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SIGNIFICANCE OF THE STEPWISE SURGICAL APPROACH TO SEVERE HAND INJURY

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Continuous one step surgical procedures on the hand in polytraumatised patients and patients with hand multi structural injured increase risk of complications and are life-threatening. The aim of our work was to evaluate the effectiveness of the stepwise surgical approach to severe hand injury. Stepwise surgical approach according "damage control" concept was applied for 28 (1.5 %) severe hand injured civilian polytraumatised patients, for 621 (32 %) multi structural hand injured patients, for 12 (34 %) multiple military wounded patients and for 23 (66 %) military multi structural hand wounded patients. The good and satisfactory hand function we received in 78.5 % polytraumatised patients and in 94.9 % patients with multi structural hand injuries, in 4.3 % – despite the hand salvage, its function was unsatisfactory. Amputations was performed at the level of the forearm in 7 patients, 5 patients died from shock and life-threatening injuries.

Key words: hand injury, damage control, stepwise surgical approach.

І.Р. Трутяк, Н.Р. Калинович, Р.І. Трутяк, Н.О. Гнатейко ЕТАПНЕ ХІРУРГІЧНЕ ЛІКУВАННЯ ТЯЖКОЇ ТРАВМИ КИСТІ

Тривала одноетапна хірургічна операція на кисті у пацієнтів з політравмою та з поліструктурною травмою кисті збільшує ризик ускладнень і становить небезпеку для життя травмованого. Метою нашої роботи було проведення оцінки ефективності етапного лікування пацієнтів з тяжкою травмою кисті. Етапні хірургічні втручання відповідно до концепції "damage control" застосували у 28 (1.5 %) цивільних пацієнтів з політравмою, у 621 (32 %) – з поліструктурною травмою кисті, та у 12 (34 %) військових з політравмою і у 23 (66 %) – з поліструктурною травмою кисті. Відповідно до запропонованого нами хірургічного лікування ушкодженої кисті добрі і задовільні функціональні результати отримали у 78.9 % пацієнтів з політравмою і у 94.9 % – з поліструктурною травмою кисті, у 4.3 % – незважаючи на порятунок руки, його функція була незадовільною. Ампутації проводили на рівні передпліччя у 7 пацієнтів. 5 пацієнтів померли від шоку та травм, що загрожували життю.

Ключові слова: травма кисті, «damage control», етапне хірургічне лікування.

The study is a fragment of the research project "Injury and diseases of the musculoskeletal system (clinic, diagnosis, treatment and prevention)", state registration No. 0120U002146.

Hand injuries sharing of the in the upper limb trauma structure accounts for about 20-30 % [10]. According to the regional medical reports and Ukrainian social expert commissions in 2017 the number of persons who were initially recognized as disabled by hand injuries was 415 people (1,074 per 100 000 population), and the number of re-recognized disabled – was 772 persons (2 per 100 000 population). About 80 % of them are people of working age, which has a definite influence on the country's social and economic well-being [9]. Primary disability after hand injury reaches 11.1–13.0 %. The frequency of this pathology, the duration of temporary disability, the high level of long-term disability lead to huge economic losses for society [2].

The most common cause of severe hand injuries is the high-energy trauma, which is characterized by multi structural damage to the hand with soft tissues defect [5, 7]. Hand anatomical structures and physiological function are complexity. Diagnostic, technical and tactical mistakes in the treatment of severe hand injured patients are conditioned of complex hand anatomical structures [13].

The general condition of the patient does not always allow to perform fully adequate surgery, both in functional and aesthetic aspects, to perform simultaneous reconstructive and to close the defect of soft tissues. Continuous one step surgical procedures on the hand in polytraumatised patients increase risk of complications and are life-threatening [4].

Method of choice medical treatment for severe trauma patients with hand multi structural injured is stepwise surgical approach. The goal of this surgical approach is life salvage, hand injured structures restore or reconstructive and limb functional restoration [8].

The purpose of the study was to evaluate the applying damage control technology in patients with severe multi structural hand injuries and in polytraumatised patients with hand injury.



