapeutic dose of the antibiotic, provides more stable and long-term saturation of the blood than traditional methods.

Comparison of the accumulation of gentamicin in the inguinal lymph nodes and soft tissues of the leg after different routes of administration showed that the highest concentration (1.44±0.64 μg/g) in the inguinal lymph nodes was observed in the lymphotropic way 6 hours after drug administration (Fig. 3.51). However, when administered intramuscularly, only “traces” of the antibiotic were detected in the inguinal lymph nodes after 6 hours.

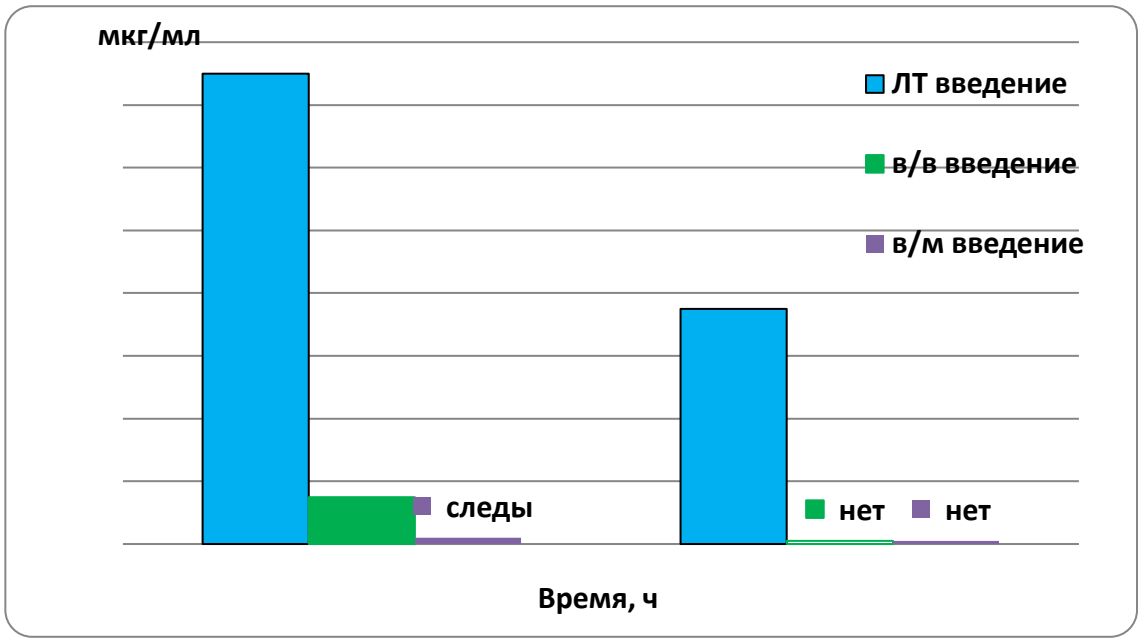

Figure 3.50. Dynamics of gentamicin concentration in the inguinal lymph node after administration of the antibiotic at a dose of 1 mg/kg by various routes.

In the soft tissues of the gunshot wound (Figs. 3.52, 3.53), the antibiotic was either not detected or was present in very low amounts 6 hours after intramuscular and subcutaneous administration. When administered intravenously, the amount of the antibiotic in the soft tissues remained low (0.12±0.06). The lymphotropic method provided higher amounts in the soft tissues and lymph nodes of the limbs. Even after 24 hours, when administered by the lymphotropic method, gentamicin was present in the lymph nodes and soft tissues of the gunshot wound of the limbs in amounts ranging from "traces" to 0.87 μg/g. In contrast, with conventional methods, the drug was not detected at all in the tissues examined.

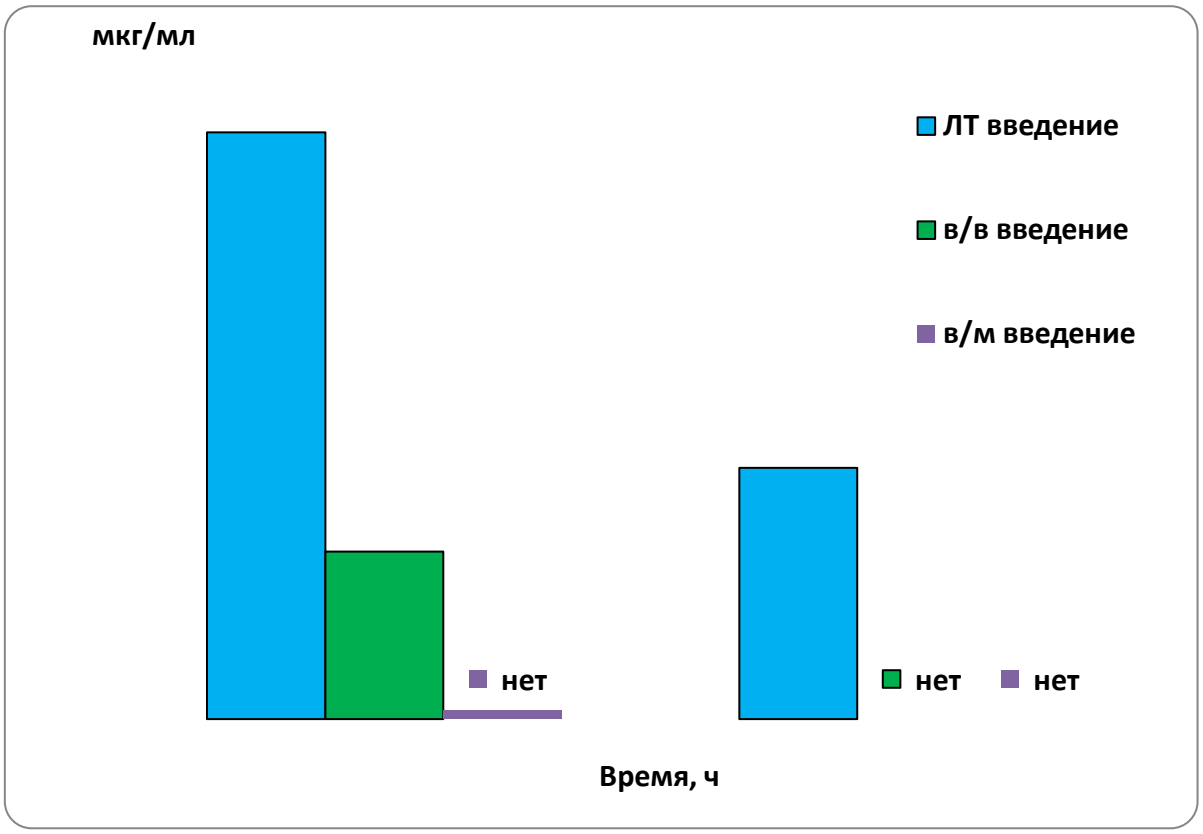

Figure 3.53. Dynamics of gentamicin concentration in muscle tissue after administration of the antibiotic at a dose of 1 mg/kg by different routes in a gunshot wound to the leg.

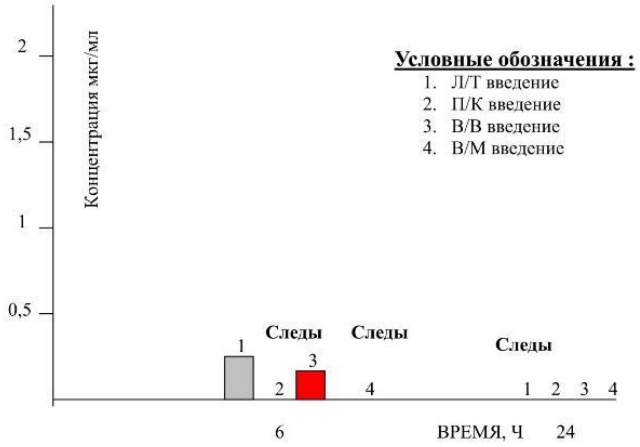

Figure 3.53. Dynamics of gentamicin concentration in the subcutaneous tissue of a gunshot wound to the leg after administration of the antibiotic at a dose of 1 mg/kg by various routes.

Thus, experimental studies show that relatively high and prolonged retention of gentamicin in lymph nodes is achieved by the lymphotropic method. The

antibiotic introduced by this method is present in the soft tissues of the limb gunshot wound for a longer period than with traditional methods.

CHAPTER IV. COMPLEX TREATMENT OF GUNWOUND WOUNDS AND THEIR PURE-SEPTIC COMPLICATIONS

In the treatment of gunshot wounds, their pathomorphological and pathophysiological characteristics are of great importance. Surgical treatment contributes to good healing and healing of wounds. Three zones appear around the gunshot wound: the wound channel, the zone of necrosis and the zone of molecular tremor. We studied gunshot wounds in detail from the point of view of the ultrastructure of the wound process. This helped to identify some mechanisms of secondary tissue necrosis in the zone of molecular tremor. The lesions are polymorphic in nature, ranging from necrotic and necrobiotic areas to areas of barely visible damage. Changes in this area are characterized by widespread hemorrhages, edema, and a significant reaction of the remaining blood and lymphatic vessels. The vessels are dilated, and signs of secondary infection are observed later. In wounds of the arms and legs, impaired drainage function of the lymphatic system is noted.

Antibacterial therapy is considered the “gold standard” for the treatment of gunshot wounds, as it is the mainstay of treatment for the prevention and treatment of infectious complications, which are the main cause of death and disability in victims. However, current antibiotic therapy methods are ineffective in approximately one-third of wounded patients and cause more harm than good in approximately 30% of cases [16, 147, 289].

Based on the above changes, the treatment of this pathology and its bacterial complications should take into account the features of the pathogenesis of the disease under study and be comprehensive.

4.1. Comprehensive treatment of soft tissue gunshot wounds.

We studied the results of treatment of 59 victims with gunshot wounds of the soft tissues of the arms and legs. They were divided into 2 groups: the main group, consisting of 40 victims, and the control group, which included 19 wounded. The

patients were distributed according to the location of the wound as follows: in the main group, the thigh - 13 (32.5%), lower leg - 13 (32.5%), shoulder - 10 (25.0%), forearm - 4 (10.0%); in the control group, the thigh - 6 (31.5%), lower leg - 6 (31.5%), shoulder - 5 (26.3%), forearm - 2 (10.5%) wounded. When distributed by gender: men - 57 (96.5%) and women - 2 (3.5%). The age of the victims ranged from 16 to 53 years.

Primary surgical intervention is the main preventive measure in the treatment of gunshot wounds. Early primary surgical intervention can increase the number of positive outcomes in the treatment of gunshot wounds. The main objectives of the primary surgical intervention performed in our study were:

1) complete examination of the wound bed and excision of the wound in order to remove foreign bodies that may later become a source of infection - bullets or fragments of a wounded projectile, pieces of clothing, particles of soil that fell during the wound, blood clots, etc.;

2) cut off the edges of the wound - necrotic, crushed and crushed, as these are a favorable environment for microorganisms that have entered the wound;

3) to ensure free drainage of the wound, wash the wound cavity with antiseptic solutions, and apply primary sutures according to instructions;

All victims underwent early primary surgical treatment under local, conduction anesthesia or general anesthesia, depending on the size of the gunshot wound. Initially, the wound was incised along the wound canal, then carefully examined. In closed wounds, pieces of clothing, formed hematomas, bullet or fragments were removed. In the second stage, the necrotic edges of the wound were radically excised within healthy tissues, taking into account the topographic and anatomical features. Secondary deviation caused the formation of pockets, which were opened and hemostasis was achieved, the wound canal cavity was thoroughly washed with antiseptic solutions. In the postoperative period, perforated tubes made of polyvinyl chloride were passed through the contraaperture to create conditions for the free outflow of wound exudate when washing the wound cavity with antiseptic solutions. To prevent edema, tissue

decompression and compartment syndrome, a wide fasciotomy was performed. In the presence of extensive soft tissue damage and defect, wound treatment was performed in an open manner, using water-soluble antiseptic ointments during dressing. When the first signs of inflammation (swelling, redness, local temperature increase) were detected, primary delayed sutures were applied 4-7 days after the inflammatory phenomena were eliminated. A plaster splint was applied to the injured leg for immobilization. In the main group, all patients underwent LTA with RLS once a day (5-8 days), depending on the severity of the injury. For flushing the wounds, a 1% solution of dioxidine diluted in a physiological solution of sodium chloride was used.

Since there were no signs of inflammation in 33 wounded, we completed the surgical procedure with primary sutures. Primary delayed sutures were applied to 4 victims, and skin grafting was performed to close the wound in 3 patients with soft tissue defects. Closed treatment was used for small wounds, in which a decrease in swelling and pain syndrome was observed already on the 2nd-3rd day. The secretion released from the wound through the drainage tube was serous-hemorrhagic in nature. With such a satisfactory course of the process in the wound, the decision to remove the drainage tubes was made on the 5th-6th day.

The cellular composition of the wound exudate examined on the first day after injury consisted of lymphocytes, single macrophages and eosinophils, and polymorphonuclear neutrophils, which was typical of a moderate inflammatory reaction (Table 4.1). 4.1).

Table 4.1.

Cytological studies dynamics (n-20) expressed in percentages

Cell structure	**Main group**			**Control group**			
	Days			**Days**			
	1	3	5	1	3	5	8
Neutrophils	74.2±0.5*	78.2±0.4***	64.3±0.3**	72.4±0.9	84.5±1.2	76.6±0.7	62.1±0.3

Macrophages	5.1±0.2	8.6±0.5**	8.6±0.5**	5.4±0.6	5.9±0.7	7.6±0.3	12.3±0.6
Lymphocytes	10.9±0.5*	5.8±0.9	7.2±0.6	12.3±0.6	5.7±0.6	7.8±0.2	6.4±1.0
Eosinophils	6.9±0.9	2.1±0.6	1.1±0.5**	6.8±1.0	2.6±0.6	3.4±0.2	7.1±1.1
Fibroblasts	-	2.1±0.5	8.7±0.4***	-	-	1.1±0.8	8.4±0.7

In 2-3 days, signs of inflammation increased, which was confirmed by an increase in the number of neutrophils in both groups examined.

As a result of the complex treatment, it was possible to reduce the number of neutrophils in the main group, but the number of macrophages increased and fibroblasts began to appear. On the 5th day, the quantitative indicators were as follows: neutrophils 66.4±0.6, macrophages 14.7±0.3, fibroblasts 9.4±0.5. In the control group, they were 78.3±0.7, 8.3±0.3, 1.3±0.9 and 8.3±0.3 ($p<0.001$), respectively. Against the background of laser therapy with RLS, already on the 3rd day of treatment, the pH values of the wound contents shifted to the alkaline side and even reached normal values (7.2±0.3). This phenomenon was not observed in the control group. The pH values of the wound contents on the day of hospitalization (6.4±0.3) had a tendency to alkalize only on the 6th day.

This allowed 33 wounded, that is, most of our patients, to apply temporary and primary delayed sutures. As a result of the measures taken, it was possible to reduce the duration of the stay of the victims in the main group to 6 days without serious complications. The rehabilitation period at the outpatient stage of treatment was significantly reduced to 3-4 days, while in the control group it was 21-23 days. Four patients with large defects were applied primary delayed sutures on 4-5 days. The same number (4) patients underwent free autodermoplasty. The final healing in the patients in the main group was noted on the 15-16th day of treatment, and in the control group much later, on the 21-23rd day. A complication in the form of partial suppuration of the postoperative wound was observed in only 1 (2.5%)

patient in the main group, and secondary sutures were applied to eliminate it. In the control group, suppuration was noted in 2 (10.5%) patients.

Thus, in the main group, complex therapy, taking into account the characteristics of gunshot wounds, helped to reduce the duration of patients' hospital stay by 2.5 times and heal wounds faster, while the percentage of postoperative wound suppuration decreased by 4 times.

Clinical observation data.

A 38-year-old patient A was brought to the admission department of the RSHTYOIM OF by ambulance. 1 hour before admission to the hospital, he received a gunshot wound to the right thigh. During the examination, soft tissue crushing and bleeding were detected in the gunshot wound to the right thigh. The wound was surgically treated under spinal anesthesia, no damage to large blood vessels was found. The necrotic edges of the wound were excised along the entire perimeter. During subsequent observations, due to numerous soft tissue defects, the thigh wound was treated open. Antiseptics (1% dioxidine) and water-soluble ointments (levomekol, miramistin) were used for dressing. On the 5th day, delayed sutures were partially applied to the thigh wound, and the remaining part of the wound was closed with a skin graft using the free autodermoplasty method.

In the postoperative period, complex treatment with LA was performed with RLS, painkillers, fluid therapy, and wound treatment with 1% dioxidide solution for 5 days were prescribed. No complications were observed. No circulatory disorders and tissue necrosis were observed in the skin folds, there were no signs of inflammation. The patient was discharged on the 9th day for dynamic outpatient observation. When examined 1.5 months later, the function of the limbs was not impaired, the skin scar was thin and painless (Fig. 4.1 and 4.2).

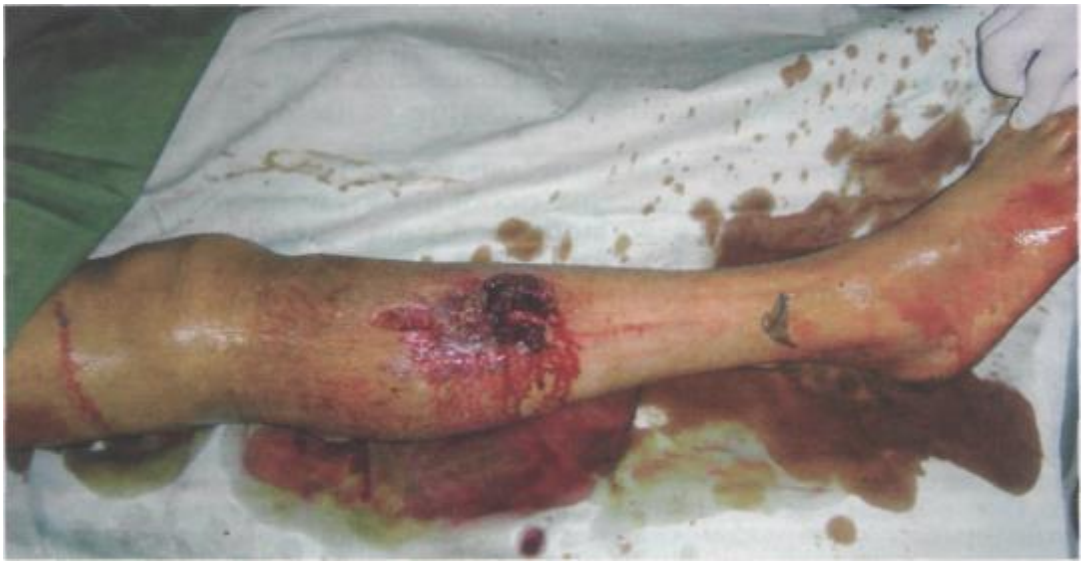

Figure 4.1. Patient A., 38 years old. Preoperative gunshot wound to the right tibia.

