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Short communication

Mistakes in the Organization of Specialized Care for Patients with Traumatic Amputation of Hand Segments

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Abstract

The aim *of the study appears to focus on identifying and analyzing errors or inadequacies within the organization of specialized care for patients who have experienced traumatic amputation of hand segments. The specific goals might include understanding the flaws in the existing care structures, improving patient outcomes, and developing recommendations to enhance the quality of specialized care provided to patients who have suffered hand segment amputations.*

Methods. *2020 to 2022 to the clinic of the National Scientific Center for Surgery named after Syzganov, 165 patients with acute injuries of limb segments were urgently hospitalized to provide specialized surgical care, leading to decompensation of blood circulation in the hand or fingers.*

Results*. Due to incorrect actions in 24 patients, it was not possible to replant the delivered segments (33 segments). These patients underwent stump formation.At the same time, 50-75% still allow diagnostic, technical and tactical errors in the treatment of this category of patients. The possibility of replantation and revascularization, as well as their outcome, largely depended on the timeliness and quality of first aid, compliance with the conditions for preserving the cut-off segment, the speed of transportation and other organizational factors.*

Conclusions. *The use of modern methods of microsurgical restorative interventions with the reconstruction of injured vessels can significantly expand the possibilities of preserving and restoring completely and partially torn segments of the hand and fingers. The improvement of the results of treatment of patients with traumatic amputations and injuries of the neurovascular bundles of limb segments was significantly affected by the provision of timely specialized microsurgical care.*

Keywords*: organization, public health, mistakes, traumatic amputation, hand surgery.*

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Introduction

Cases of disability due to traumatic amputation of segments of the hand reach 30% of the total number of disabled people [1,2]. The introduction of microsurgical methods into clinical practice has significantly expanded the possibilities of organ-preserving treatment tactics, opened up real prospects for reducing the level of disability in this large and socially significant group of patients. At the same time, 50-75% still make diagnostic, technical and tactical errors in the treatment of this category of patients.

According to various authors, disability during the primary referral of patients to the Bureau of Medical and Social Expertise ranges from 19% to 46% among all examined, and the main cause of it is amputation defects of the hand and fingers [3]. In specialized departments of hand surgery, patients with the consequences of injuries account for 40-56%. Significant financial resources are spent on the treatment of such patients and the payment of social benefits. In practice, the high economic efficiency of qualified treatment of the injured has been convincingly shown.

From the foregoing, it follows that many issues related to the surgical rehabilitation of patients with hand injuries remain debatable, the views of a number of authors are sometimes contradictory, modern methods of treatment are not sufficiently linked to traditional ones, and the latter have not yet been fully studied [4].

It should be emphasized that the severity of hand tissue defects, often leading to psycho-emotional disorders, a high percentage of disability of the victims, causing material damage to society, despite the use of a number of reconstructive operations, there is no doubt that it is expedient to develop new and improve existing methods of plastic surgery, clarify indications and contraindications to the use of various types of plasty, development of a method for one-stage surgical treatment of soft tissue defects and bone phalanges of the fingers, one-stage flap plastic of soft tissue defects and reconstruction of functionally important anatomical formations of the hand [3,5].

The aim of the study appears to focus on identifying and analyzing errors or inadequacies within the organization of specialized care for patients who have experienced traumatic amputation of hand segments. The specific goals might include understanding the flaws in the existing care structures, improving patient outcomes, and developing recommendations to enhance the quality of specialized care provided to patients who have suffered hand segment amputations.

Materials and methods

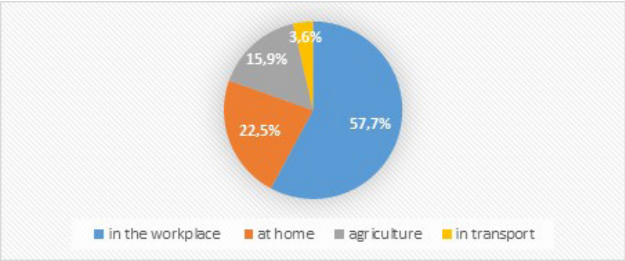
The study was conducted in accordance with the Helsinki Declaration of the World Medical Association on ethical principles for conducting medical research involving human subjects.

2020 to 2022 to the clinic of the National Scientific Center for Surgery named after Syzganov, 165 patients with acute injuries of limb segments were urgently hospitalized to provide specialized surgical care, leading to decompensation of blood circulation in the hand or fingers: complete traumatic amputation - 68, incomplete amputation - 47, traumatic injury to the neurovascular bundles of the hand with circulatory disorders - 50 patients. Male - 142, female - 23 (Table 1).

