

## TACTICS OF SURGICAL TREATMENT OF INJURIES OF THE ARTERIES OF THE EXTREMITIES IN CONCOMITANT INJURIES



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### ҚЎШМА ЖАРОҲАТЛАРДА ҚЎЛ-ОЁҚ АРТЕРИЯЛАРИ ШИКАСТЛАНИШЛАРИНИ ЖАРРОҲЛИК ДАВОЛАШ ТАКТИКАСИ

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### ТАКТИКА ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ ПОВРЕЖДЕНИЙ АРТЕРИЙ КОНЕЧНОСТЕЙ ПРИ СОЧЕТАННЫХ ТРАВМАХ

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**Резюме.** Долзарблиги. Бугунги кунда қон-томир жарроҳлигида артериялар жароҳатланишини таххислаши ва даволаши долзарб муаммолардан биридир.. Мақсад: Қўл-оёқ қўшма жароҳатида таххислаши ва даволаши тактикасини оптимизациялаши йўли орқали периферик артериялар жароҳатлари билан ҳаста бўлган беморларни даволаши натижаларини яхшилаши. Материал ва услублар. 2020-2022 йиллардаги 56 қўшма жароҳат билан мурожат қилган ва периферик артериялар жароҳати аниқланган беморлар анализ қилинди. Диагностика ва даволаши натижаларига таъсир этишида беморнинг жароҳат олгандан мурожат қилишгача бўлган вақт, жароҳатнинг генези, компенсатор механизмларнинг ва кўрсатилган ёрдамнинг ўрни ўрганилди. Хулоса. Ижобий натижаларнинг асосида ўз вақтида ва тезкор равишда жароҳатланган артериал қон-томирларнинг магистрал қон оқимини тиклаш шошилинч ангиохирургик ёрдамнинг асосий устуворлиги аниқланди.

**Калит сўзлар:** қўл-оёқ артериялари жароҳатланиши; артериялар қўшма жароҳати.

**Abstract.** Relevance. Diagnosis and treatment of patients with arterial injury is one of the urgent tasks of modern vascular surgery. Purpose of the research: To improve the results of treatment of patients with peripheral arterial injuries with associated limb injuries, by optimizing the diagnosis and treatment tactics. Material and methods. The analysis of the results of diagnosis and treatment of 56 patients with damage to peripheral arteries with combined injuries for the period from 2020 to 2022 was carried out. The influence on the results of diagnosis and treatment of the time interval between injury and admission to the hospital, the genesis of the injury, the role of compensatory mechanisms and the assistance provided were studied. Conclusions. Timely and rapid restoration of the main blood flow in case of combined osteovascular injuries is the main priority of emergency angiosurgical care.

**Key words:** damage to the arteries of the extremities; associated arterial injury.

**Introduction.** Diagnosis and treatment of patients with arterial injury is one of the urgent tasks of modern vascular surgery. In the structure of all injuries, according to various authors, they range from 2% to 11% [1]. Recently, road traffic, domestic, industrial injuries in terms of disability and mortality ranks second, second only to cardiovascular diseases. Until now, the overall mortality in vascular injury remains high (18%), reaching 62% with damage to large vessels of the chest and abdominal cavity, 35% - with combined injuries, 20.5% - with injuries of neck vessels. About 5% of victims of peacetime die with trauma to the vessels of the extremities. The frequency of limb amputations in case

of vascular injuries is 8% [2]. Diagnosis of vascular injury and assistance to the victim is an emergency as a rule, so any mistake in this pathology can be fatal. The success of treatment depends on the speed of specialized surgical care. One of the complex and urgent problems of vascular surgery is iatrogenic damage to blood vessels. This circumstance is dictated by the fact that the current trend towards increased surgical activity in all branches of surgery entails a number of errors by doctors, in particular, unintentional damage to arterial and venous vessels [4]. The importance of the problem of diagnosing and treating arterial injury lies in the fact that vascular damage in the late post-traumatic period is

complicated by repeated massive bleeding, infection of the wound, all this can occur against the background of damage to other organs and tissues, which aggravates the general condition of the patient [5]. Prolonged bleeding with damage to even small branches leads to massive blood loss. Severe concomitant injury, which worsens the general condition of the patient, increases the incidence of complications and lethality [6].