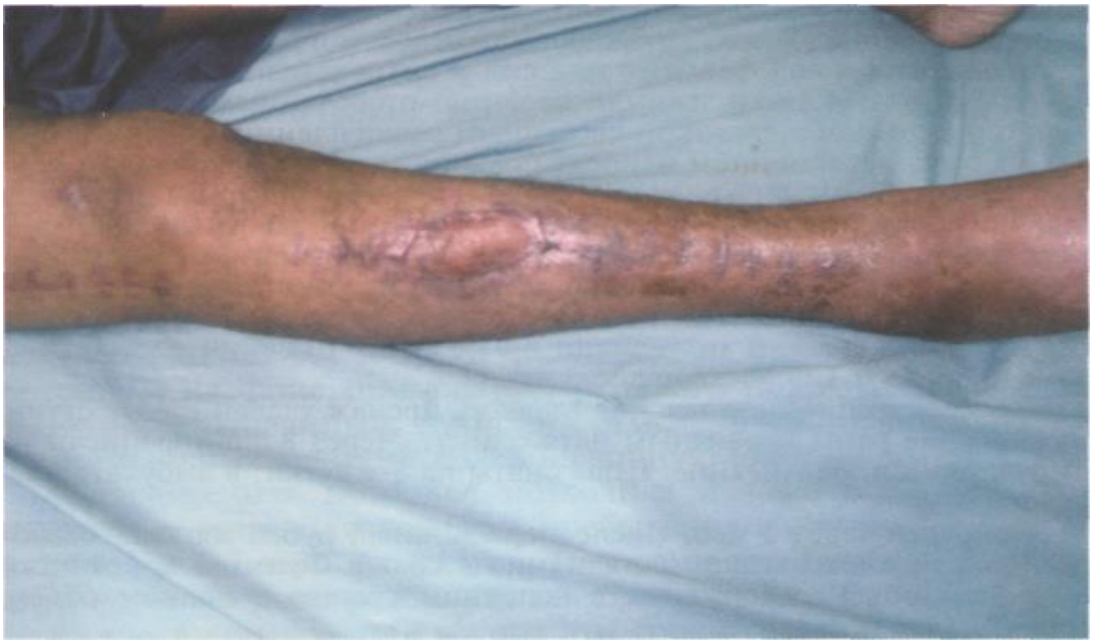

Figure 4.2. Patient A., 38 years old. Appearance of the injured limb 2 months after surgery.

The method of lymphotropic antibiotic therapy with local lymphostimulation proposed by us in the treatment of gunshot wounds of soft tissues is pathogenetically justified. The main goal of treatment is to prevent the expansion of the secondary necrosis zone of the wound, which ultimately leads to a deterioration in lymphatic drainage. When using LTA with RLS, taking into

account the bacterial infection of the wound, the concentration of antibiotics in the blood, soft tissues and lymph increases several times. RLS reduces edema, effectively affects all aspects of the pathological process, and has a positive effect on the course of the inflammatory process.

4.2. LTA and RLS in the complex treatment of gunshot fractures.

According to observations, when implant osteosynthesis is used for fixation of fractures of the arms and legs in gunshot wounds, a number of early postoperative complications are detected. This situation requires caution when using primary implant (intra-, extramedullary) osteosynthesis in surgery for gunshot fractures of the limbs. Therefore, external osteosynthesis is mainly used. When using extramedullary osteosynthesis, a number of serious drawbacks are also observed, such as osteoporosis, sequestration, and slow healing of fractures due to impaired blood supply to the cortical layer under the plate. Therefore, we used limited contact AO plates with recesses on the inner surface for fixation of fractures in gunshot wounds, which do not disrupt periosteal blood circulation.

4.2.1. Comprehensive treatment of gunshot fractures. Primary implant osteosynthesis.

We observed 31 patients with gunshot fractures of the limbs. They were divided into 2 groups: control group - 15 (48.4%) and main group - 16 patients (51.6%). Patients were distributed according to the location of the fracture as follows: in the main group - 4 (25.0%), lower leg - 6 (37.5%), shoulder - 3 (18.7%), wrist - 3 (18.7%), in the control group - 4 (26.6%), lower leg - 5 (33.3%), shoulder - 3 (20.0%), wrist - 3 (20.0%). Non-surgical methods of fixation of gunshot wounds of the limbs, such as plaster casts and skeletal traction, were used in patients in the control group. At the same time, antibiotics, metronidazole,

infusion therapy, and fluid drainage were prescribed according to the generally accepted method. Extra- or intramedullary osteosynthesis, depending on the type of fracture, was performed 3-4 weeks after the signs of the inflammatory process had resolved and the wound healed.

Patients in the control group underwent non-surgical methods of fixation of gunshot wounds of the limbs, such as plaster casts and skeletal traction. At the same time, antibiotics, metronidazole, infusion therapy and fluid drainage were prescribed according to the generally accepted method. Extra- or intramedullary osteosynthesis was performed 3-4 weeks after the signs of the inflammatory process were eliminated and the wound healed, depending on the type of fracture.

In the main group (n-16), primary extramedullary osteosynthesis was used in the complex treatment of gunshot fractures, as well as in combination with bone autoplasty. Primary osteosynthesis was not performed in the presence of large wounds, signs of their inflammation and tissue crushing. The operation was performed under spinal anesthesia or general anesthesia. During the surgical procedure, bone fragments were brought into place and extramedullary osteosynthesis was performed using AO plates.

Under the influence of high-speed bullets, bones are broken into many small fragments, which in turn leads to damage to the surrounding soft tissues and bone tissue defects. In such cases, bone autoplasty was performed in combination with fixation with plates. For the treatment of fractures caused by gunshot wounds in the main group of patients, we performed primary deep osteosynthesis and LTA with RLS. LTA with RLS lasted 5-7 days. Cefazolin 1000 mg once a day with RLS was administered lymphotropically before and after surgery. The method we proposed led to a decrease in pain syndrome and surrounding edema on the second postoperative day. With a decrease in discharge from the drainage tube, we removed the tube on the 4-7th postoperative day.

Cytological examination at the time of hospitalization showed lymphocytes, eosinophils, polymorphonuclear neutrophils, and solitary macrophages - indicating a moderate inflammatory response.

Also, a slight increase in neutrophils was observed in both groups of patients on the third day. The microflora was reduced. Our method of complex treatment of patients in the main group led to positive results on the fifth day - the number of neutrophils decreased (63.3±0.7), fibroblasts appeared (11.2±0.6), macrophage reactions increased. In the control group, these indicators were 78.3±0.7 and 1.3±0.9, respectively.

Table 4.2.

Cytological examination dynamics (n-20) expressed in percentages

Cell structure	Main group			Control group			
	Days			Days			
	1	3	5	1	3	5	8
Neutrophils	76.0±0.4***	77.4±0.9***	62.3±0.6***	73.2±0.8	79.3±1.1	72.9±0.6	62.8±0.4
Macrophages	4.7±0.1	10.2±0.6***	15.1±0.3***	5.4±0.6	7.0±0.7	7.9±0.3	12.9±0.6
Lymphocytes	12.1±0.3*	6.6±0.1	8.7±0.5	13.6±0.5	5.8±0.6	8.2±0.2	6.9±1.2
Eosinophils	6.2±0.6	2.5±0.2*	1.6±0.6	8.2±1.2	2.3±0.6	3.4±0.4	7.5±1.0
Fibroblasts	-	1.7±0.9	11.3±0.5***	-	-	1.5±0.8	9.3±0.8

Thanks to the complex treatment method we proposed, in 15 patients in the main group, the wounds closed with primary closure on the 8th-9th day, in 1 patient (6.2%) the inflammatory process was limited to soft tissues, and only one required repeated surgery due to osteomyelitis caused by gunshot wounds (6.2%). Necrosequestrectomy was performed, metal structures were removed, and osteosynthesis was performed using the Ilizarov apparatus. After the complex treatment, good functional results were observed in the patients - complete

recovery. In the control group, postoperative suppuration of the wound was noted in 1 patient, and in 2 more patients (total 20%), separation of the wound edges, osteomyelitis with removal of fixation plates and osteosynthesis using the Ilizarov apparatus were noted in 2 patients (13.3%).

We present a clinical observation.

Patient T., 31 years old. He was brought to the reception after 2 hours with a gunshot wound to the left shoulder, a displaced fragmentary fracture of the lower third of the scapula. Examination revealed an entrance hole of a gunshot wound measuring approximately 1 cm. No signs of inflammation or bleeding were observed during the examination. An X-ray of the right shoulder showed a fracture of the scapula with displacement of bone fragments. There is a bullet in the projection of the lower third of the shoulder.

After preliminary preoperative preparation, the patient was given general anesthesia and primary surgical treatment of the wound. Examination of the wound revealed a bullet in the soft tissues and it was removed. Small bone fragments were removed. Necroectomy was performed at the border of living tissue. Internal osteosynthesis was performed using AO plates. The postoperative wound was sutured with a perforated drain.

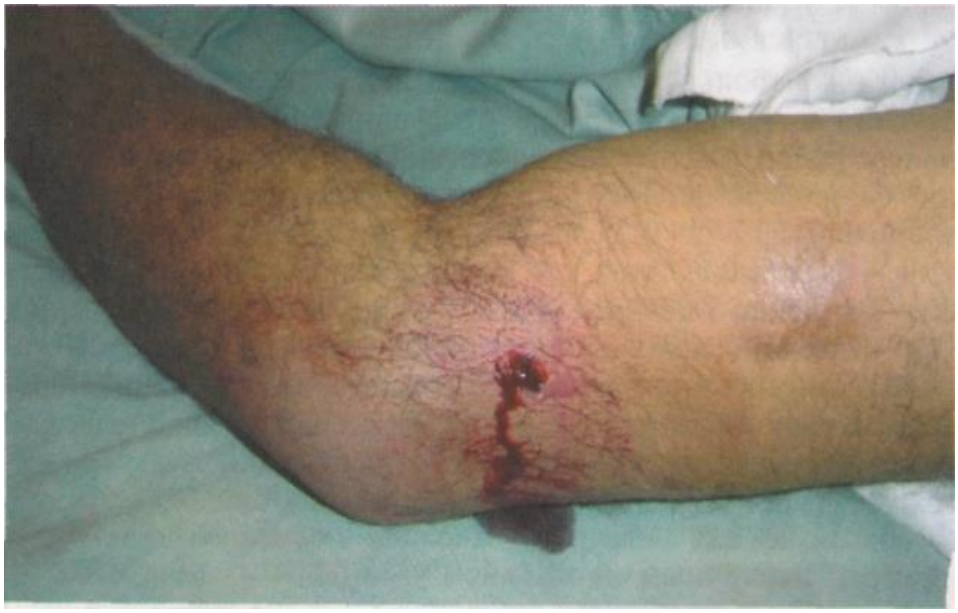

Figure 4.3. Patient T., 31 years old, with gunshot wound. Preoperative image.

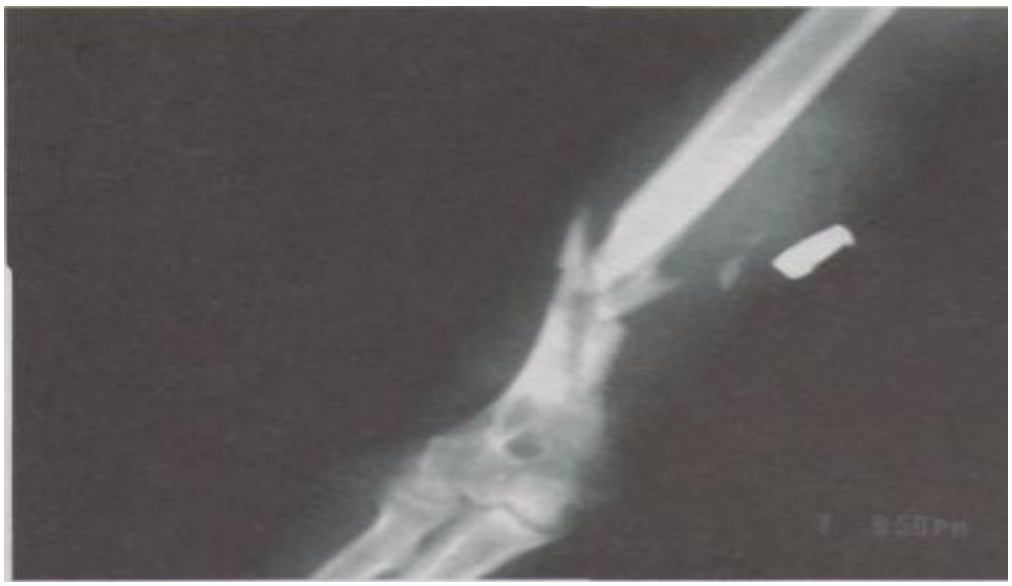

Figure 4.4. Patient T., 31 years old. Radiograph. Foreign metal object in the shoulder (arrow). Fracture of the humerus..

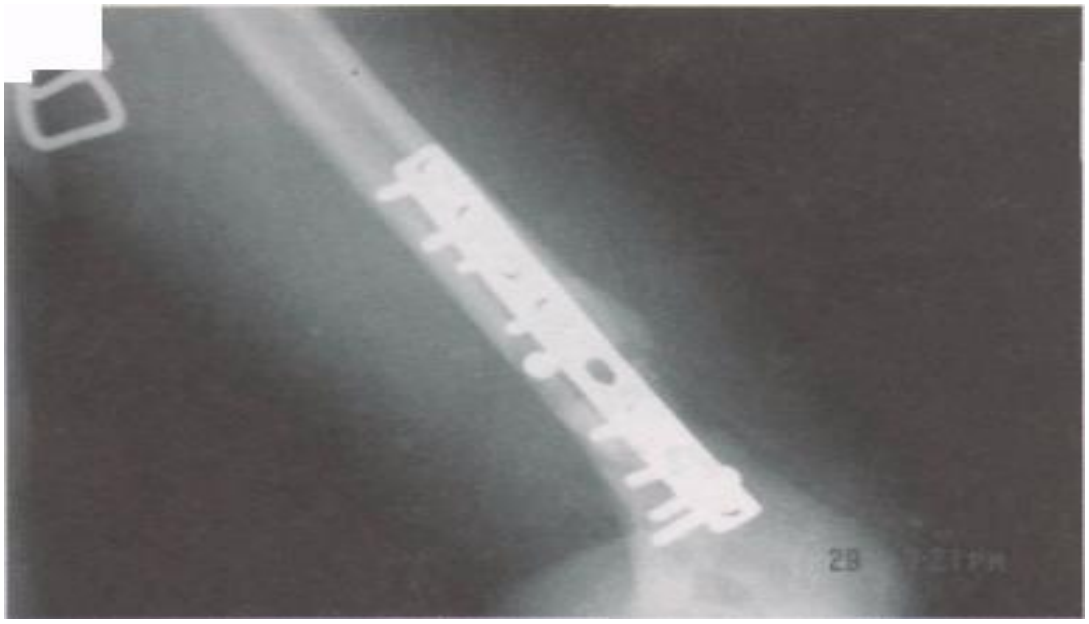

Figure 4.5. Patient T, 31 years old, 3rd postoperative day. Extramedullary osteosynthesis, fixation of a comminuted fracture of the humerus using a plate and screws.

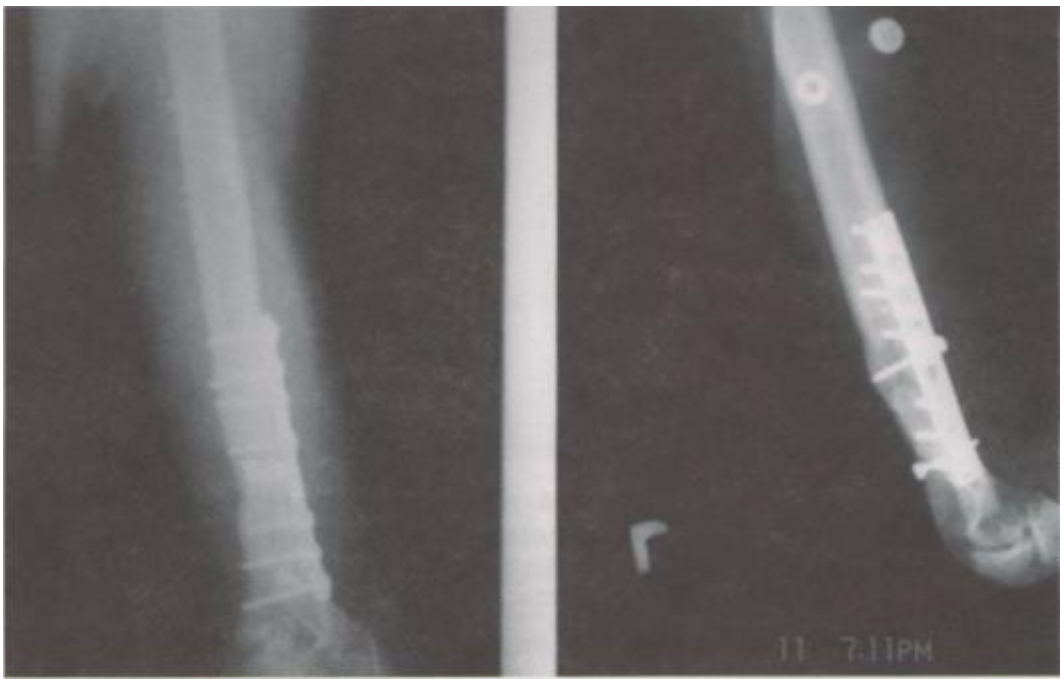

Figure 4.6. Patient T., 31 years old. X-ray taken after 3 months

The patient received 1000 mg of cefazolin once a day for a week in the postoperative period with lymphotropic RLS. After four days, the drain was removed. On the seventh day, the patient was discharged from the hospital with primary wound healing. The sutures were removed in the outpatient clinic on the ninth day. Three months after the operation, an examination was performed, the scar was soft to the touch, there were no adhesions to the surrounding tissues, the fracture was completely healed, the elbow joint was fully mobile (Fig. 54).