Table 1 - Frequency and types of amputation

Complete traumatic amputation	Incomplete amputation	Traumatic damage to the neurovascular bundles of the hand with circulatory disorders	Male	Female
68	47	50	142	23

Among those admitted, it should be noted the predominance of young people, of the most able-bodied age (21-50), especially needing labor and social rehabilitation. Of the total, 57.7% of cases were injured at work, 22.5% at home, 15.9% in agriculture and 3.6% in transport (Picture 1).



Picture 1 - Causes and frequency of injuries

Out of 165 patients, 101 (61.2%) patients had the following errors during transportation and preservation of severed segments:

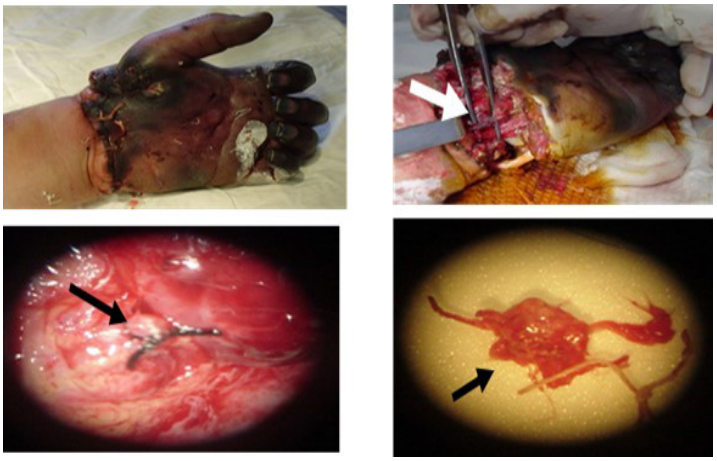
• Unreasonable ligation of neurovascular bundles - 14 (8.5%) cases (Picture 2);

• Direct contact with coolant or use of a large volume of water, which prevents cold anoxia and reduces the period of possible replantation - 3 (1.8%) cases;

• Refusal to cool in non-perfused incompletely dissected segments - 17 (10.3%) cases;

• Late onset of cooling of the severed segment - 9 (5.5%) cases;

• Frostbite of the tissues of the severed segment due to direct contact with ice and snow, transportation in an open form at negative air temperatures, as well as in freezers, etc. – 6 (3.6%) observations;



Picture 2 - Decompensation of blood circulation in the hand. The main arteries are ligated. Ligatures (x8 magnification)

• Long and unreasonable delay in transporting a patient to a specialized department, delivery with subsequent transfer of the patient to non-core hospitals (from 2 to 5 hospitals) - 31 (18.8%) cases;

• Insufficient coordination of the actions of the ambulance team and the microsurgeon of the center: untimely reporting or failure to report on the injury and the timing of delivery of the patient with limb segment detachment - 21 (17.7%) cases.

During amputation with an electric saw, the injury was caused by rapidly rotating teeth of the saw blade, the width of the destroyed tissue in the area of the amputation zone depended on the distance and the size of the saw teeth. 39 (23.63%) patients were hospitalized with this type of injury. The width of the zone of destroyed tissues during amputation from crushing depended on the area of the injuring agent. 40 (24.24%) patients with this type of amputation were delivered. Avulsion amputation was characterized by prolonged damage to soft tissues at a significant extent from the wound surface. Patients with avulsion amputation were admitted 17 people (10.3%). In total, 251 segments were damaged in 165 patients admitted. A high frequency of injuries of the most functionally significant fingers 1 (35.7%) and 2 (28.3%) was noted. Equally often there was a detachment of IV, V fingers. Dissections in the 4th zone occurred in a "block" consisting of several fingers, more often (12.4%) from I, II fingers. Dissection of the block I-V of the fingers was in 1 patient with a tear-off mechanism of injury.

The terms from the moment of injury to the admission of patients to the clinic, depending on the level of damage to the limb, are shown in Table 1 (bold lines indicate the acceptable terms of ischemia of the segments of the hand). This division allowed us to determine the surgical tactics and predict the postoperative period. Taking into account the necessary time for organizing the operation (in the evening and at night it ranged from 1 hour to 3.5 hours), the time to restore blood flow in the severed segment of the limb (2-3 hours), the time for maintaining the viability of muscle tissue (6 hours) we considered late the timing of admission of patients with detachment of a segment of the limb proximal to the 4th zone for more than 4 hours. For macro amputation over 3 hours and for amputation zones 1-4 - over 6 hours. Based on this, the upper part of the table shows the number of patients admitted early after the injury, and the lower part shows the number of patients admitted late. The number of late delivered patients was 52 (31.2%). The maximum time from injury to admission in our observations was 25.5 hours.