A



B



C

Fig. 1. Incomplete traumatic abjunction of the hand: a) palmar and dorsal surface of the injury hand; b) bones fractures fixation by the Kirschner's wires and vascular sutures; c) external bones fractures fixation device.

Materials and methods. A retrospective analysis of 1531 and a prospective analysis of 392 hand injury patients who were treated in Lviv City Clinical Hospital and a retrospective analysis of 29 and prospective analyzes of 6 wounded patients who were treated with injured hand in the Military Mobile Hospital and the Military Medical Clinical Center of the Western Region from 2014 to 2017 years. Gender distribution: men – 98 %, women – 2 %. Age was 18 – 62 years, median 37 ± 4.1 . 87 % of those were able-bodied. Severe injuries to the hand in 28 (1.5 %) civilian patients were constituent of polytrauma. 621 (32 %) – there were multi structural hand injured. Military trauma of the hand was a component of multiple and combined injuries in 12 (34 %) wounded and 23 (66 %) – had multi structural hand injured.

All polytraumatised patients and multi structural hand injured patients had a traumatic shock and blood loss. Inclusion criteria for patients for the study were: post-traumatic soft tissue defect of the hand, age over 18 years, individual patient consent to participate in the study.

Exclusion criteria were the patient's refusal to sign informed consent and participate in the study, diabetes mellitus, vascular disease with peripheral circulatory disorders, cancer or chronic diseases in the decompensation stage and long-term use of steroid medications.

Medical documentation used for the research work: inpatient medical record / medical history (form 003 / o) and outpatient medical record (form 025/o), upper extremity functional questionnaire DASH and our developed questionnaire to assess the quality of life of patients after hand injury.

Stepwise surgical approach according damage control concept was applied for this patients.

Statistical processing of the study results was carried out using the Microsoft Office Excel software and Statistica 8. The nonparametric Mann-Whitney test was used to determine the statistical significance of differences between the groups. The difference was considered statistically significant at $p < 0.05$.

Results of the study and their discussion. The crucial principles of management in polytraumatised patients were haemorrhage control and other life saving measures So, according damage control surgery

concept, the first step was diagnostic life-threatening injury and haemorrhage stop. All surgical procedures were rapid and short, minimally traumatic to the patient and little blood loss. Definitive treatment of the

injured hand is not indicated in the acute phase. Initial measures on damaged limb were minimal – stop bleeding and fractures bone stable by plaster splint or external device. The next step was intensive therapy to stabilize the patient's life support functions. Further complex reconstructive interventions were delayed after life support patients function stabilized.

After that performed restorative surgical interventions, including on the hand. In patients with multi structural injured of the hand and incomplete traumatic abjunction of its segment without damage to other anatomical functional areas, but with blood loss of more than 15 % of the circulating blood volume, restoration surgery on the upper limb was performed in a stepwise surgical approach.

The initially performed carefully wound irrigation using antiseptic solution, assess the damaged structures and remove all dead and contaminated tissues to decrease the bacterial pollution. The next step – bones fractures fixation by the Kirschner's wires or the external device and repair the blood supply to the damaged segment of the limb by means of vascular sutures or vascular shunt – the minimum volume of surgery procedures.

If the patient has complete traumatic disruption part of the limb, we adhered to the principle – for one repairing artery, minimum two veins may be repair and if damaged segment after revascularization was doubtful survival then other structures repair were delayed.

Thus, in 5 wounded military (14.3 %) and 2 civilian patients (0.3 %) with brachial artery injury, primary medical care included temporary intraluminal shunt of the damaged vessel by the silastic tube. This enabled him to be transported to the specialized surgical department, where, the final repair of the blood flow and organ-safe operation on the hand were performed. Urgent limb-saving fasciotomy were performed in 5 wounded military patients (14.3 %) with suspicion for compartment syndrome.

In 3 military (8.6 %) and 2 civilian (0.3 %) patients with life-threatening injuries to other organ systems and unstable parameters of life support, replanting of the detached limb segments were not performed and we adhered to the principle – “life before limb”. The early amputation was indicated at the unreconstructable osseous, irreparable vascular injuries, and severe soft-tissue loss [11].