40-year-old patient V. was examined one hour after the injury. A comminuted fracture of the bones of the right forearm was detected as a result of a penetrating gunshot wound. The entrance hole measuring 3.2x2.9 cm is of irregular shape. The exit hole measuring 3.3x3.6 cm is located on the dorsal surface of the lower third of the right forearm (Fig. 4.7) The exit hole measuring 3.3x3.6 cm is located on the dorsal surface of the lower third of the right forearm (Fig. 4.7)

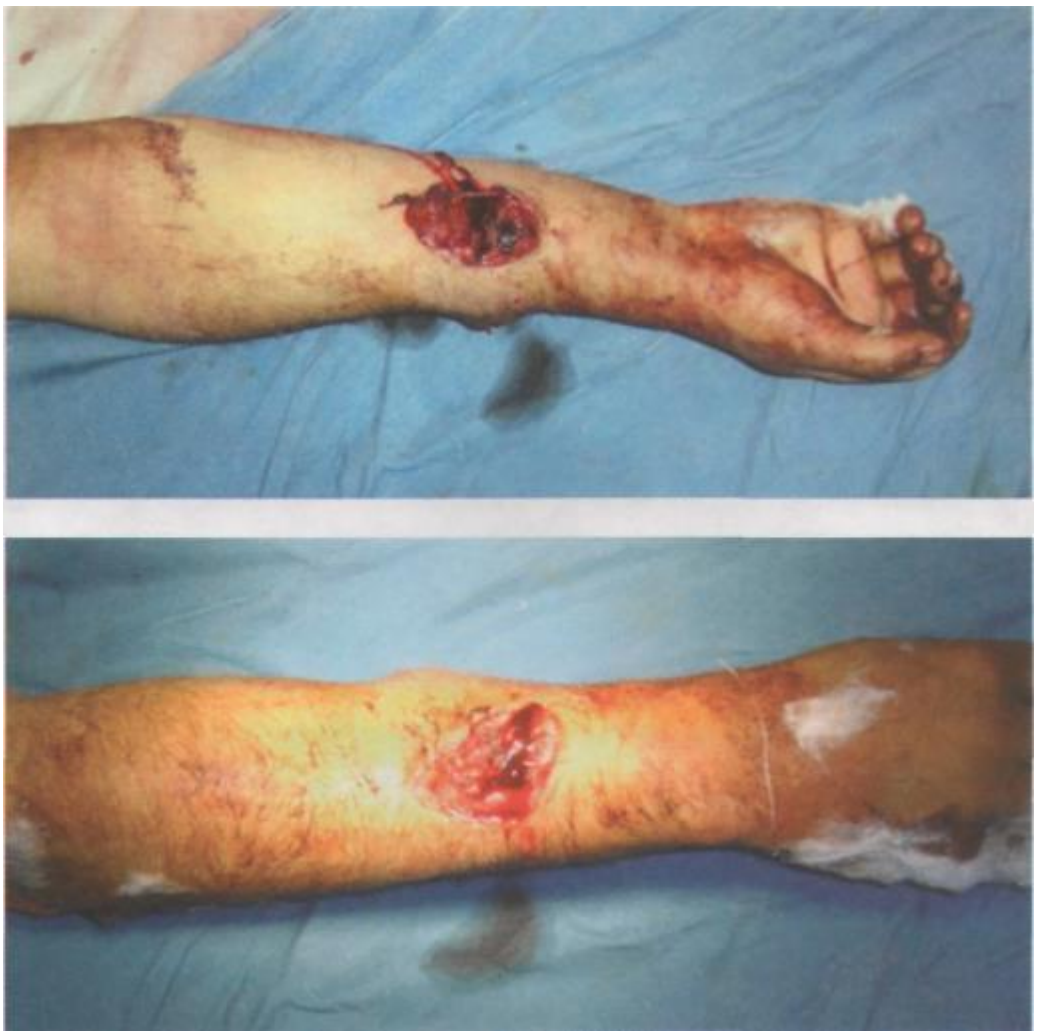

Figure 4.7. Patient B, 40 years old. Penetrating gunshot wound.

The radiograph revealed a comminuted fracture with a fracture defect in the lower third of the forearm (Fig. 4.8). Under local anesthesia, the wound was treated with primary surgical excision of the loose bone fragments. The bone fragments were realigned and fixed using AO plates.

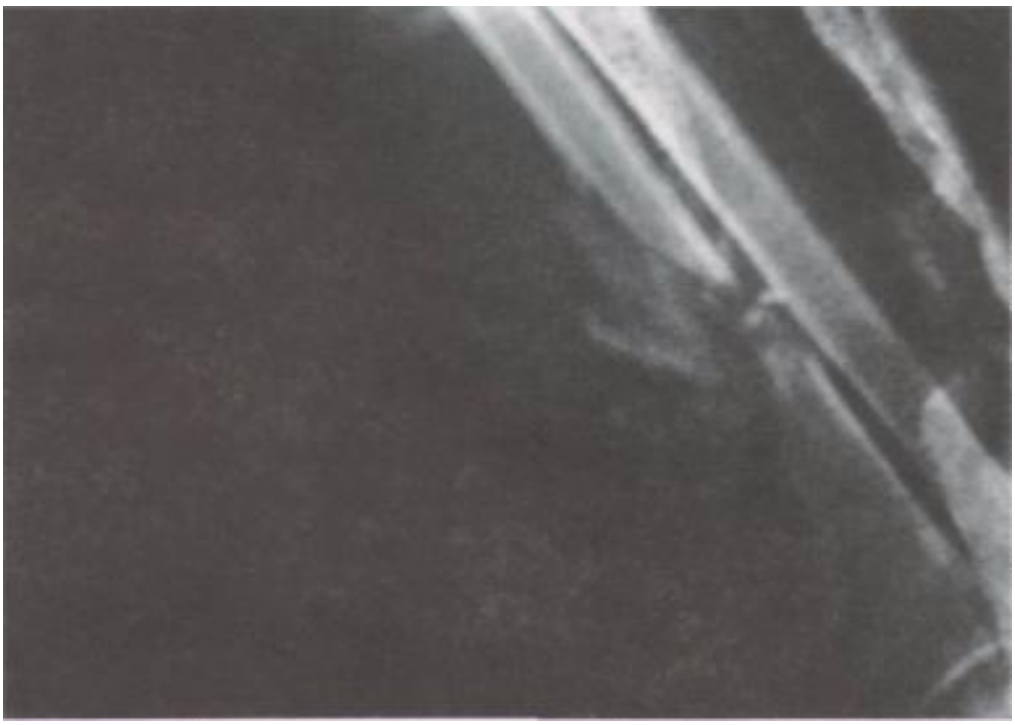

Figure 4.8. Preoperative X-ray. Radial fracture of the right forearm.

A perforating drain was placed for flushing with antiseptics. The wounds were sutured tightly, layer by layer without external immobilization (Fig. 4.10). The patient was treated with LTA with RLS in accordance with the standard accepted for the treatment of the postoperative period. The wound cavity was flushed with a flushing method for 6 days. Smooth healing of the postoperative wound, healing with primary tension, was observed. On the 8th day, the sutures were removed and the patient was discharged under the supervision of an outpatient surgeon (Fig. 4.11). At the follow-up examination after three months, the X-ray revealed complete union of the fracture. The postoperative scars were painless, soft, and did not adhere to the surrounding tissues. The functional state of the wrist and hand was fully preserved (Fig. 4.12). The functional state of the wrist and hand was fully preserved (Fig. 4.12)

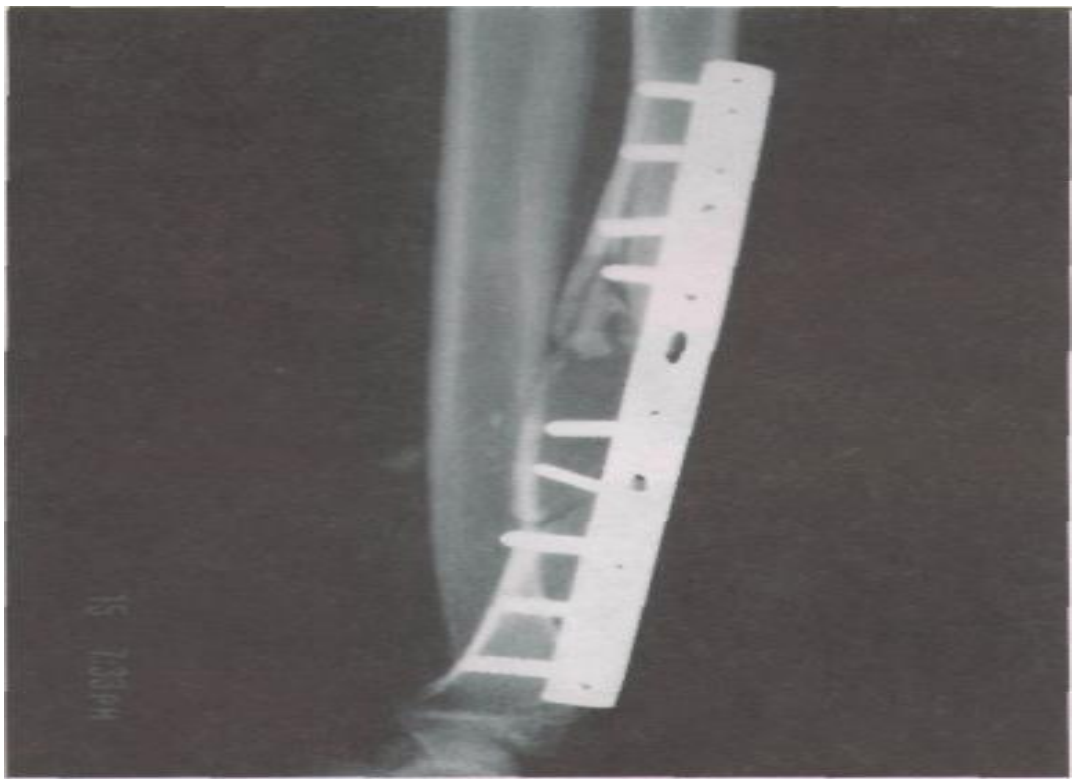

Figure 4.9. Patient V., after surgery for a fracture of the forearm bone resulting from a gunshot wound, osteosynthesis with skin grafting and a plate.

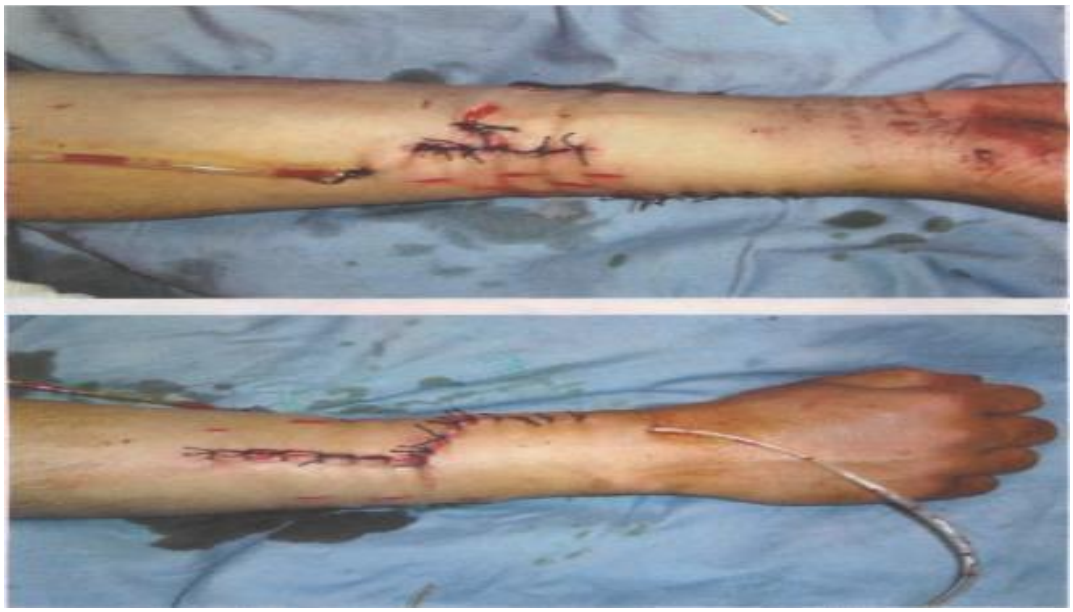

Figure 4.10. Patient V. Result of primary surgical treatment.

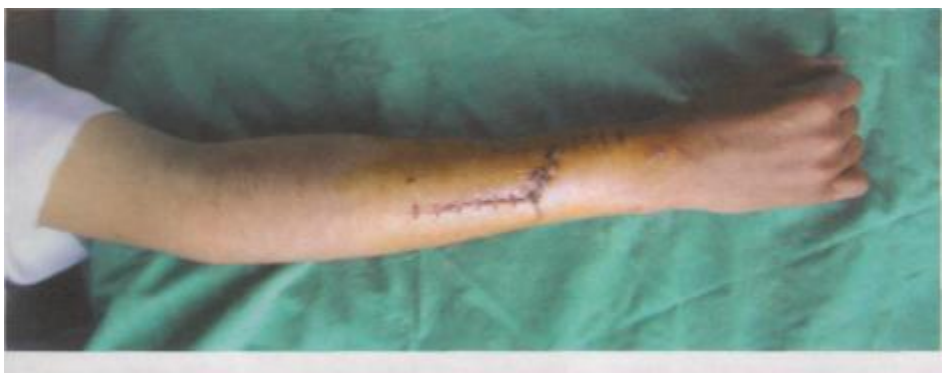

Figure 4.11. Patient V. 10 days after surgery

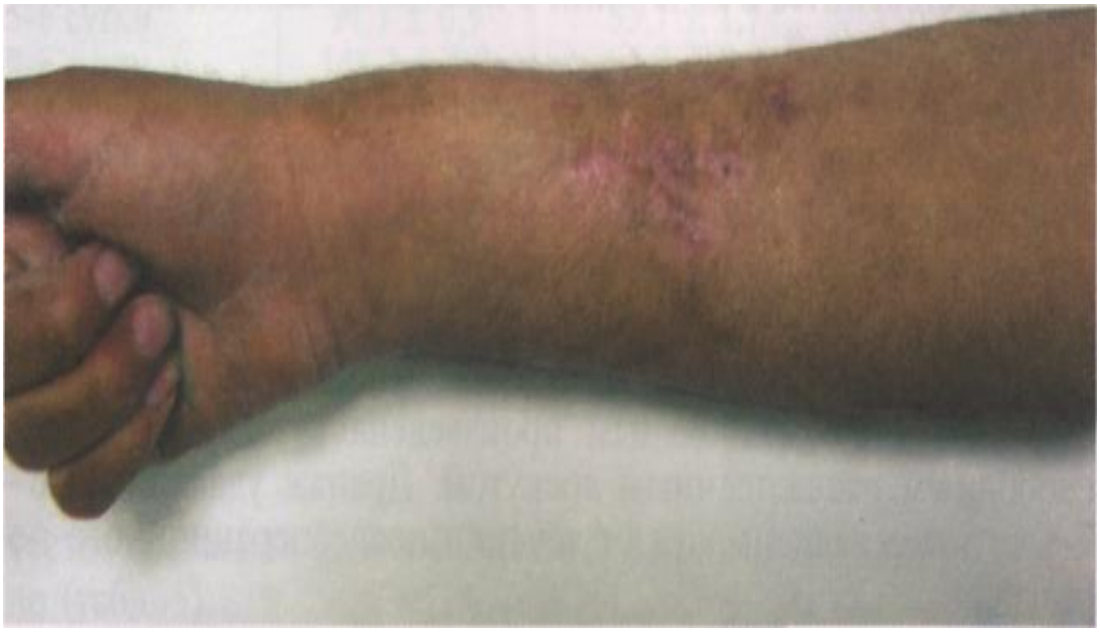

Figure 4.12. Patient V. Follow-up result after 3 months.

Based on the above, the proposed method of complex treatment of fractures caused by gunshot wounds, based on their pathogenesis, minimizes the duration of hospital treatment. Better functional results in the main group of patients compared to the control group, a decrease in postoperative gunshot wound suppuration from 20% to 6.2% and osteomyelitis from 13.3% to 6.2% allow us to recommend primary extramedullary osteosynthesis in combination with LTA and RLS in the treatment of gunshot wounds of the limbs.

4.2.2. Complex therapy of fractures caused by gunshot wounds. The role of extracorporeal osteosynthesis.

Patients were divided into 2 groups: main (n-26) and control (n-16).

The distribution of patients by fracture location was as follows: in the main group, 8 at the hip level, 6 at the lower leg, 6 at the shoulder, and 6 at the wrist; in the control group, 5 at the hip level, 4 at the lower leg, 3 at the wrist, and 4 at the shoulder.

In the presence of extensive damage, crushing and defects of soft tissues, extracorporeal osteosynthesis was used. Taking into account the topographic and anatomical features of the damaged area, the necrotic areas were radically excised, trying to preserve healthy tissues to the maximum extent. After that, reposition of bone fragments was performed, and at the end of the surgical procedure, osteosynthesis was performed using external fixation devices.

If there was a bone tissue defect, the inflammation was initially eliminated, and then bone autoplasty was performed after 3-4 weeks.

In the control group, 16 wounded patients underwent extra-articular osteosynthesis using the Ilizarov apparatus and then antibiotic therapy in the traditional way. Three wounded patients (11.5%) underwent bone autoplasty. The wound was surgically treated, impaired body functions were corrected, and painkillers were used. The wound was cleaned with antiseptics, antiseptic ointments were applied, and the drainage was washed with antiseptic solutions for a long time.

The patients of the main group underwent extra-focal osteosynthesis, and four of them (15.4%) underwent bone autoplasty in parallel, which was also included in the treatment complex. Patients of the main group (n-26) after surgery, depending on the severity of the wound, received infusion therapy with 1000 mg of cefazolin LTA and RLS once for 5-7 days. At the same time, fluid drainage was also performed. Wounds were bandaged daily using water-soluble ointments and

antiseptic solutions. Thus, in the complex treatment of the patients of the main group, extra-focal osteosynthesis and LTA with RLS were used.

In the main group, a significant decrease in perifocal edema and a decrease in pain syndrome was observed from 2-3 days. Over the next 5-6 days, the wound process proceeded without complications and the issue of wound closure was resolved.

Initial delayed sutures were applied to 8 patients (30.7%), local tissue to 6 patients (23.1%). The remaining 12 patients underwent autodermoplasty. Depending on the course of the postoperative period, the drain was removed on day 6-7.

The cytological picture on the first day of the disease consisted of lymphocytes, polymorphonuclear neutrophils, a small number of macrophages and eosinophils, which reflected a moderate inflammatory reaction. In both groups, an increase in the number of neutrophils was observed on the third day, which was reduced in the patients of the main group after our complex treatment. The macrophage reaction intensified, fibroblasts appeared. On the 9th day, these indicators were as follows: neutrophils 44.5±0.8, fibroblasts 21.0±0.4 and macrophages 24.5±0.3. In the control group, they were 63.3±0.3; 9.2±0.9 and 13.1±0.7, respectively (Table 4.3).