Table 2 - Timing of admission and level of injury

Timing of admission	The level of damage on the hand (according to Beamer)				Total (%)
	1-2	3	4	5	
Up to 3 hours	3	43	27	3	76(46%)
3-4h		19	3		22(13.3%)
4-6h	2	10		2	14(8,5%)
6-12h	3	26	15	4	48(29.2%)
12-18h		1	1		2(1.2%)
18-24h				1	1(0.6%)
Over 24h		1	1		2(1.2%)
Total (%)	8 (4.8%)	100 (60.6%)	47 (28.5%)	10 (6.1%)	165

Results

The possibility of replantation and revascularization, as well as their outcome, largely depended on the timeliness and quality of first aid, compliance with the conditions for preserving the cut-off segment, the speed of transportation and other organizational factors.

Due to incorrect actions in 24 patients, it was not possible to replant the delivered segments (33 segments). These patients underwent stump formation. Analyzing the received material, we came to the conclusion that a number of mistakes were made at the pre-hospital stage, which could have been avoided if the work had been properly organized.

A large number of errors in the provision of first aid to patients determined the need to develop appropriate rules, since a prehospital medical worker needs to have an idea about the possibilities of modern reconstructive surgery of the hand and its segments using microsurgical techniques.

Discussion

To successfully perform replantation in a microsurgical center, medical workers from other medical institutions must adhere to the following rules:

1. Immediately inform the specialists of the Department of Reconstructive Microsurgery about the injury and its nature and agree on the advisability of transporting the patient for surgical treatment. Indications for transportation of the victim with limb segment detachment to a specialized institution are determined by the staff of this institution after discussing all the details of the injury by phone. In doubtful cases, the issue is resolved in favor of transportation, if there are no general contraindications. From experience, a preliminary telephone message allows you to prepare in advance for the reception of the patient and for the upcoming operation.

2. Stop bleeding from the stump of a hand or finger by applying a pressure bandage, soft clamps, soft inflatable cuffs (apply a tourniquet only as a last resort).

3. Carry out anti-shock measures, perform radiography of the stump and the amputated segment.

4. The wound surface of the amputated segment must be covered with a sterile napkin, the limb segment should be “preserved”. The main method of preservation is the cooling of tissues to a temperature of +4 +8 degrees. With cold anoxia, the period of possible replantation is up to 24-36 hours for the fingers, up to 12-24 hours for the hand. If it is impossible to provide cold preservation of the detached segment, the period of thermal anoxia of the segment is reduced by half. It must be remembered that the suitability of a detached segment for replantation, regardless of the condition of the wound and the timing of cold or heat anoxia, is determined only by a microsurgeon during direct examination and primary surgical treatment.

5. Preservation of a severed segment requires the use of the “rule of three packets”: the separated segment in a dry sterile napkin must be placed in a dry sealed plastic bag and tightly tied. This bag is placed in a second bag of water, which is also tied tightly and placed in a third bag of ice and/or snow. The volume of water in the second bag should only be sufficient to prevent direct contact of the severed segment with ice. These measures make it possible to avoid maceration of the skin and tissues of the severed segment, as well as its frostbite and glaciation from direct contact with ice. If there is a thermal container, the packages are placed in it. The amputee must be delivered with the patient.

6. In case of incomplete detachment of the hand and its segments, if its distal part is connected with the proximal skin flap, the flap should not be cut, immobilization of the entire limb and cooling of the distal segment is necessary.

7. In case of severe injuries of two limbs and combined trauma of the internal organs and skull, the transportation of the patient to the microsurgery center from other medical and preventive institutions of the Republic is impractical due to the territorial remoteness and, as a result, the severity of the patient's condition. At the same time, it is necessary to carry out anti-shock therapy and organize an operation in regional (city, district, regional) medical institutions with the involvement of specialists in vascular surgery.

8. In the direction of the medical institution, indicate all the therapeutic measures performed at each stage of transportation and treatment of the patient. The patient should be urgently delivered to the clinic by ambulance, if the condition allows by other modes of transport. The medical staff of the microsurgery department should be made aware of the likely timing of the patient's admission to the hospital.

Conclusions

The use of modern methods of microsurgical restorative interventions with the reconstruction of injured vessels can significantly expand the possibilities of preserving and restoring completely and partially severed segments of the hand and fingers. The improvement of the outcomes of treatment of patients with traumatic amputations and injuries of the neurovascular bundles of limb segments was significantly affected by the provision of timely specialized microsurgical care. The developed rules for the provision of medical care and transportation of patients with traumatic amputation of hand segments make it possible to significantly expand the possibilities of preserving and restoring completely or partially severed hand segments.