**Purpose of the research.** Improving the results of treatment of patients with peripheral arterial injuries with associated limb injuries by optimizing the diagnosis and treatment tactics.

**Materials and methods.** For the period from 2020 to 2022, 56 patients with combined injuries of peripheral arteries underwent various types of reconstructive surgery. There were 36 (64%) men and 20 (36%) women. Age ranged from 5 to 78 years. Among the total number of admitted patients, 32 were under the age of 45, which accounted for 57%. When analyzing the timing of admission, it was found that 34 (60%) of the victims applied within 6 hours from the moment of injury. In the time interval from 6 to 12 hours after the injury, 11 (19%) victims were hospitalized. 8 (14%) patients applied within 24 hours. 3 (5%) patients were admitted from remote regions of the republic in the winter period of the year within more than 24 hours. Among the etiological factors of damage, the leading place was occupied by sharp objects, i.e. 28 (50%) patients were admitted with incised and lacerated wounds. These victims had a combined injury at the level of the shoulder, forearm, thigh and lower leg. The combination of bone fracture with damage to the neurovascular bundle and tendons occurred in 22 (37%) patients. A transcondylar fracture was observed in 17 (30%) patients, and dislocations in 5 (9%) patients. Gunshot wounds of the upper or lower extremities with bone fractures, injuries of the neurovascular bundle and tendon-muscular apparatus, extensive crushing of the soft tissues of the limb, as an etiological factor, occurred in 6 (11%) patients. Among 28 (50%) patients with incised wounds, in 9 (16%) cases, the cause of the injury was electric machines. At the same time, the wounds in the victims were multiple and were located on the anterior surface of the forearm (14%) and lower leg (1.7%). In a state of shock of varying severity, 27 (48%) patients were admitted; among this number, severe shock occurred in patients with gunshot wounds (10%) and patients who were injured by electric machines (16%). The algorithm for examining patients included: examination of the injured limb, assessment of the degree of circulatory disorders, ultrasound duplex scanning of blood vessels (USDS), radiography of the bones of the lower extremities, as well as consultation of related specialists. In difficult situations, to assess the degree of vascular damage in multiple bone fractures and significant edema, 6 (11%) patients underwent X-ray contrast angiography (due to severe edema covering the limb, in order to determine the level of vascular damage and choose treatment tactics). When

studying the degree of circulatory disorders in the injured limb, it was found that in 38 (68%) cases, it remained compensated. These were patients with incised wounds and fractures. Subcompensated nature of the blood circulation of the limb occurred in 12 (21%) patients. In 6 (11%) patients, decompensation of the blood circulation of the extremities was noted, which was associated with the extent of the damage and the violation of all components of the blood circulation of the limb. Estimation of ischemia according to the classification of V.S. Saveliev was not possible due to the given damage to the bones, muscles and nerves in patients.