Table 4.3.

Cytological examination dynamics (n-20) expressed in percentages

Cell structure	Main group				Control group			
	Days				Days			
	1	3	5	8	1	3	5	8
Neutrophils	76.4±0.6**	79.5±0.9**	67.4±0.5***	46.2±0.7***	72.9±0.8	84.9±1.1	77.4±0.6	62.7±0.3
Macrophages	4.2±0.2	8.5±0.3**	12.6±0.3***	24.7±0.4***	5.6±0.6	6.3±0.7	8.5±0.2	13.5±0.6
Lymphocytes	11.9±0.5*	7.1±0.8	9.9±0.6	10.2±0.3*	13.9±0.5	5.9±0.6	8.7±0.3	7.3±1.2
Eosinophils	5.9±1.0	2.7±0.3*	1.3±0.8*	-	7.6±1.0	2.5±0.6	3.4±0.2	7.5±1.1
Fibroblasts	-	1.4±0.7	8.5±0.5***	20.9±0.3***	-	-	1.2±0.8	9.1±0.8

Note: reliability of the main and control groups: * - $p<0.05$; ** - $p<0.01$; *** - $p<0.001$.

The pH of the wound contents was compared in both study groups upon admission to the hospital and at the initial stages of treatment. On the first day, the acidity was 6.4±1.1, and after the application of LTA and RLS, it normalized on the 3rd day. This allowed 8 (30.7%) patients to apply primary delayed sutures on the 5th day. The wound healed without complications, and on the 11th day the patient was discharged from the hospital. Rehabilitation was carried out on an outpatient basis and lasted about 5 days. The wound healing period in these patients was significantly reduced to 16-17 days compared to the control group

(24-26 days) ($p<0.05$). In the patients of the main group, due to the complex therapy using LTA and RLS, autodermoplasty with a freely separated skin layer and local tissue plasticity with full-thickness skin grafting were performed, which contributed to faster wound healing.

Complex treatment with the use of LTA and RLS allowed to close the defect of the gunshot wound on the 5th-6th day, thereby reducing the duration of inpatient treatment to 11.7±0.7 days, and outpatient rehabilitation to 5.1±0.3 days. Only 2 (7.7%) patients had skin redness and slight detachment around the wires of the Ilizarov apparatus. The anti-inflammatory treatment was effective, only 1 (3.8%) of them had to be readjusted due to osteomyelitis. In the control group, postoperative wound suppuration was noted in 3 (18.5%) patients, and osteomyelitis developed in 2 patients, which was 12.5%.

Clinical observation data.

Patient S.,31 years old, brought to the clinic 1.5 hours after the injury. Objective examination revealed: gunshot wound, multiple fractures of the tibia and fibula, severe soft tissue damage of the tibia. There is an entrance hole measuring 2.5 x 1.0 cm on the outer surface. The exit hole is located on the inner surface of the tibia measuring 10.5 x 5 cm. On the medial surface, parallel protruding bone fragments caused extensive soft tissue damage. The radiograph (Fig. 4.13) clearly shows a multiple fracture of the left tibia. The gunshot wound was treated surgically, necrotic tissue was carefully excised, foreign bodies and loose bone fragments were removed. The wound was sutured, and a perforated drain was left for fluid irrigation. The bones were fixed using the Ilizarov apparatus (Fig. 4.14). In the postoperative period, standard treatment, infusion therapy, and painkillers were used in combination with LTA and RLS.

Water-soluble antiseptics and ointments (levomekol, miramistin) were applied daily, and the bandages were changed.

As a result of comprehensive treatment, it was possible to perform autodermoplasty with a freely separated skin flap on the 6th day.

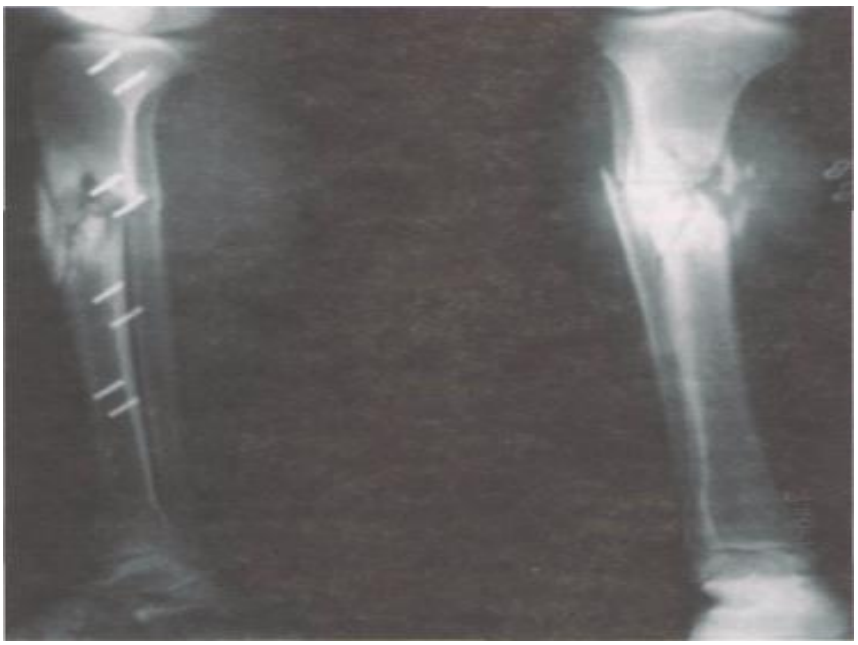

Figure 4.13. X-ray of patient S. on the day of admission to the hospital.

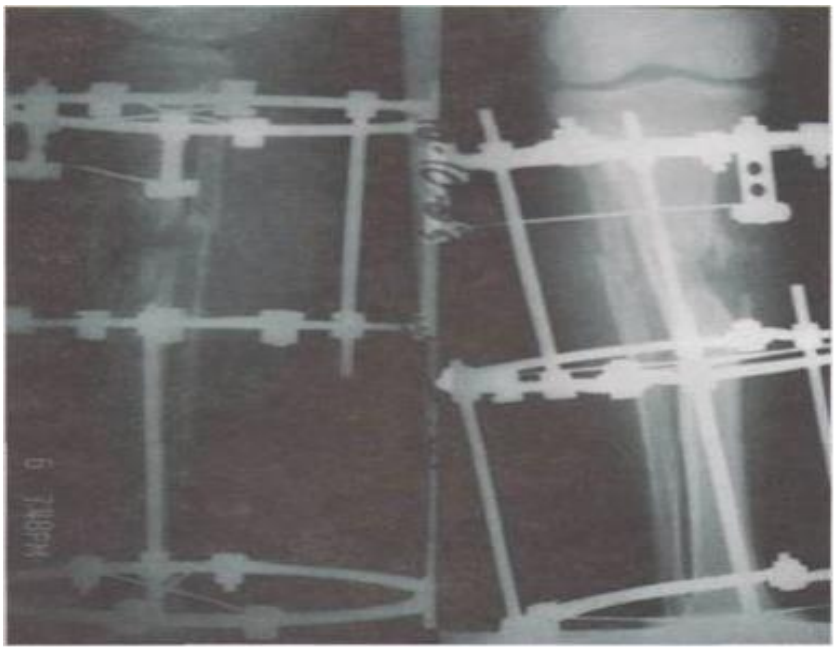

Figure 4.14. Postoperative radiograph of patient S. The condition after extra-focal osteosynthesis using the Ilizarov apparatus.

The graft was completely healed, and the patient was hospitalized for 15 days. A follow-up examination 5 months later revealed complete union of both fractures of the tibia. The function of the limb was preserved (Figure 4.15).

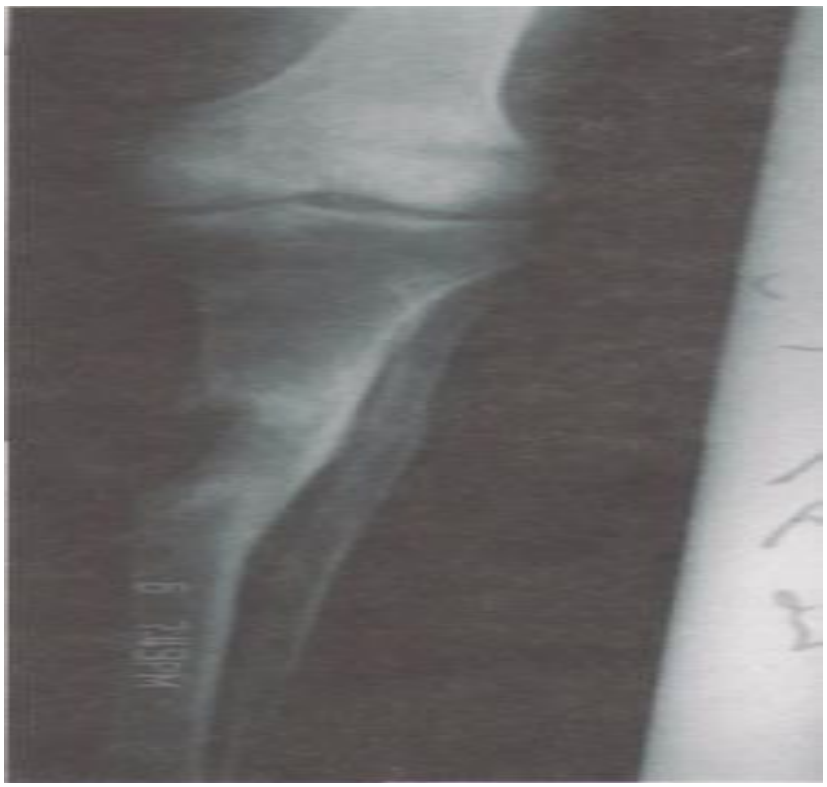

Figure 4.15. X-ray of patient S. 5 months after surgery.

2. A 38-year-old patient A. was examined in the emergency department. He had received a gunshot wound 1 hour before his arrival at the hospital. During the examination, a circular entrance hole measuring 1.4 x 0.9 cm was found in the lower third of the outer surface of the left thigh, and an oval-circular exit hole measuring 2.2 x 1.8 cm was found on the posterior inner surface. A large wound measuring 20 x 13 cm was found on the anterior inner surface of the left thigh, in which a large soft tissue defect, hemorrhage, and protruding bone fragments were observed (Fig. 4.16). Further examination revealed damage to the greater trochanteric artery. The radiograph showed a multi-fracture of the greater trochanteric and lesser trochanteric bones and displacement of bone fragments (Fig. 4.17).

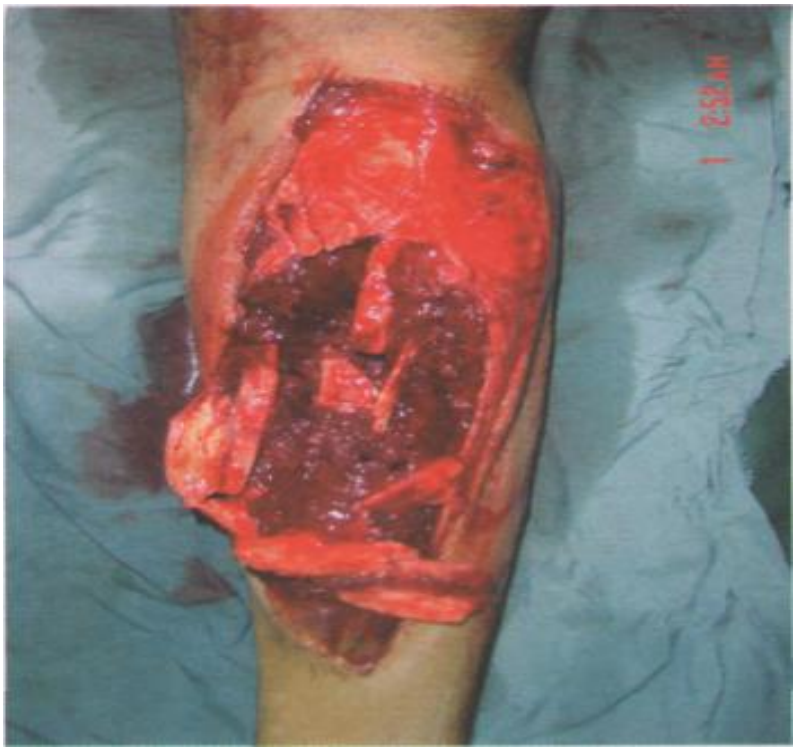

Figure 4.16. Photograph of a gunshot wound to the left thigh of patient A.

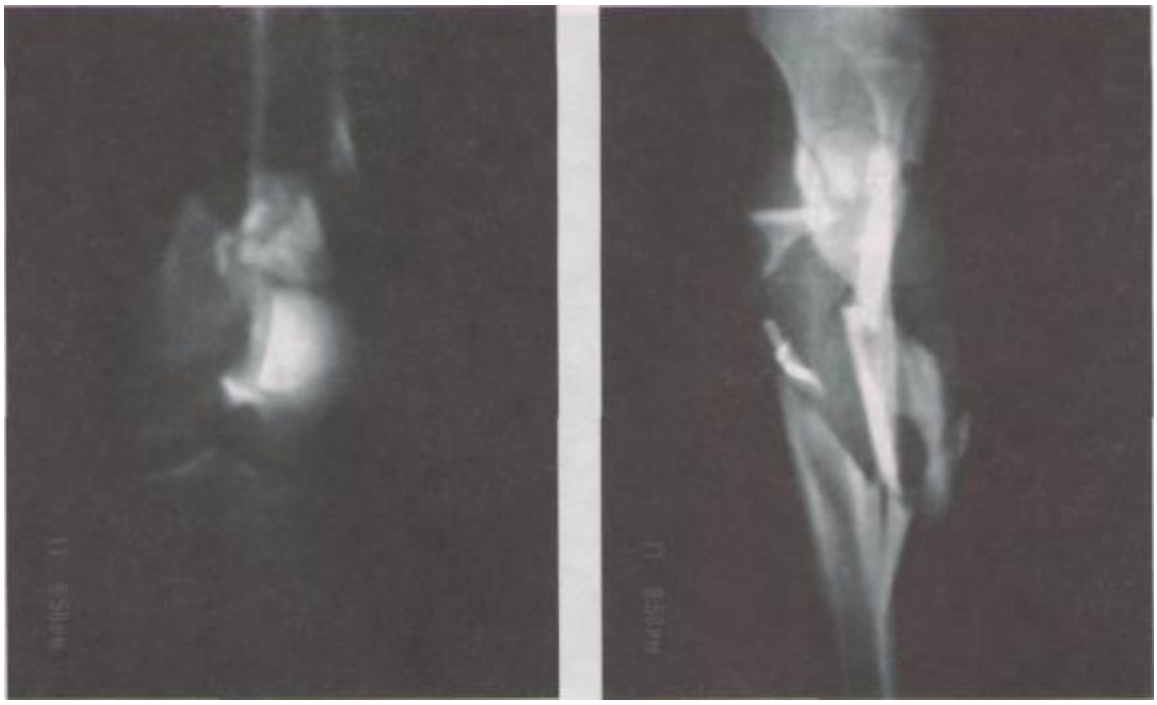

Figure 418. X-ray of the tibia of patient A. Comminuted fracture of the tibia

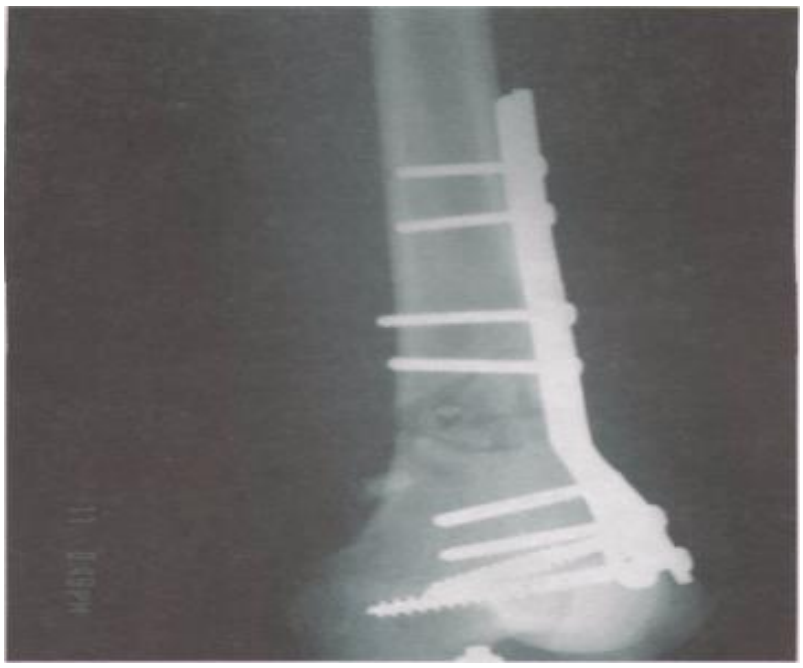

Figure 4.19. Postoperative X-ray of the left hip of patient A. Extramedullary osteosynthesis of the femur.

In the operating room, measures were taken to relieve the patient from shock and stabilize hemodynamic parameters. Then, the thigh and calf wounds were surgically debrided. Sutures were placed to completely stop bleeding from the posterior tibial artery. Open reduction of the femoral fracture using cancellous and cortical screws and fixation with an AO plate were performed. The bone fragments of the femur were brought into place and fixed with screws (Fig. 4.19). Extraosseous osteosynthesis was performed according to the Ilizarov method (Figs. 4.20, 4.21). The thigh and calf wounds were closed with dense sutures.

In addition, intensive infusion therapy was used throughout the postoperative period, LTA with RLS was performed. Drains were continuously flushed with antiseptics for 6 days. The postoperative period was uneventful. The wounds healed with primary closure (Fig. 4.22). After seven months, complete fusion of bone fragments was observed. The postoperative scars were painless, soft, and did not adhere to the surrounding tissues. The functions of the knee and ankle joints were fully preserved. The functions of the knee and ankle joints were fully preserved.

Thus, the use of extra-focal osteosynthesis for bone fixation in extensive soft tissue injuries in combination with LTA and RLS allowed for wound closure on day 5-6, reducing wound suppuration from 18.5% to 7.7%, and the development of osteomyelitis from 12.5% to 3.8%.