Conflict of interest. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Contribution of authors. A.R.: conceptualization and organization of the database, writing a draft. T.S.: review and editing of the manuscript. All authors have given final approval for the version to be submitted.

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Қол сегменттерінің жарақат салдарынан болған ампутациясы бар науқастарға мамандандырылған көмекті ұйымдастырудағы қателер

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Түйіндеме

Зерттеудің мақсаты қол сегменттерінің жарақат салдарынан болған ампутациясы бар науқастарға мамандандырылған көмекті ұйымдастырудағы қателерді немесе сәйкессіздіктерді анықтауға және талдауға бағытталған. Арнайы мақсаттарға қолданыстағы күтім құрылымдарындағы кемшіліктерді түсіну, емнің нәтижелерін жақсарту және қол сегменттерінің ампутациясынан зардап шеккен науқастарға көрсетілетін мамандандырылған көмектің сапасын арттыру бойынша ұсыныстар әзірлеу кіреді.

Әдістері. Сызғанов атындағы Ұлттық ғылыми хирургия орталығының клиникасына 2020-2022 жылдар аралығында қолдың немесе саусақтардың қан айналымының декомпенсациясына әкеліп соқтыратын мамандандырылған хирургиялық көмек көрсету үшін аяқ-қол сегменттерінің жедел жарақаты бар жалпы саны 165 науқас шұғыл ауруханаға жатқызылды.

Нәтижелер. 24 науқаста дұрыс емес әрекеттерге байланысты жеткізілген сегменттерді (33 сегмент) қайта отырғызу мүмкін болмады. Бұл науқастарда діңгек түзілуі жүргізілді. Бұл ретте осы санаттағы науқастардың 50-75%-ын емдеуде әлі де диагностикалық, техникалық және тактикалық қателіктерге жол берілетіні назар аударды. Реплантация және реваскуляризация мүмкіндігі, сондай-ақ олардың нәтижесі көбінесе алғашқы медициналық көмектің уақтылылығы мен сапасына, кесу сегментін сақтау шарттарын сақтауға, тасымалдау жылдамдығына және басқа ұйымдастырушылық факторларға байланысты болды.

Қорытынды. Зақымдалған тамырларды қалпына келтіре отырып, микрохирургиялық қалпына келтіретін араласудың заманауи әдістерін қолдану қол мен саусақтардың толық және ішінара жыртылған сегменттерін сақтау және қалпына келтіру мүмкіндіктерін айтарлықтай кеңейтеді. Травматикалық ампутациясы бар және аяқ-қол сегменттерінің жүйке-тамыр түйіндерінің жарақаттары бар науқастарды емдеу нәтижелерінің жақсаруына уақтылы мамандандырылған микрохирургиялық көмек көрсету айтарлықтай әсер етті.

Түйін сөздер: ұйымдастыру, денсаулық сақтау, қателер, жарақат салдарынан болған ампутация, қол хирургиясы.

Ошибки в организации специализированной помощи больным с травматической ампутацией сегментов кисти

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Резюме

Целью исследования является выявление и анализ ошибок в организации специализированной помощи пациентам, перенесшим травматическую ампутацию сегментов кисти. Конкретные цели могут включать понимание недостатков существующих структур оказания помощи, улучшение результатов лечения пациентов и разработку рекомендаций по повышению качества специализированной помощи, предоставляемой пациентам, перенесшим ампутации сегментов рук.

Методы. С 2020 по 2022 год в клинику Национального научного центра хирургии имени Сызганова для оказания специализированной хирургической помощи были срочно госпитализированы 165 пациентов с острыми повреждениями сегментов конечностей, приведшими к декомпенсации кровообращения в кисти или пальцах.

Результаты. Из-за неправильных действий у 24 пациентов не удалось реплантировать доставленные сегменты (33 сегмента). У этих пациентов произошло формирование культи. При этом в 50-75% случаях все же допускались диагностические, технические и тактические ошибки при лечении этой категории больных. Возможность реплантации и реваскуляризации, а также их исход во многом зависели от своевременности и качества оказания первой помощи, соблюдения условий сохранения отрезанного сегмента, скорости транспортировки и других организационных факторов.

Выводы. Использование современных методов микрохирургических восстановительных вмешательств с реконструкцией поврежденных сосудов позволяет существенно расширить возможности восстановления разорванных сегментов кисти и пальцев полностью или частично. Оказание своевременной специализированной микрохирургической помощи существенно повлияло на улучшение результатов лечения больных с травматическими ампутациями и повреждениями сосудисто-нервных пучков сегментов конечностей.

Ключевые слова: организация, здравоохранение, ошибки, травматическая ампутация, хирургия кисти.