**Results and its discussion.** The complexity of diagnosis in associated injuries is associated with the absence of obvious signs of vascular damage (external bleeding, large hematoma, and signs of tissue ischemia), which was caused by significant tissue edema and covering the defect on the vessel wall. Therapeutic tactics for osteovascular damage to the limbs was aimed at saving the life and limb of the patient, given the high probability of the possible development of severe shock and fat embolism in such cases. The tactics of surgical treatment in this group of patients consisted in restoring the patency of the main blood flow and eliminating extravasal compression in the first hours of admission. In this case, the restoration of all damaged structures was considered the best option. Circular suture of the artery was performed only in 11 cases, with a wound surface no more than 3 cm. In 13 cases, with a large wound surface, autovenous plasty of the vessel was performed. In case of damage to the bifurcation of the artery, 5 (9%) patients underwent bifurcation bypass grafting with an auto-venous patch. In the 16 (28%) cases of simultaneous damage to several supply arteries of the limb, 9 (16%) cases were sutured and 7 (12%) auto-venous patch plasty was performed. With isolated injuries of one artery out of several, in 13 (23%) cases, it was possible to improve the blood circulation of the limb by applying a circular suture. Indications for performing auto-venous vascular plasty were mainly given to patients in whom vascular damage was noted during bone crushing, tissue crushing and gunshot wounds (Fig. 1, 2). In our observations, in 6 (11%) cases, patients received treatment in non-specialized medical institutions, they underwent interventions on damaged soft tissues: primary surgical debridement (4), ligation of damaged ends of arteries (2). One of these patients underwent ligation of the ulnar artery together with the ulnar nerve. All of these 6 (11%) patients underwent delayed reconstructive surgery. In the long-term period, along with objective data, the ultrasound technique was widely used to study the degree of blood circulation in the limb. 55 (98%) patients were examined. Only in 1 (2%) observation there was thrombosis of the tibial artery, the rest of the vessels were patent. Clinical signs of chronic arterial ischemia during exercise were not detected in any case.



**Fig. 1.** Intraoperative photo. Recovering of a damaged artery by applying an anastomosis of the "end-to-end" type



**Fig. 2.** Intraoperative photo. Recovering of the integrity of the bones of the lower leg by reposition

In the early postoperative period, 6 (11%) operated patients developed complications such as suppuration of the postoperative wound, thrombosis of the operated vessel (n=1; 2%), and bleeding (n=1; 2%). All of these complications were resolved successfully. Only in 1 (2%) case, amputation was performed after the operation. The cause of limb amputation was thrombosis of the operated vessel, more progressive than limb ischemia with the development of necrobiotic changes in tissues. In 1 (2%) patient, a lethal outcome was noted, the cause of which was due to shock and severe blood loss incompatible with life. Consequently, out of all 56 (100%) patients with combined osteovascular injury of the extremities, 54 (96%) patients managed to achieve a positive result, which indicates the correct choice of surgical tactics. Most authors provide convincing data on the high frequency of errors and errors in the provision of first aid to victims with combined bone and vascular injuries. The only way to reduce the level of diagnostic and tactical errors in the provision of specialized care to this category of patients, according to a number of authors, is to increase the level of doctors' knowledge about blood vessel injuries and their consequences, and the widespread use of additional invasive research methods. Therefore, adequate revascularization and restoration of damaged limb structures using various methods of surgical correction of damaged tissues reduce the risk of complications and the incidence of chronic arterial ischemia.

**Conclusions:** 1. Recovering of the main blood flow in case of combined osteovascular injuries is the main priority of emergency angiosurgical care. Only the provision of specialized care using the most complex

surgical interventions for this category of patients guarantees good treatment results. 2. To achieve high clinical efficiency, in our opinion, in all cases with combined osteovascular injuries, care should be provided by a team of vascular surgeons and traumatologists.

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**Резюме.** Актуальность. Диагностика и лечение больных с травмой артерий является одной из актуальных задач современной сосудистой хирургии. Цель исследования: Улучшение результатов лечения больных с повреждениями периферических артерий при сочетанных травмах конечностей, путем оптимизации диагностики и тактики лечения. Материал и методы. Проведен анализ результатов диагностики и лечения 56 больных с повреждением периферических артерий при сочетанных травмах за период с 2020 по 2022 гг. Изучены влияние на результаты диагностики и лечения временный промежуток между травмой и обращением в стационар, генез травмы, роль компенсаторных механизмов и оказанной помощи. Выводы. Своевременное и быстрое восстановление магистрального кровотока при сочетанных костно-сосудистых повреждениях является основным приоритетом экстренной ангиохирургической помощи.

**Ключевые слова:** повреждение артерий конечностей; сочетанные повреждения артерий.