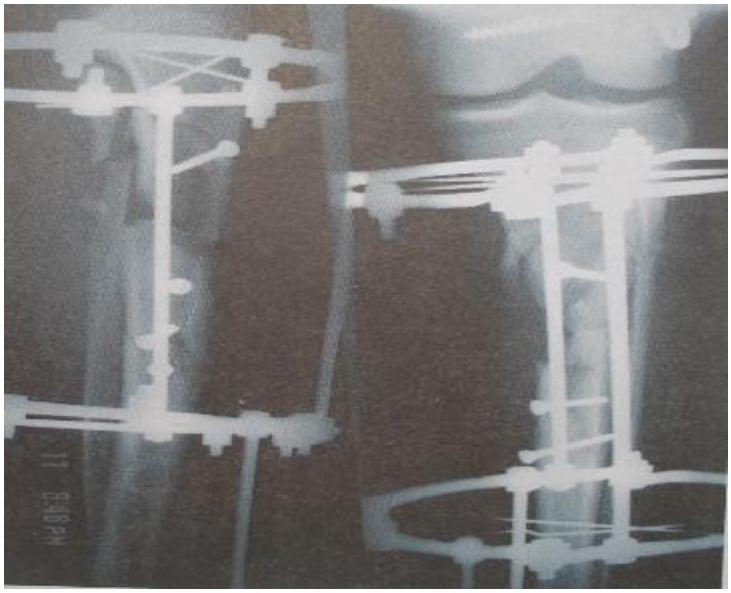

Figure 4.20. Patient A. External focal osteosynthesis of the left tibia using the Ilizarov apparatus.

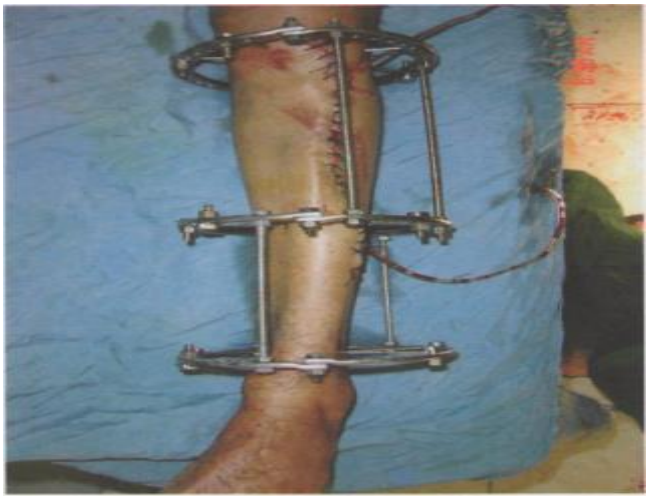

Figure 4.21. Left tibia after surgery.

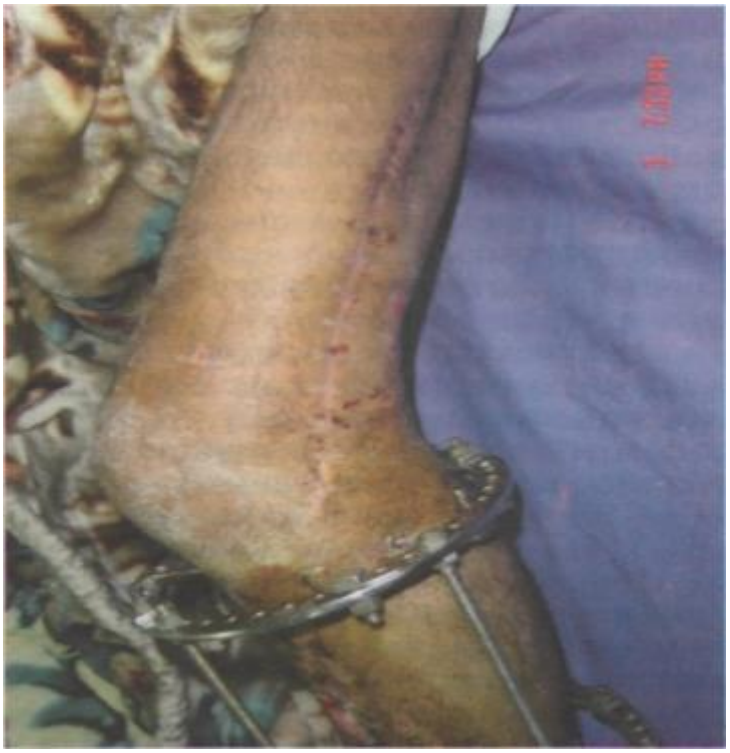

Figure 4.22. Patient A. 28 days after surgery.

4.3. The role of LT and RLS in the treatment of purulent-septic complications of gunshot wounds.

Purulent-septic complications of gunshot wounds lead to complex pathomorphological changes in the body of the wounded and disruption of the vital functions of organs and systems. The complex treatment method we proposed directly affects the microflora in the wound and lymphatic bed, suppresses it and restores the disturbed homeostasis. We examined 37 victims with various purulent-septic complications of gunshot wounds. This group of patients was composed of patients brought from subbranches, who underwent primary surgical treatment of the wound and were treated using traditional methods. The distribution of patients by fracture location was as follows: in the main group - 5 hip, 12 thigh, 4 shoulder, 4 wrist, in the control group - 3 hip, 5 thigh, 2 shoulder, 2 wrist. The age of the wounded ranged from 18 to 58 years. The duration of gunshot wounds ranges from 16 to 56 days.

In 8 (21%) of the injured, multiple joint injuries were detected, in 29 (78.4%) only one segment was affected. Microbial complications were of various types. Five (13.6%) of the injured had purulent-resorptive fever, in four (10.9%) septicemia and local purulent-necrotic process were noted. Purulent foci caused a wave-like course of the process with intermittent fever, which lasted at least 7 days after the opening of the purulent focus and was accompanied by pronounced functional disorders. The blood was sterile, the results of bacteriological studies were negative.

Septicemia developed in 4 (10.9%) patients. The general condition of these patients was severe, with high fever, and despite active antimicrobial therapy, the functions of many organs were impaired and deteriorated. In 28 patients, purulent-necrotic changes with a putrefactive nature were detected in the wound area.

Patients were depressed, drowsy, the tissues on the wound surface were dry and lifeless, a dirty-brown or dirty-green color appeared, which later turned into a cloudy-dirty color, a large amount of exudate was released, in some cases, foamy gas bubbles were observed in the wound bed. In patients with infectious complications, the pain syndrome was less pronounced, the body temperature fluctuated in the range from 36.6°C to 38.8°C. It is worth noting that in subfilial conditions, in 13 patients (35.1%) the primary surgical treatment of the wound was not sufficiently radical: in 10 (27%) patients it was limited only to excision of the wound and primary sutures on the skin. In addition, in 5 (13.6%) patients, primary osteosynthesis was performed unstable, and in 9 of them (24.4%) the intervention was not sufficiently adequate.

The main task of treating infectious complications is to correct homeostasis, timely eliminate the purulent process in the wound through repeated surgical intervention, which significantly reduces the risk of secondary complications. At the next stage, it is necessary to influence pathogenic microorganisms using LTA and RLS, strengthen immunity, properly fix the fracture using an external fixation device, and conduct rehabilitation measures. This technique was used in 25 patients in the main group. The purulent wound was treated surgically in two

directions - wide excision with opening of purulent foci and pockets, which included radical excision of all necrotic and non-viable tissues soaked with pus, creating conditions for subsequent drainage of the wound.

The following main objectives are pursued:

1. Removal of non-viable tissue in a purulent-necrotic focus, where there are many pathogens.

2. Ensuring the complete removal of exudate from the wound, the removal of tissue decomposition products, primarily toxins, and ultimately reducing the overall intoxication of the body.

3. Sequestrectomy and appropriate fixation of bone fragments.

4. To facilitate the inflammatory process, reduce hyperhydration and acidosis, normalize tissue metabolism. Palliative operations are recommended in cases of advanced sepsis.

In very severe cases of wounds, when the purulent process is complicated by sepsis, we consider that complete opening and drainage of purulent foci is sufficient. The gradual removal of necrotic tissue is carried out according to the instructions.

In infectious complications, purulent intoxication leads to persistent disturbances in homeostasis. This is manifested in disturbances in carbohydrate, protein, water-salt and acid-base balance. Therefore, in the pathogenesis of treatment, it is necessary to appropriately correct multiorgan failure, which includes detoxification and replacement therapy: restoration of water-electrolyte and protein composition. It is necessary to use parenteral nutrition and drugs that improve microcirculation.

Assuming that anaerobic infection with infectious complications may occur in gunshot wounds, we prescribed a broad-spectrum antibiotic ceftriaxone. In the main group, ceftriaxone 1000 mg was administered by lymphotropic route with RLS once a day for 5-7 days, depending on the severity of the disease.

The fractures were fixed with an Ilizarov external fixation apparatus. During the same periods, the drainage was flushed with antiseptic solutions. Water-soluble antiseptics and ointments were also used during daily dressing.

In this observation, the control group included 12 patients with the same complications of gunshot wounds, who received comprehensive treatment and antibacterial therapy using traditional methods.

LAT with RLS had a multifunctional effect, positively affecting both the general condition of patients and the course of the wound process. The very next day, 41.7% of patients showed an improvement in their general condition, relaxation and immobility, vegetative symptoms, and the effects of intoxication disappeared. The respiratory rate decreased from 25.8±0.1 to 24.6±0.1 per minute ($p<0.001$). By the 3rd day, this indicator was 23.1±0.1 ($p<0.001$). A significant positive effect of complex treatment with LTA with RLS was manifested in peripheral blood parameters. From the first day, the number of lymphocytes increased, the number of leukocytes decreased significantly, and the functions of the main detoxification systems of the body improved. This was objectively confirmed by liver parameters: total bilirubin decreased to 20.2±1.7 μmol/l (initial 34.27±2.23 μmol/l), total protein increased to 64.1±2.1 g/l compared to initial 54.8±2.3 ($P<0.01$). Residual nitrogen decreased from initial 46.7±3.2 mmol/l to 30.1±4.2 mmol/l.

The positive effect of our treatment method on the immune status is clearly shown in the figures in table (4.4). T and V lymphocytes were activated, the level of M and G increased, in contrast to the patients in the control group, whose immunodepression did not disappear even after the wounds healed.

Although the initial state of the microorganism undoubtedly played a certain role in the treatment, it should be noted that the effectiveness of our treatment method was noticeable immediately after the first sessions. Cytograms of the degenerative-necrotic type moved to the degenerative-inflammatory period, that is, to the initial stage of the reparative period, the discharge of pus increased, and peripheral edema decreased as a result of its liquefaction.

Table 4.4.

Changes in the dynamics of immune status indicators

Immunity indicators The object under study	T-lymphocytes, %	Abs.number, kl/μkl	Activity, %	Abs.number, kl/μkl	V-lymphocytes, %	Abs.number, kl/μkl	Immunoglobulins G	Immunoglobulins M
Donors	51.6±4.8	10.6±1.2	19.8±2.6	314±15.6	16.2±1.1	332±1.41	11.25±0.18	1.15±0.1
Patients before treatment	28.9±3.8	796±54	1.8±0.3	15.9±2.2	11.4±1.8	322±21.1	3.83±0.12	0.63±0.11
Patients after treatment	51.2±4.9	991±32	3.8±1.1	36.1±3.9	15.6±1.9	382±13.9	7.68±0.39	0.76±0.04
Reliability (r)	**P<0.05**	**P<0.05**		**P<0.05**		**P<0.05**	**P<0.001**	

In the control group, the swelling remained, and sometimes even increased, compared to the main group, for the same period of time, the pH value in the wound shifted to the alkaline side. On the 3rd-5th day, dark pink watery granulation islands appeared around the wound in the patients of the main group, which by the end of the treatment course covered a large part of the wound surface. At the same time, the pH-metric indicators stabilized at 7.3-7.6 (Table 4.5).

Table 4.5.

Wound pH-metry (M ± m)

Research day	Main group	Control group	Reliability (r)
Day 1	6.3±0.5	6.3±0.2	
Day 3	6.9±0.3	6.2±0.2	p<0.02
Day 5	7.52±0.3	6.31±0.3	p<0.05
Day 9	7.6±0.2	7.2±0.2	p<0.05

In the group of wounded who underwent LTA with RLS, positive dynamics of wound healing was observed on the 5th day. This was manifested in a decrease in wound size and the appearance of fine-grained granulations. The possibility of early wound closure and autodermoplasty is a result of LTA performed with RLS.

In the control group, signs of inflammation and purulent discharge from the wound persisted until the 6th day of treatment. The wounds in this group were sufficiently deep and were covered with purulent-necrotic membranes by this time. Granulations appeared on day 6.4±0.7, and wound healing was observed on day 27.8±1.6.

In the main group of patients, the number of neutrophils changed on the 5th day of smear examination was 14.1±1.9. Compared with the control group, neutrophils in a state of phagocytosis, immature mononuclear elements, macrophages and a small amount of fibroblasts were detected. Microflora, fibroblasts and detrital strands were observed in moderate quantities. The initial period of reparation (7th day) was characterized by a significant increase in the number of immature mononuclear elements and macrophages, which was a sign of a favorable course of the disease. By the 9th day, the number of immature mononuclear elements and macrophages decreased, while the number of young and mature fibroblasts increased several times.

The number of young and mature fibroblasts increased compared to the previous period and the control group. In smears, slightly altered neutrophils, accumulation of detritus were noted, which was less than in the previous period, and microflora was rarely detected. Observations showed a positive dynamics of

the wound process for 11-12 days, which was confirmed by an increase in the number of structural elements of fibroblasts and their mature forms.

On days 3-5 of treatment, a decrease in the number of neutrophils and altered microflora, the presence of neutrophil and macrophage phagocytosis, as well as an increase in rapidly maturing and stratifying reparative elements were observed in the main group.

The amount of microflora and its sensitivity to antibiotics were determined using standard methods. Staphylococcus aureus played a major role in bacterial complications of gunshot wounds. It was isolated both as a monoculture and in association with other microorganisms (51.7%). Among them, 16.2% - Pseudomonas aeruginosa (blue pus stick), 12.9% - Proteus vulgaris (vulgar proteus) and in equal proportions 9.6% - Bacteroides fragilis (fragilis bacteroids) and Escherichia coli (intestinal coli) were detected. The number of microbes in 1 gram of wound tissue (the total number of all types of microorganisms) was 107-109. In the main group, where LAT and RLS were used, bacterial contamination with microorganisms decreased to 103-105 already on the 5th-6th day after surgery. Later, the number of microbes decreased to 103, that is, to an indicator below the critical level. In the control group, such indicators were recorded only on days 17-18 of treatment. The results are presented in Table 4.6.

Table 4.6.

Dynamics of quantitative microflora analysis

Research day	Control group	Main group
Day 1	1.0 x 108	2.3 x 107
Day 2	1.2 x 107	1.1 x 105
Day 3	4.2 x 106	3.4 x 104
Day 4	6.4 x 106	3.0 x 103

The positive result of the complex treatment applied in the patients of the main group was objectively manifested in the cleansing and granulation of the wound, which led to its complete healing on days 18-19. Starting from the 6-7th day of complex therapy, nineteen patients were simultaneously placed with

primary-delayed sutures, and 6 patients underwent free autodermoplasty. No complications were observed.

The results are presented in Table 4.7. 4.7.

Table 4.7.

Results of treatment of the wounded

Wounded groups	wound cleansing (days)	appearance of granulations (in days)	Wound healing time (in days)
Comparison group	7.1±0.2	6.8±0.5	18.9±1.5
Control group	13.9±0.5	12.5±0.3	35.1±1.3

Statistical reliability $r < 0.001$

The recovery of patients in the main group was complete (100%). Good results in terms of restoration of functions were noted in 20 patients. The severity of the gunshot wound affected the functional impairment of the limbs, which was manifested in the form of a defect of the bone diaphyses in 5 patients. In the long-term period, bone autoplasty and extramedullary osteosynthesis were performed in all 5 patients with a bone tissue defect. Positive results were observed in all patients.

Clinical observation data.

A 21-year-old patient named X. was transferred from the Zhalakuduk subbranch to the RSHTYOIM OF. He received a gunshot wound to the left shin 50 days ago. An extract from the medical history was diagnosed with a comminuted fracture of the large and small tibia bones of the left shin. Extra- and intramedullary osteosynthesis was performed on both bones 45 days ago. On admission, the patient's condition was moderately severe, body temperature was 38.3°C. Objective examination revealed a wound measuring 9x6 cm on the front surface of the left shin, with swollen edges, necrosis of fascia and muscles. The shin wound is covered with a serous-purulent coating (Figs. 4.29 and 4.24). Complete blood count: Hb - 60 g/l, erythrocytes 3.1x109/l, leukocytes -

16.5x109/l, ECHT - 45 mm/h, segmental - 84%, monocytes - 5%, lymphocytes - 9%, eosinophils - 5%. Total protein - 48.1 g/l. The results of bacterial analysis of pus revealed the etiological factors Staphylococcus aureus and Bacteroides fragilis, sensitivity to antibiotics - the highest level was determined to ceftriaxone. Total protein - 48.1 g/l. The results of bacterial analysis of pus revealed the etiological factors Staphylococcus aureus and Bacteroides fragilis, sensitivity to antibiotics - the highest level was determined to ceftriaxone.

Intensive preparation was carried out before the operation. The purulent focus was surgically treated under general anesthesia - metal structures were removed, sequestrectomy was performed.

To eliminate the bone tissue defect (5 cm) formed during the resection of the greater tibia, a two-stage osteosynthesis of the tibia bones was performed according to the Ilizarov method with osteotomy of the greater tibia. At the same time, infusion therapy, lymphotropic antibiotic therapy with RLS were performed. Bandages were performed daily using Levomekol antiseptic ointment. By the 6th day, positive dynamics were observed, the wound surface was cleared of necrotic tissue, as a result of which swelling and pain significantly decreased, and bright fine-grained granulations were formed. On the 7th day, the greater tibia was lowered and free autodermoplasty with a dissected skin flap was performed. The greater tibia defect was eliminated. The wounds completely healed, and the patient was discharged from the hospital on the 21st day (Fig. 4.26). The fixation device was used for seven months, which eventually allowed for full restoration of leg functions (free walking without any support).

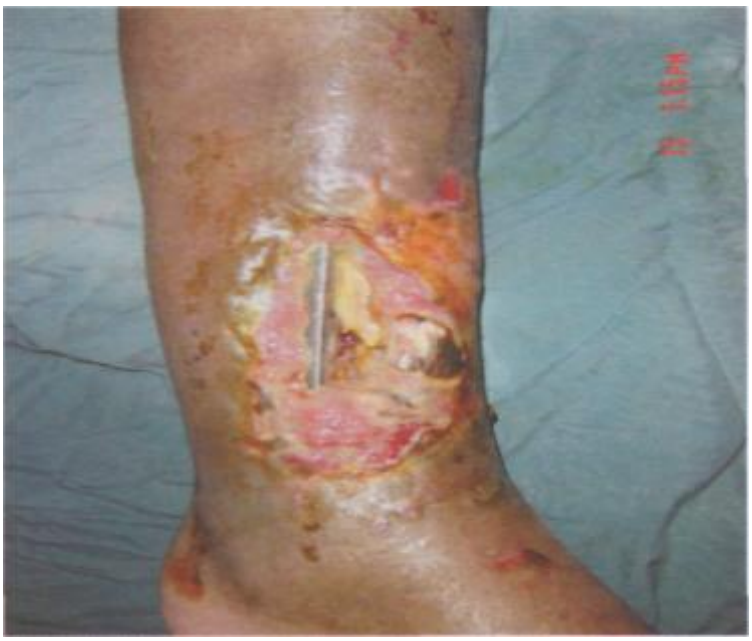

Figure 4.23. By X. 21 years old. Photo taken upon arrival at the hospital

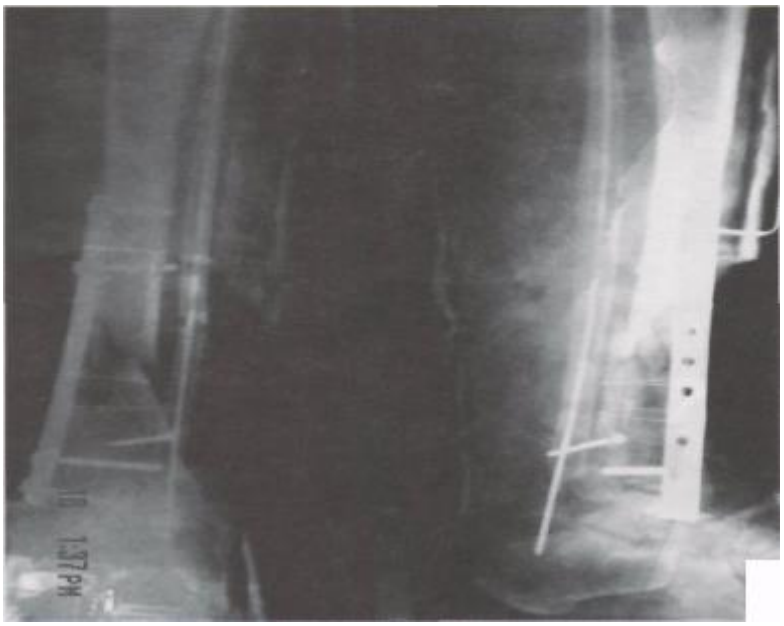

Figure 4.24. Patient X, 21 years old. X-ray of the left tibia at the time of admission to the clinic.

Figure 4.25. Patient X, 21 years old. Dynamic image

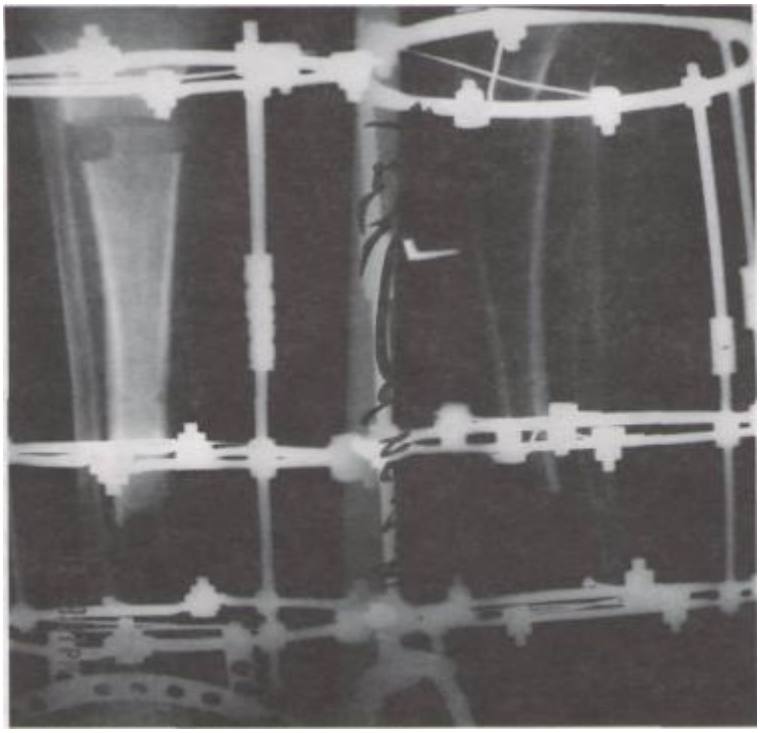

Figure 4.26. Patient X, 21 years old. Dynamic radiograph of the left tibia.

In a military-urban combat situation, early and rapid delivery of the wounded and the use of regional lymphotropic antibiotic therapy and lymphostimulation allow us to change the tactics of treating patients with gunshot wounds. This tactic

is to provide a full cycle of treatment of the wounded using primary suturing and primary osteosynthesis.

When the injured arrive at the district units of the EMM system, it is advisable to use the principle of "Damage control" (emergency service) to provide specialized assistance. This principle is aimed at temporarily stopping bleeding, immobilizing limbs, taking measures against shock, and evacuating the injured to the regional EMM center.

Accordingly, based on the results of clinical, microbiological and cytological studies, it can be concluded that the complex therapy of using LTA and RLS in the treatment of purulent-septic complications of gunshot wounds of the limbs proposed by us is justified from the point of view of pathogenesis. The positive effect of LTA with RLS is that it quickly penetrates the affected area, the drug is absorbed into the bloodstreamand its maximum concentration in soft tissues is maintained for a long time, and also has an important effect on the lymphatic system. RLS reduces edema, improves lymphatic circulation and microcirculation, which activates local metabolism, improves tissue nutrition and recovery processes in the area of compression.

Thus, the comprehensive treatment method for this group of patients that we proposed has a positive effect on the main links in the pathogenesis of gunshot wounds and their infectious complications, and has proven to be an effective method in the treatment of this severe pathology.

CHAPTER V. EMERGENCY MEDICAL AID DURING MEDICAL EVACUATION STAGES IN EMERGENCY SITUATIONS IN CASE OF A MASS ARRIVAL OF GUNSWORTHY INJURIES

In recent years, we have witnessed and participated in terrorist acts by extremists, whose geography has spread everywhere. Nowadays, wars using firearms are very relevant.

For the first time in the world, steps are being taken to systematize emergency medical care for civilians and military personnel in the face of a mass influx of gunshot wounds in urban settings.

The most important focus of this reorganization is the early provision of specialized medical care and the evacuation of injured persons to areas close to armed conflicts.

Multidisciplinary treatment and prevention institutions (DPM) of the emergency medical care system in Uzbekistan are best suited to provide emergency medical care (EMC) during terrorist acts. Specialists of the branches of the RShTYoIM have high professional training in emergency situations, they are assigned to "ambulance" and sanitary aviation departments, emergency brigades on constant alert, these units are of priority importance in local armed conflicts in urban conditions.

We studied the experience of the Republican Emergency Medical Service of the Republic of Uzbekistan in mass admission of the wounded with the Scientific Center of the Republican Emergency Medical Service, regional branches, district subbranches. A retrospective analysis of the results of medical care for the wounded showed that their effectiveness depends on the timely provision of specialized care. Unsatisfactory treatment results were noted in the wounded who had gone through all the standard stages before being admitted to specialized institutions. It became clear that the development of adverse complications is associated with the delay in the provision of sufficiently specialized care. Based on

the above, reducing the number of stages of medical care is an urgent problem, the solution of which is determined by medical necessity.

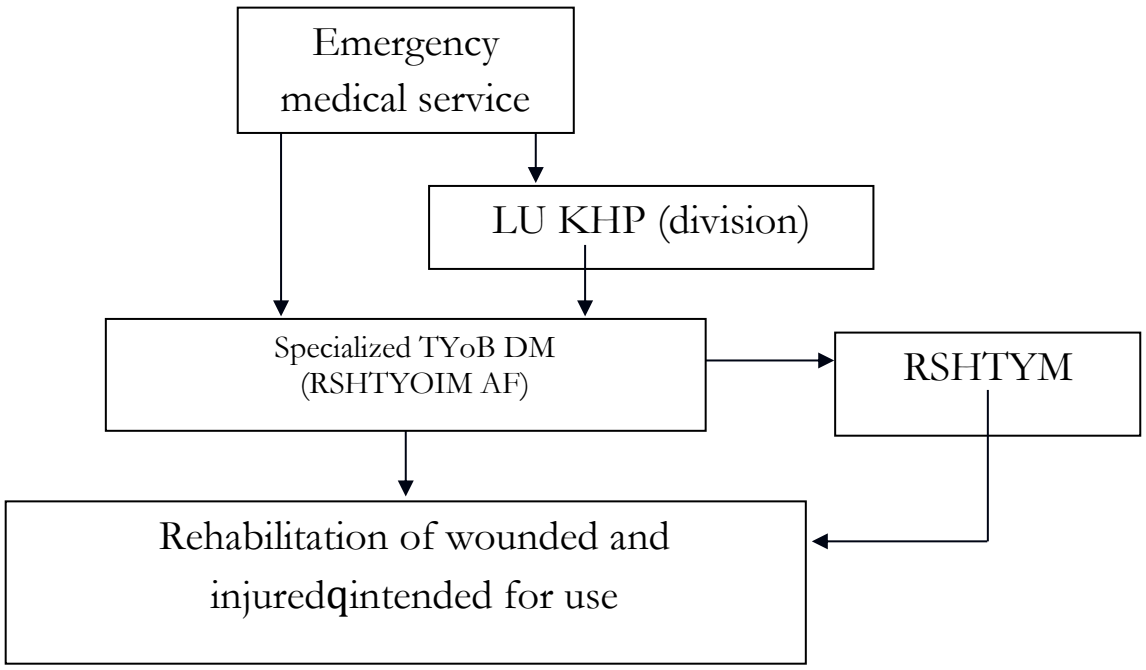

Figure 5.1. Scheme of construction of a treatment and evacuation support system in emergency situations.

In the conditions of civilian healthcare, the provision of medical care to victims with gunshot wounds is significantly simplified and has its own advantages. The results of treatment are directly related to the rapid delivery of the wounded to a multidisciplinary medical facility, where they will be provided with specialized medical care. In urban conditions, this process is facilitated several times due to the presence of the “03” ambulance service and mobile units of sanitary aviation in the healthcare system. All this makes it possible to use the wide capabilities of a multidisciplinary medical facility even in conditions of mass admission of victims. The participation of various specialists in the treatment process helps to achieve the best results in the treatment of this category of patients. We have proposed an algorithm for diagnosing and treating victims with

gunshot wounds in a multidisciplinary medical facility (5.2). When the injured are mass admitted to a hospital, the main task of providing medical care is to restore the integrity of damaged blood vessels and internal organs. The sequence of operations performed in the surgical care algorithm depends on the severity of the victim's condition. Specialized medical care for the injured in the regional branch was provided by stopping bleeding completely, applying vascular sutures, thorough and adequate surgical treatment of wounds, using microsurgical techniques to restore damaged structures of the limbs, early osteosynthesis and plastic surgery. We also include the use of lymphatic therapy methods in specialized medical care due to the high pathogenetic basis of this method. This method can be very effective even in the early stages of evacuation, since it is easy to implement and does not require special equipment and skills to use it.

Figure 5.2. Algorithm for diagnosis and surgical care in a multidisciplinary DPM

5.1. Organization of the BMY with the participation of RSHTYOIM AF units, its content and scope.

First aid is provided directly at the scene of the emergency.

The following had a decisive impact on the organization of medical care for the wounded in the emergency zone:

• The unexpectedness, suddenness, and unpredictability of the emergency;

• Lack of prior experience in organizing medical care during terrorist acts;

• The diversity of combat situations in complex urban environments;

• Lack of medical knowledge and skills among civilians in providing medical care in terrorist attack situations;

• The complexity of evacuating the wounded from the combat zone, as terrorists opened fire even on ambulances;

• An increase in the number of serious and critically injured people due to the traumatic effects of modern firearms and the accuracy of sniper weapons.

Therefore, from the very beginning of the conflict (terrorist act), we used all measures that allowed us to bring medical care closer to the wounded.

An ambulance, staffed by a general practitioner and a paramedic, and air ambulance were deployed to provide first aid and evacuate the wounded. The medical equipment for first aid included:

Narcotic analgesic solution, hemostatic tourniquet, aseptic dressing materials, means of immobilization in transport, antibiotics, systems and solutions for intravenous administration.

The wounded were evacuated by ambulance to the RSHTYOIM AF for specialized care, and if this was not possible, to sub-branches and other specialized multidisciplinary treatment and prevention institutions.

Analyzing the experience of providing assistance in armed conflicts, it was found that the "03" service, with its capabilities, allowed for the rapid evacuation of victims from the dangerous area, expanding the scope of medical assistance, and bringing medical assistance closer to the wounded (79% of the wounded were provided with medical assistance in the first 3 hours after injury).

The use of ambulances and medical aviation of the "03" service for the evacuation of the wounded directly from the scene of the incident to specialized medical and preventive institutions (RSHTYOIM AF, sub-branches and other multidisciplinary medical and preventive institutions) improved the quality of treatment of victims with gunshot wounds. First aid at the pre-hospital stage consisted in preparing the wounded for qualified and specialized care before transporting them to medical institutions. The involvement of doctors of the "03" service directly to the scene of medical assistance made it possible to significantly improve the quality of care and prevent possible complications of the injuries received. In addition, the experience of the events showed that the use of specialists with primary training in surgery and anesthesiology-resuscitation in

ambulances and medical aviation was effective and expedient, especially in providing medical care to seriously wounded people.

The headquarters' medical aviation vehicles evacuated mainly seriously wounded people from sub-branches and other medical and preventive institutions to the RSHTYOIM AF. The headquarters of the sub-branches and medical and preventive institutions were in constant contact with the headquarters of the RSHTYOIM AF, which made it possible to organize the effective use of medical aviation for the evacuation of the wounded.

FIRST AID FOR THE VICTIMS.

A case history analysis study revealed that the majority (70%) of gunshot victims in the events of May 13, 2005, received first aid.

The main goal of first aid was to save the patient's life and prevent possible complications. First aid was provided directly by the injured person, by nearby paramedics, as well as by ambulance doctors. The incidence of mutual aid was 20 percent (Table 5.1). 5.1).

Table 5.1.

Frequency of first aid (expressed in percentage)

Who provided first aid?	Citizens		Military personnel	
	Absolute number	%	Absolute number	%
Providing first aid in the order of	31	22.5	22	71.0
self-help and mutual aid	82	59.4	5	16.1
Mutual aid	25	18.1	4	12.9
Emergency room doctor				
PDO				
Total	138	100.0	31	100.0

First aid measures are listed in Table 5.2.

Table 5.2.

Level of performance of necessary first aid procedures, in percent

Treatments	Must be done	Truly fully

			accomplished	
	Absolute number	%	Absolute number	%
Aseptic bandage	169	100	135	79.9
Narcotic analgesic injections	169	100	102	60.4
Stop the bleeding	42	24.8	41	97.6
Immobilization with transport tires	95	56.2	25	26.3
Occlusal ligament	2	1.2	2	100

Most patients received aseptic dressings, and 60.4% of patients received painkillers.

According to the instructions, a tourniquet or a pressure bandage was applied to stop external bleeding. A tourniquet was used to stop bleeding in 24 wounded (58.5%), and a pressure bandage in 17 (41.5%). A tourniquet was applied in cases of damage to the main vessels of the limbs, brain contusions, and extensive injuries.

Transport immobilization was performed with improvised means due to insufficient stretcher tools and was performed in 26.3% of cases, which is a low figure.

Thus, in the complex conditions of the emergency situation in Andijan on May 13, 2005, early assistance was provided to the majority of PP injured. Due to the lack of simple and accessible means, the use of transport immobilization in providing assistance remained low. The methods of giving, storing, using and reporting painkillers lead to difficulties in their use in emergency situations.

In the events of May 13, 2005, prehospital care (PHC) was not as important as the participation of emergency medical doctors in the PHC event. This was due to the desire to quickly evacuate the wounded to the specialized treatment stage after the PX was provided.

5.2. Organization of the SCT in the sub-branches of the RSHTYOIM OF, its content and scope.

During the events of 13.05.2005, the sub-branches of the RSHTYOIM OF provided qualified surgical assistance (KXY) to the wounded. In emergency situations, the main burden fell on the sub-branches located in the Zhalakuduk and Kurgan-tepa districts. Starting from May 13, 2005, all patients hospitalized with gunshot wounds in the surgical departments of the RSHTYOIM OF sub-branches were provided with qualified medical assistance. In addition, reinforcement groups were sent from the RSHTYOIM OF to the sub-branches.

Sub-branches provided medical care to 57 wounded during the events of May 13, 2005. Qualified medical care was provided to 21 (36.8%) patients wounded by firearms in sub-branches, and first aid was provided to 36 (63.2%) patients. Urgent surgical interventions were performed on 5 (23.9%) wounded, and emergency operations on 4 (19.1%). 12 (57%) patients were operated on in sub-branches on delayed instructions. Pleural drainage was performed on two (9.5%) wounded with tension pneumothorax and hemopneumothorax. In the absence of limb amputation and the inability to restore integrity (4.8%), laparotomy was performed on 1 patient with a perforated abdominal wound, which ended in the death of the injured person.

15.3% of the wounded were provided with qualified resuscitation assistance. In 9.5% of the wounded, bleeding was stopped by tying the vessel in the wound. In 4.8% of the wounded, upper amputations were performed.

One patient with a penetrating abdominal wound underwent laparotomy. After the operation, the patient died due to blood loss.

Emergency surgery was performed for hematothorax in 4.8% of patients, and primary surgical treatment of injuries was performed in 9.5%.

Surgical treatment of gunshot wounds was performed in 57% of the wounded under delayed indications. Primary surgical treatment of wounds accounted for a significant majority of sub-branch surgical interventions (Table 5.3).

Table 5.3.

Structure of surgical interventions in subbranches.

The nature of surgical interventions	Abs.	%
Urgent operations:		
Tying a blood vessel in a wound; Pleural cavity drainage (severe pneumothorax); Opening the abdomen (laparotomy) to stop bleeding; Amputations; Total:	2 1 1 1 5	9.5% 4.8% 4.8% 4.8% 23.9%
Emergency surgeries Pleural cavity drainage (hemopneumothorax) Temporary prosthesis of major blood vessels (limb ischemia); Primary surgical treatment (large and dirty wounds); Total:	 1 1 2 4	 4.8% 4.8% 9.5% 19.1%
Delayed operations PXO injuries	 12	 57%
Total transactions	21	100%

Isolated injuries accounted for 57.9 percent, multiple injuries accounted for 24.6 percent, and combined injuries accounted for 17.5 percent.

Limb and arm injuries accounted for 65.1 percent, head injuries for 15.8 percent, chest injuries for 6.95 percent, and abdominal injuries for 4.8 percent (Table 5.4). (Table 5.4)

Table 5.4.

Location and description of injuries

Injury site	Solo		Plural		Combined		All	
	Number of wounded	%	Number of wounded	%	Number of wounded	%	Number of wounded	%
Hands and	23	38.7	11	19.4	4	7.0	38	65.1
feet	5	8.8	2	3.5	2	3.5	9	15.8
Head	1	1.7	-	-	-	-	1	1.7
Neck	2	3.5	1	1.7	1	1.75	4	6.95
Rib cage	2	3.5	-	-	1	1.75	3	5.25
Belly	1	1.7	-	-	1	1.75	2	3.45
Pelvic area	-	-	-	-	1	1.75	1	1.75
Spine								
Total	33	57.9	14	24.6	10	17.5	56	100

Mild injuries were recorded in 59.3 percent, moderate injuries in 17.9 percent. Severe injuries accounted for 19.6 percent, and those in critical condition accounted for 3.2 percent.

During the first "golden" hour, 41 (71.9 percent) wounded were transported to sub-branches.

The mortality rate of the wounded brought to the sub-branches of the Andijan branch of the RSHTYOIM was 1.4%. Deaths were observed in the wounded brought to the sub-branches within 2 hours of injury. The deaths of the wounded were associated with severe combined injuries and severe blood loss.

The main feature of the work of sub-branches is the provision of early qualified assistance and the rapid delivery of seriously injured people to the regional emergency medical center within the first 2 hours. Due to this, the operational activity in sub-branches is significantly reduced to 36.8 percent. A

significant share of primary surgical treatment of wounds remains in the structure of surgical operations and reaches 63 percent. Today, the ability to bring the wounded to the Andijan branch of the RSHTYOIM for specialized assistance within 1-2 hours can reduce the share of primary surgical treatment in sub-branches to a minimum. The considered group of patients with infectious complications, presented in the previous chapter, belonged to this contingent of wounded (63 percent).

Taking into account the availability of a multidisciplinary hospital with the ability to provide highly specialized care, from microsurgery with extensive diagnostic capabilities, a medical aviation service, and the ability to deliver the wounded from any sub-branch in the region within 1 hour, we consider it appropriate to quickly evacuate the wounded to the Andijan branch of the RSHTYOIM after eliminating a life-threatening situation, that is, to use the modern concept of "Damage control". As the sub-branches are equipped with modern treatment and diagnostic equipment, the level of medical care provided in these units will undoubtedly increase to a high level of qualification in most cases. In this regard, the capabilities of the sub-branches as a stage of medical evacuation will increase significantly.

Therefore, at the modern stage, the main task of sub-branches is not only to provide qualified surgical care, but also to quickly and safely evacuate the wounded. The main condition for this treatment-evacuation system is the full preparation of the wounded before evacuation. For this, it is necessary to strengthen them with surgeons and anesthesiologists-resuscitators sent on a business trip from the regional center.

All of the above allows us to fundamentally reconsider the role of sub-branches in providing assistance to the wounded during terrorist acts. We are deeply convinced that during local combat clashes in populated areas, sub-branches should only carry out procedures that eliminate potentially fatal situations.

These activities include:

- Elimination of acute respiratory failure, which will allow for subsequent transfer to the regional branch of the RSHTYOIM for specialized medical care;
- Stopping bleeding wounds: ligating the vessel, temporarily prosthetically replacing large vessels when injured, using hemostatic drugs, and tamponade and tight bandaging of the bleeding wound in case of technical difficulties;
- When it is not possible to save the limbs, a high amputation is performed;
- Thoracocentesis with drainage of the pleural cavity in pneumothorax;
- Stop intra-abdominal bleeding;

Appropriately correcting intra-organ abnormalities that allow the injured to reach the SPM stage.

In sub-branches, wounds are treated surgically to stop ongoing bleeding. Previous dressings are replaced if they are contaminated. Rapid evacuation to provide specialized care in the regional branch of the RSHTYOIM is the key to success and the basis for reducing complications. Laparotomy and thoracotomy are performed in sub-branches according to urgent instructions in order to save the life of the wounded, as well as in cases of delay in evacuation to the regional branch of the RSHTYOIM.

Thus, during the events that occurred on May 13, 2005 in the city of Andijan and nearby districts, the main task of the sub-branches was to fully prepare and ensure evacuation before evacuation using the capabilities of the "03" ambulance service and sanitary aviation, and to evacuate the wounded to the regional branch of the RSHTYOIM. Sub-branches are the stage of providing CCP, and in most cases they provide this assistance in the first medical and qualified volume. We believe that the sequential provision of the above types of medical assistance in the sub-branches is tactically justified. After the surgeon's examination, the majority of the wounded (70%) admitted to the sub-branches were assessed as having light and moderate injuries. This allowed the victims, after first aid, to be delivered to the

regional branch of the RSHTYOIM for further treatment using ambulances and sanitary aviation.

The main task of the sub-branches should be to provide maximum assistance to save the life of the victim. The assistance provided should be sufficiently simplified based on the developed recommendations and instructions. Surgical care provided to patients with light and moderate injuries in the sub-branches is considered pre-evacuation preparation for transfer to specialized treatment and prevention institutions in the system of medical care for victims with gunshot wounds.

CONCLUSION

Nowadays, the world is witnessing many events, from small military conflicts to large-scale armed conflicts. In such cases, patients with gunshot wounds are often encountered. In particular, soft tissue, blood vessel and bone injuries are widespread. The spread of firearms among the civilian population has led to an increase in the number of gunshot wounds in local armed conflicts and terrorist acts. Injuries to the arms and legs occur in 50-70% of cases. Often, gunshot wounds become infected and cause various complications. The spread of infection through the lymph and the development of lymphostasis lead to the formation of abscesses, phlegmons, wound edema and sepsis around the wound. Therefore, lymphotropic and endolymphatic antibiotic therapy methods, as well as enhanced lymphatic drainage, are of particular importance in gunshot wounds. In addition, when the injured are brought in en masse, it is of great importance to determine the sequence and volume of surgical care at different stages of triage, evacuation, and evacuation to save their lives and reduce complications.

In this regard, we set a goal to study the effectiveness of lymphotropic antibiotic therapy with local lymphostimulation in the treatment and prevention of

gunshot wounds of the arms and legs and their bacterial complications, and to develop principles and methods of treatment during evacuation stages in peacetime.

This research work is part of the comprehensive research program of the Andijan branch of the Republican Scientific Center for Emergency Medical Care on the provision of medical care during mass admission of victims in emergency situations. Experimental studies consisted of 2 stages and included: the first - ultrastructural (electron microscopic) study of gunshot wounds of the arms and legs in cases with and without lymphotropic therapy; the second - study of the pharmacokinetics of the antibacterial drug in the blood, lymph nodes and soft tissues using lymphotropic antibiotic therapy (LTA) and local lymphostimulation (MLS).

In the first series of experiments, a model of gunshot wounds of the limbs was created in 50 rabbits. After a gunshot wound was inflicted on the thigh of a rabbit in the comparison groups, lymphotropic antibiotic therapy with local lymphostimulation was used in the main group, and traditional methods of administering antibiotics were used in the control group. The functional morphology of the walls of the gunshot wound channel was studied using light, scanning (SEM) and transmission electron microscopy (TEM). The results obtained showed that there were no significant differences in the healing process of wounds in the control and main groups in the initial periods. Significant differences noted in SEM, TEM and light microscopy began to appear from the 3rd day. In the group receiving lymphotropic therapy, a significant resorption of necrotic muscles was observed in the area of commosis. In the main group, in addition to the expansion of lymphatic capillaries, signs indicating an increase in transport processes through the wall of lymphatic capillaries were also detected under electron microscopy at an earlier time point than in the control group. This is a structural manifestation of the stimulation of lymphatic drainage under the influence of lymphotherapy. As a result, edema is eliminated early and the regeneration process is accelerated.

Our morphological studies have shown that the zone of molecular oscillation (commotio) plays a significant role in the course of the wound process. The accumulation of edema and microbes and dysmetabolism products in this area significantly aggravates the course of the wound process, while necrosis, lymphangitis and lymphadenitis, as well as severe purulent-septic complications can develop in this area. Violation of microcirculation and lymphostasis in this area prevents antibiotics from reaching this area and sufficient immunological control of regeneration processes. All this requires the use of methods that stimulate lymphatic drainage and deliver antibiotics to the lymphatic flow - the place where the infection most often accumulates and spreads.

In the second series of experiments, the pharmacokinetics of gentamicin by lymphotropic and conventional methods were studied in 30 rabbits with experimental gunshot wounds to the limbs. Pharmacokinetic analysis showed that the lymphotropic method of administration of gentamicin provides a stable and prolonged amount of the drug in the blood, lymph nodes and soft tissues of the gunshot wound compared to conventional methods of administration. As a result of the conducted experimental studies, it was found that a single lymphotropic administration of gentamicin at an average therapeutic dose provides subtherapeutic concentrations of the antibiotic in the blood for 24 hours. This allows for the use of average therapeutic doses of the drug in lymphotropic antibiotic therapy of gunshot wounds of the limbs once a day.

Experimental studies have provided the basis for the clinical application of regional lymphatic therapy.

We observed 169 wounded with various injuries of the limbs and their bacterial complications. By the method of random distribution, the patients were divided into two groups: the main group - 107 wounded, who were treated with lymphatic antibiotic therapy with regional lymphostimulation, and the control group - 62 wounded, who were treated traditionally. The patients under observation were divided into 4 subgroups.

Patients with gunshot wounds of the soft tissues of the limbs (59) formed the first group, 40 of whom were included in the main group and 19 in the control group.

We carefully examined the wound of all the wounded brought to the clinic and cut it along the entire canal. Pieces of clothing, foreign bodies, bone fragments not connected with the periosteum were removed. Taking into account the anatomical and topographic features of the injured area, necrotic tissues were radically cut. All pockets that appeared as a result of secondary deviation were opened. During the operation, hemostasis was achieved. In the postoperative period, the wound was washed with antiseptic solutions through the installed perforating drains. A wide fasciotomy was performed for decompression as a mandatory procedure. If extensive soft tissue crushing was not observed, the wound was completely sutured. In case of extensive crushing, the wound was treated open. During dressing, 1% dioxidine solution and levomycol were used. After wound debridement, primary delayed sutures were applied or skin grafting was performed using local tissues and a free skin layer. Wound closure was performed 4-7 days after surgery. Immobilization with a plaster splint was performed at the end of the operation.

The main group was treated with lymphatic antibiotic therapy using 1000 mg of cefazolin once a day and regional lymphostimulation. When the patients were admitted, the inflammatory reaction was moderate, which was confirmed by cytological data - polymorphonuclear neutrophils, lymphocytes, a small number of macrophages and eosinophils were detected. However, over the next two days, the inflammatory reaction intensified in patients from both groups, which was manifested by an increase in the number of neutrophils. On the 5th day of complex treatment of patients from the main group, the number of neutrophils decreased, the macrophage reaction intensified, fibroblasts appeared, while in the control group, signs of inflammation remained on cytograms. Quantitatively, the cytological picture in patients from the main group was as follows - neutrophils 66.4 ± 0.6; macrophages 14.7 ± 0.3; fibroblasts 9.4 ± 0.5, in the control group,

respectively, 63.3 ± 0.3; 13.1 ± 0.7; 9.2±0.9; ($p<0.01$). In patients with open wound treatment, the wound acidity level at the time of admission to the hospital was 6.4±1.2. After the use of complex treatment using lymphatic antibiotic therapy and regional lymphostimulation, the pH index (7.5±1.0) normalized or shifted towards alkalization. Also, the method we proposed allowed for the application of primary sutures, which we performed in 33 wounded patients and achieved complete healing of wounds without complications, reducing the duration of the wounded's stay in the hospital to 6-7 days. Outpatient rehabilitation of the victims in the main group was reduced to 3-4 days, while in the control group such results were achieved after 21-23 days ($p<0.01$).

Some of the wounded in the main group (3) had significant soft tissue defects. On days 4-5, primary-delayed sutures were applied, and five underwent autodermoplasty. In the main group, complete wound healing was observed 15-16 days after injury, while in the control group this occurred only after 20-23 days.

Wound suppuration was observed only in one patient (2.5%) in the main group. He was sutured with secondary sutures and as a result, complete healing occurred. Complications in the form of suppuration were observed in two patients (10.5%) in the control group.

The above indicators show that in the main group, treatment was 2.5 times faster. This allows to reduce the length of stay in the hospital, and complications in the form of suppuration are reduced by 4 times. All this objectively proves the advantage of the pathogenetically based method of treatment of gunshot wounds of soft tissues proposed by us. This method allows to eliminate the cause of secondary necrosis around the wound associated with lymphostasis and edema of this area. The use of LTA with RLS contributes to the disappearance of edema and historeanimation of the molecular oscillation zone, and also has an effective effect on all links of the wound process.

For osteosynthesis of bones in gunshot wounds of the limbs, external fixation devices were often used, which allowed to stabilize any fracture. The frequent complications that occur in gunshot fractures after the use of primary

extramedullary osteosynthesis make this method of bone fixation very cautious. Unfortunately, this method can lead to impaired blood supply to the cortical layer under the plate. As a result, osteoporosis, sequestration may occur, and fracture union is delayed. When fixing gunshot fractures, we used incomplete contact AO plates. The grooves in them allow to preserve the blood supply to the bone and give the implanted plates greater flexibility.

Gunshot fractures without major injuries, tissue crushing and soft tissue defects constituted the second group (31 wounded). They were divided into the main (16 patients) and control (15) groups. The treatment method consisted of primary extramedullary osteosynthesis, which was applied to 16 patients in the main group, six of whom underwent bone autoplasty in parallel. Foreign bodies, clothing fragments, bone fragments not connected to the periosteum resulting from gunshot fractures were removed during primary surgical treatment under general anesthesia. Necrotic soft tissues were carefully radically excised, taking into account anatomical and topographic features. After repositioning the bone fragments with AO plates, subluxation osteosynthesis was performed.

Gunshot wounds are characterized by the formation of multiple small fractures, which leads to extensive trauma and bone diastasis. To eliminate them, bone autoplasty and extramedullary osteosynthesis were performed. The autograft was adjusted to the size and shape of the bone diastasis. The gunshot wound defect was then sutured, and if necessary, it was closed by local tissue mobilization and transplantation. Lymphotropic antibiotic therapy was administered once a day, depending on the severity of the disease, with regional lymphostimulation.

At the same time, the drain was washed with 0.9% saline with the addition of 1% dioxidine. Complex treatment of the main group of patients with primary extramedullary osteosynthesis and lymphotropic therapy reduced perifocal edema and pain syndrome by day 2. The fluid released from the drain was hemorrhagic in nature. The drain was removed on the 6-7th postoperative day. In cytological examination, neutrophils released from the drain increased by day 3 in both groups, but after the use of complex therapy, neutrophils in the main group of

patients tended to decrease by day 5 (63±0.7), an increase in macrophages (15.2±0.4), and the appearance of fibroblasts (11.2±0.9) in cytograms were noted. In the control group, neutrophil counts remained high (78.3±0.7), while macrophages (8.3±0.3) and fibroblasts (1.3±0.9) remained low.

Wound healing with primary closure was observed in 15 patients. The duration of treatment in the inpatient setting was 8.2 ± 0.9 days, while in the control group this figure was 21.8 ± 1.2 days ($p<0.001$). Two patients in the main group developed complications: in one patient (6.2%), the purulent-inflammatory process was limited to soft tissues, in the second (6.2%) osteomyelitis was observed, for which necrosequestrectomy was performed with removal of the metal structure and fixation of bone fragments using the Ilizarov apparatus. In the main group of patients, the functions of the damaged limbs were fully restored.

Postoperative complications were more pronounced in the control group: postoperative wound suppuration was observed in three patients (20%), and osteomyelitis in two patients (13.3%).

The above-mentioned points to the advantage of lymphotropic antibiotic therapy and regional lymphostimulation in the complex treatment of gunshot wounds. This method is based on the pathogenesis of this pathology, as a result of which the duration of treatment in inpatient and outpatient settings was significantly reduced, and early restoration of the functions of the injured limbs was observed.

In the third group, which had a gunshot wound fracture, extra-focal osteosynthesis was used depending on the extent of soft tissue damage and defect. Patients were divided into the main (26) and control (16) groups.

After primary surgical treatment and wound drainage, osteosynthesis with an external fixation device was performed in the control group of patients. Then, infusion treatment was performed, the wound was washed with antiseptic solutions, antibiotics were administered in the usual way, ointments and antiseptics were used during dressing. Patients in the main group underwent extra-focal osteosynthesis, four of whom (15.4%) underwent bone autoplasty in parallel. In the

postoperative period, lymphotropic antibiotic therapy with regional lymphostimulation was performed.

Primary surgical treatment, repositioning of fragments and osteosynthesis with external fixation devices were performed under general anesthesia or sedation, spinal anesthesia. If a bone defect was detected, bone autoplasty was performed after 3-4 weeks.

Thus, in the main group, which underwent extra-focal osteosynthesis in combination with lymphotropic antibiotic therapy and regional lymphostimulation, perifocal edema and pain syndrome decreased within 2-3 days. The nature of the discharge was serous-hemorrhagic, and in the patients of the main group, wound closure was planned on the 5-6th day after complex treatment, taking into account the positive course of the wound process. Cytological data in patients of the main group showed an increase in macrophage reaction and the presence of fibroblasts, a legitimate decrease in neutrophils. A significant decrease in neutrophils was noted on the 9th day, while in patients of the control group, cytological indicators of the inflammatory process remained high.

Comprehensive treatment of the main group of patients allowed to normalize the pH-metric indicators of the wound contents much earlier than in the control group.

This allowed us to apply primary-delayed sutures to six (23%) patients in the main group on the fifth day. In all of them, the wounds healed without complications, which reduced the duration of hospital stay to 11 days and the duration of outpatient rehabilitation to 5 days. The wounds completely healed in 16.5±0.6 days, compared to 24.9±1.9 days in the control group ($p<0.05$).

Local tissue grafting was performed in eight patients (30.8%), and autodermoplasty with free-disintegrating clot was performed in twelve patients (46.2%). The method used allowed us to reduce the duration of wound closure from 5-6 days and hospital stay to 12-13 days, and outpatient rehabilitation to 5 days.

Soft tissue inflammation was noted in two patients (7.7%), and one patient (3.8%) had the device re-compacted due to complications such as osteomyelitis. In the control group, soft tissue suppuration was observed in three (18.5%) patients and osteomyelitis in two (12.5%) patients.

Bone fractures from a bullet can lead to disruption of the functioning of vital organs of the body and multiple organ failure due to the increased inflammatory process. This is due to the specific features of the pathomorphological process, bacterial invasion and endogenous intoxication. Therefore, the approach to effectively solving these problems should be comprehensive and include direct impact on the wound, destruction of bacterial flora, restoration of disturbed homeostasis.

Purulent-septic complications formed a separate group, and under our observation there were 37 wounded with various purulent-septic complications of gunshot wounds of the limbs.

Bacterial complications of gunshot wounds were of a different nature. Signs of purulent-resorptive fever were observed in five patients (13.5%), sepsis in four (10.8%), and in most patients (n-28, 75.7%), the purulent-necrotic process was local in nature. An increase in temperature was observed in 13.5% of patients due to clearly expressed purulent foci. Fever persisted for seven days after the opening of the abscess and necrotectomy, was undulating and intermittent in nature. At the same time, the blood remained sterile. In patients with sepsis, the disease was severe (10.8%), high temperature, impaired functional activity of some systems were noted, and even despite active treatment, it worsened.

Of the twenty-eight (75.7%) patients with local purulent-necrotic changes, eight (28.6%) had a putrefactive infection characterized by a sharp fetid odor. The main etiological factor was Escherichia coli, fusobacteria, and proteus. Depression and drowsiness were noted in 7 patients. The bottom of the wound was covered with a gray, dry, dirty-brown coating. Foul-smelling discharge from the wound was often abundant, and sometimes in small quantities in the area of the wound with gas bubbles. Body temperature indicators remained within 37.5-39 ° C. Pain

syndrome was not expressed. In 13 patients, the primary surgical treatment of the wound was not radical, and in 10 it was not carried out at all, where the injured were only cut off the skin and applied primary sutures (AFRSEMP subbranches).

Unstable osteosynthesis was identified in five (13.5%) patients and incomplete surgical intervention to eliminate complications was identified in nine (24.4%) patients.

The 25 wounded included in the main group were given complete correction of impaired body functions, restoration of normal homeostasis indicators, and adequate and careful excision of necrotic tissues during surgical treatment. An external fixation device was used for fractures, repeated reconstructive surgery was performed if necessary, and microflora was combated. In addition, replacement infusion therapy was mandatory to eliminate water-salt and protein metabolism, acid-base balance, anemia, dehydration, and vitamin saturation. All wounded in the main group were given LTA and RLS. After sensitivity testing, the broad-spectrum antibiotic ceftriaxone was used.

The control group consisted of 12 patients with similar complications, but with the same complex therapy as in the main group, using traditional methods of administration of ceftriaxone.

The day after the use of LTA with RLS, the general condition of 41.7% of patients improved, weakness, adynamia and signs of intoxication disappeared. Respiratory rate decreased from 25.8 ± 0.1 to 21.3 ± 0.3 per minute ($p<0.05$). Lymphotropic treatment with RLS normalized peripheral blood parameters, increased the number of lymphocytes and reduced leukocytes.

The activity of detoxification systems normalized. This was evident in the positive change in liver and kidney function indicators, namely, the total protein content increased, the increased bilirubin and residual nitrogen content decreased. Lymphotropic treatment also stimulated the immune system, which was manifested in an increase in the level of immunoglobulins M and G. In the control group, these indicators were much lower. The result of lymphotropic antibiotic treatment with RLS was also reflected in cytograms. Already on the 2nd-3rd day of

treatment, the cytograms switched from the necrotic type to the inflammatory type, which corresponds to the initial stage of the recovery period. The pus liquefied, which accelerated its outflow, and the surrounding edema decreased. Dense necrotic tissues softened and softened, as a result of which they could be easily removed during bandaging. In patients in the control group, the opposite situation was observed: the edema around the wound sometimes remained, the necrotic tissues tightly adhered to the wound bed and did not move.

In the main group, the pH of the wound contents shifted to the alkaline side and stabilized on days 3-5. During the same period, pinkish watery granulations appeared, which later spread to a large part of the wound. As a result of lymphotropic antibiotic treatment with RLS, the wounds healed by days 5-6, and in some cases, autodermoplasty was performed. In the control group, during the same period, dirty-gray exudate was observed, wound cleansing and granulations appeared on days 6-7. The wound bed remained deep, and healing occurred only on days 27-28. In the main group patients, the cytological picture on days 5-6 was characterized by a small number of changed neutrophils (14.1 ± 1.9). They were often in a state of phagocytosis, macrophages, immature mononuclear cells and a small number of fibroblasts were also observed. The amount of microflora, fibrin fibers and detritus was average. Signs of a positive prognosis of the course of the disease appeared from the seventh day: the number of immature mononuclear elements and macrophages increased sharply. All this was not observed in patients in the control group. An increase in young and mature fibroblasts was also noted. A similar positive trend was observed on days 9-12: mature elements of the fibroblastic line increased, and microflora disappeared. All this proves the advantage of complex treatment of bacterial complications using lymphotropic therapy with local lymphostimulation.

Bacteriological analysis showed that in the wound composition, st. aureus (golden staphylococcus) prevailed. It caused purulent inflammation both singly and associatively (51.7%). Also, pseudomonas aeruginosa (blue staphylococcus 16.2%), B. fragilis (bacteroids fragilis) and E. coli (Escherichia coli) were detected

in 9.6%. As a result of determining the sensitivity to antibiotics, it turned out that ceftriaxone was the most effective. From 107 to 109 different microorganisms grew in 1 gram of wound tissue. Surgical treatment and LTA with RLS reduced this indicator to 103 - 105 by 5-6 days and showed the dynamics of a decrease to 103. In the control group, this process occurred by 17-18 days. In the main group of wounded, the wounds were cleared of purulent-necrotic masses on the 6th day, granulation appeared, and after 18.7 ± 1.2 days the wound completely healed. On the 6th-7th day, 18 wounded who were in the hospital were given primary-delayed sutures, and four underwent free autodermoplasty with partially folded skin. All patients recovered without complications. A significant improvement in limb function was observed in 20 victims. The severity of the injury had a negative effect, and in 4 wounded, the movement in the limbs was not fully restored functionally. Later, 2 patients underwent repeated operations. After bone autoplasty and extramedullary osteosynthesis, positive results were noted in four wounded. This indicates that the use of lymphotropic antibiotic therapy with RLS in the treatment of bacterial complications of gunshot wounds of the limbs is pathogenetically justified. The pathogenesis of the effect of LTA with RLS is based, first of all, on the fact that when the antibiotic is administered lymphotropically due to the flow of lymph through the lymphatic vessels, it slowly penetrates the area of the gunshot wound and remains in this area for a long time. RLS promotes the complete penetration of the antibiotic into the lymphatic system, eliminates edema in the gunshot wound, improves lymph flow, and thereby accelerates recovery processes. LTA with RLS affects the main links in the pathogenesis of gunshot wounds and is an effective method in the complex treatment of gunshot wounds and their bacterial complications.

The use of LTA and RLS in the complex treatment of soft tissues in gunshot wounds in most cases allowed the imposition of primary sutures in 33 (82.5%) victims, in the presence of soft tissue defects, primary-delayed sutures were applied to 4 (10%) wounded on 4-5 days, and wounds were closed with free partially folded skin in 3 (7.5%) wounded. Complete wound healing was observed

in the main group in 15.2 ± 1.1 days, and in the control group - in 21.7 ± 2.3 days ($r < 0.01$).

An analysis of the results of the treatment of fractures resulting from gunshot wounds showed that an integrated approach using lymphotropic antibiotic therapy with extramedullary osteosynthesis and local lymphostimulation significantly reduces the duration of patients' hospital stay.

In the main group, the use of a comprehensive treatment method for bone fractures with significant soft tissue damage allowed 8 (30.7%) of the injured to apply early sutures to the wound, 8 (30.7%) to close the wound using local tissue displacement, and 10 (38.6%) to perform autodermoplasty. This reduced the treatment period by 9.4 ± 1.3 ($r < 0.01$) days compared to the control group and reduced the incidence of inflammation in soft tissues by 2 times.

The use of RLS and LTA in combination with surgical treatment of wounds reduced the exudative inflammatory phase, the activation and proliferation of fibroblastic and macrophage cell elements, and shifted the pH to the alkaline side. A significant decrease in bilirubin and residual nitrogen, an increase in the total protein content in the blood, increased the production of T and V lymphocytes, and increased the level of immunoglobulins M and G were noted.

The use of lymphotropic antibiotic therapy with local lymphostimulation in patients with purulent-infectious complications made it possible to significantly reduce the total number of microorganisms in 1 g of tissue from 107 to 103. Wound cleansing and the appearance of granulation occurred much earlier, and the pH-metric indicators of the wound exudate stabilized.

The developed and applied method of lymphotropic antibiotic therapy with local lymphostimulation in the complex treatment of gunshot wounds of the limbs, in combination with surgical treatment of the wound, extramedullary and extra-focal osteosynthesis, is pathogenetically based and highly effective. This is objectively confirmed by morphological, microbiological studies, wound pH-metry indicators and the clinical picture of the disease. Wound healing and restoration of functional activity are accelerated by 1.5-2 times.

In recent years, the number of military operations in cities has increased, and the number of wounded, both among military personnel and civilians, has increased. For the first time in the world, efforts are being made to systematize the provision of medical care to the wounded in new conditions. The most important direction of this reorganization is the possibility of providing specialized care as close as possible to the battlefield.

Specialists of the RSHTYOIM branches have high professional training, taking into account the activities in emergency situations, and the "ambulance" units and medical aviation and emergency brigades attached to them are constantly on standby, which makes these units a priority in emergency situations.

The main goal is to reduce the time required to provide specialized care to the wounded as much as possible in order to prevent the development of various complications.

The specific features of the treatment of firearm injuries in peacetime, in our opinion, are as follows:

3. The ability to perform first aid, anti-shock and resuscitation measures early.

4. Accelerate specialized care and perform early reconstructive surgeries.

The timing of specialized care for the injured largely determines the success of treatment. Within 1 hour, 79% of patients were delivered to the hospital, within 2 hours - 15%, after 3-4 hours - 6%. Anti-shock, resuscitation measures, immobilization of limbs, antibacterial therapy were started at the pre-hospital stage, which significantly influenced the development of purulent-septic complications. Early provision of specialized care associated with the restoration of damaged blood vessels, nerves and bone fragments made it possible to fully and adequately preserve the lost functions of the limbs.

First aid is provided directly at the scene of the emergency.

Ambulances and medical aviation were mobilized under the leadership of a general practitioner to provide first aid and evacuate the wounded.

The use of the "103" ambulance service and medical aviation vehicles to evacuate the wounded and quickly deliver them to medical institutions (Andijan branch and subbranches of the RSHTYOIM) for qualified and specialized assistance allowed for the full preparation of the wounded in the pre-hospital period, thereby significantly improving the quality of medical care.

In addition, the experience of the events has shown that the use of specialists with basic training in surgery and anesthesiology and intensive care in ambulances and medical aviation has been effective and appropriate, especially in providing medical care to the seriously wounded.

A retrospective analysis of the events in Andijan in May 2005 shows that 70 percent of the wounded received first aid. First aid was provided, as far as possible, by the wounded themselves, bystanders, and emergency personnel.

The events in Andijan on May 13, 2005, exposed the lack of simple and accessible means of immobilization in first aid. Although assistance was provided to most of the wounded, there was a shortage of narcotics for pain relief, as the methods of storing, dispensing, and reporting them posed major problems in emergency situations.

The desire to quickly transport victims from the scene to the stage of specialized treatment (May 13, 2005) has reduced the importance of the pre-medical stage. This is also explained by the participation of ambulance doctors in the provision of first aid measures. During the terrorist act, 37 victims were provided with medical care in sub-branches, 36.8% of whom received qualified medical care. Emergency operations accounted for 23.9%, urgent operations for 19.1%, and delayed qualified medical care for 57%. Primary medical care was provided to 63.2% of the wounded. Surgical intervention consisted of primary surgical treatment of soft tissue injuries (66.5%), drainage of the pleural cavity (9.5%), and amputation of limbs (4.8%). One wounded person died after laparotomy due to a combined abdominal puncture wound. 15.3% of the injured were provided with qualified resuscitation care.

The main feature of the sub-branches of the Andijan branch of the RSHTYOIM is that most seriously wounded, if necessary, are transferred to the regional emergency medical center in a timely manner within the first two hours after the provision of qualified assistance. Due to this, the number of operations is reduced, and the main part of the operations is surgical treatment of gunshot wounds. The above-mentioned group of patients with purulent-septic complications belonged to this category of wounded.

Therefore, at the current stage, the main task of the sub-branches is to provide qualified surgical care based on the principle of "damage control". This primarily includes stopping bleeding in case of temporary or small vessel damage, anti-shock treatment, immobilization of the injured limb, and safe evacuation of the victim for specialized surgical care.

Thus, during the events that took place in Andijan on May 13, 2005, the main task of the sub-branches was to fully prepare for evacuation using the capabilities of medical aviation and quickly deliver the wounded to the regional branch. Surgical interventions in sub-branches should be aimed solely at saving the lives of the victims, based on the developed instructions and taking into account the technical characteristics. The main goal is to carry out timely surgical intervention ("damage control") with minimal complications.

Specialized medical care for the injured in the regional branch was provided by stopping bleeding completely, applying vascular sutures, providing thorough and adequate surgical treatment of wounds, using microsurgical techniques to restore damaged structures of the limbs, early osteosynthesis and plastic surgery. We also include the use of lymphatic therapy methods in specialized medical care due to the high pathogenetic basis of this method. This method can be very effective even in the initial stages of evacuation, since it is easy to implement and does not require special equipment and application skills.

CONCLUSIONS

1. According to the results of electron microscopic studies, experimental gunshot wounds of soft tissues are characterized by severe damage to muscle and collagen structures, microcirculatory disorders, inflammation, dystrophic and necrotic processes, lymphostasis, as well as the presence of an extensive zone of molecular shaking (parabiosis).

2. When RLAT and RLS were used in animals with infected soft tissue gunshot wounds, a faster reduction in signs of inflammation and edema was observed by stimulating lymphatic drainage of tissues, restoring microcirculation, and cleaning the wound from detritus and colonies of microorganisms. This is an important measure to prevent necrobiosis in the zone of molecular shock. Acceleration of granulation and shortening of healing times were also noted.

3. Based on the conducted clinical studies and the results obtained, a comprehensive approach to the treatment of gunshot wounds of the limbs is recommended. This approach takes into account the time factor, the nature of the gunshot wound, the extent of soft tissue damage, the involvement of bone structures and blood vessels. Wound closure by primary sutures is carried out only when there is the possibility of regular observation of the wound condition in a hospital.

4. In case of gunshot wounds of the soft tissues of the limbs, the wound is treated with a full surgical procedure, which ends with primary suturing and fluid drainage. In the postoperative period, lymphotropic therapy with local lymphostimulation is performed once a day for 5-7 days. In case of extensive soft tissue lesions, autodermoplasty is recommended on the 5-6th day.

5. In fractures of the limbs, in the presence of small soft tissue defects, adequate surgical treatment of the gunshot wound is performed and primary extramedullary osteosynthesis is performed using LTA and RLS. If there is a bone tissue defect, early bone autoplasty may be indicated.

6. In cases of fractures of the limbs with significant soft tissue damage and defects, it is recommended to perform external osteosynthesis using LTA and RLS

after primary surgical treatment. After adequate cleaning and preparation of the wound, skin grafting or autodermoplasty using local tissues is performed. If necessary, bone autografting is performed after 4 weeks according to indications.

7. In the event of purulent-septic complications in gunshot wounds of the limbs, correction of homeostasis and hemodynamic disorders, surgical debridement of the purulent focus, application of external fixators in bone fractures, and lymphotropic antibiotic therapy with regional lymph stimulation are mandatory.

8. Lymphotropic antibiotic therapy ensures a higher and longer-lasting maintenance of therapeutic concentrations of antibiotics in the blood ($P<0.05$), lymph nodes and soft tissues of gunshot wounds ($P<0.005$) compared to traditional methods of administration, while reducing the daily dose of drugs used and the number of injections by 2 or more times.

9. The use of lymphotropic therapy in combination with early specialized medical care for gunshot wounds of the soft tissues of the arms and legs helped to reduce wound suppuration to 2.5% compared to 10.5% in the control group. When using extramedullary osteosynthesis for gunshot fractures of bones, wound suppuration was observed in 6.2% in the main group, in the comparison group - 20%, osteomyelitis in 6.2% and 13.3% ($R<0.005$), respectively, with external osteosynthesis, wound suppuration was observed in 7.7% and 18.5% ($p<0.001$), osteomyelitis in 3.8% and 12.5% ($p<0.001$), respectively.

10. The developed principles of providing assistance for gunshot wounds of the limbs during the evacuation stages made it possible to determine the rational volume of assistance: in sub-branches (primary surgical treatment, stopping external bleeding, immobilization, anti-shock measures) only minimal interventions aimed at saving the lives of the victims (damage control), followed by evacuation to the regional branch of the Republican Scientific Center for Emergency Medical Care and provision of early specialized medical care.

11. The development of standards and protocols for emergency medical care in the mass admission of those wounded with gunshot wounds, as well as the

preparation of medical administration and civilian doctors to work in conditions of terrorist attacks and local armed conflicts, is one of the important tasks of modern healthcare.

PRACTICAL RECOMMENDATIONS

1. Based on the conducted clinical studies and the results obtained, a comprehensive approach to the treatment of gunshot wounds of the limbs is recommended. This approach takes into account the nature of the gunshot wound,

its width and the presence of soft tissue defects. Wound closure by primary sutures is carried out in the hospital, provided that there is an opportunity for dynamic monitoring of the wound condition.

2. In cases of gunshot wounds to the soft tissues of the limbs, the wound is fully surgically treated, followed by primary sutures and fluid drainage. In the postoperative period, LTA with RLS is performed once a day for 5-7 days. In cases of extensive soft tissue damage, autodermoplasty is recommended on the 5-6th day.

3. In cases of fractures of the limbs and minor soft tissue defects, appropriate surgical treatment of the gunshot wound is performed, with primary extramedullary osteosynthesis, followed by LTA and RLS. In cases of bone tissue defects, early bone autoplasty may be indicated.

4. In cases of fractures of the limbs with significant soft tissue damage and defects, after primary surgical treatment, external osteosynthesis using LTA and RLS is recommended. After sufficient wound cleansing and preparation, skin grafting or autodermoplasty using local tissues is performed. If necessary, bone autografting is performed after 4 weeks according to indications.

5. In the event of purulent-septic complications in gunshot wounds of the limbs, correction of homeostasis and hemodynamic disorders, surgical debridement of the purulent focus, application of external fixation in bone fractures, and the use of LTA with RLS are mandatory.

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