The reduced volume of surgical procedures includes stabilizing the bone fractures, revascularization and repair of the injured nerve and fingers flexor tendons. Restoration injured fingers extensor tendons were delayed to the next step of the surgery (6 military (17.1 %) and 17 civilian (2.6 %) patients), (fig. 1).

In patients with severe hand injury and stable parameters of life support all dead and contaminated tissues were removed with preserve viable blood vessels, nerves and tendons. Antiseptic solution careful wound irrigated and full surgical procedures were performed for all injury structures restoration (fig. 2).



Fig. 2. Incomplete traumatic abjunction of the hand a) before surgery; b) after restoration of all injury structures (complete volume of surgery procedures).

The terms and method plastic of the hand and forearm soft tissues post-traumatic defects were chosen in a differential way. Skin grafting was delayed if was not possible to determine of non-viable tissues margin. The doubtful viability tissues not removed. Debridement was repeated after the demarcation of necrotic tissues and the appropriate method of plastics was used.

The good and satisfactory hand function we received in 78.5 % civilian polytraumatised patients and in 94.9 % patients with multi structural hand injuries, in 4.3 % – despite the hand salvage, its function was unsatisfactory. In the military patients good and satisfactory hand function we received in 75 % polytraumatised patients and in 91.2 % patients with multi structural hand injuries. Amputation was performed at the level of the forearm in 7 civilian patients: 2 patients (7.1 %) with polytrauma, and 5 patients

5 (0.8 %) with multi structural hand injuries. 5 patients with hand trauma and polytrauma died from shock and life-threatening injuries (4 military (14.3 %) and 1 civilian (8.3 %) patients). (table 1).

Table 1

Functional results stepwise treatment of severe hand injury

| Hand function | Hand injury in polytraumatised patients | | Multi structural hand injuries | |
|----------------|---|------------|--------------------------------|-------------|
| | Civilian | Military | Civilian | Military |
| Good | 12 (42.8 %) | 5 (41.7 %) | 378 (60.9 %) | 13 (56.5 %) |
| Satisfactory | 10 (35.7 %) | 4 (33.3 %) | 211 (34 %) | 8 (34.7 %) |
| Unsatisfactory | 0 (0 %) | 2 (16.7 %) | 27 (4.3 %) | 2 (8.8 %) |
| Missing | 2 (7.1 %) | 0 (0 %) | 5 (0.8 %) | 0 (0 %) |
| The dead | 4 (14.3 %) | 1 (8.3 %) | 0 (0 %) | 0(0 %) |
| Total | 28 | 12 | 621 | 23 |

In patients with polystructural, multiple and combined injuries, with questionable prognosis due to injury, one-step long-term surgery on the hand can be life-threatening. Due to multiple injuries, pathological processes and developed conditions (pain shock, blood loss) burden each other and the general condition of the patient [12]. In addition, there are often no conditions and opportunities to perform complex one-step reconstructive surgeries, no equipment or qualified medical staff.

The most significant goal polytraumatised patients treatment with severe multi structural hand injury is life salvage [6]. All measures must be performed according advanced trauma life support principles. Choice of surgical procedures volume depended on patient's condition [1]. Stepwise surgical approach is indicated for polytraumatised patients with hand injury and for patients with severe multi structural hand injuries in nonspecialized surgical department. In polytraumatised patients with unstable condition interventions on the hand should be rapid and minimally traumatic to the patient – stop bleeding, cover and splint the hand. The second step surgery – irrigate the wound, primary surgical debridement of the hand and repair of damage structures should be perform after intensive therapy and stabilization of the patient.

In patients with polystructural trauma of the hand and incomplete traumatic amputation of its segment without damage to other anatomical and functional segments, but with blood loss of more than 15% of circulating blood volume, reconstructive surgery on the upper extremity should also be performed in stages.

After patient's condition stabilizing we must to perform surgical treatment of the hand wound with a reduced volume of surgery. Treatment of wounds of the hand and fingers should be atraumatic, extremely economical. Nevertheless, it is quite radical in relation to non-viable tissues. Skin flaps of questionable viability do not need to be excised. Bone fixation must be performed with Kirchner needles or an external fixation device. After that it is necessary to restore blood supply to the damaged segment.

If the patient's condition did not allow to continue the operation and in case of doubtful survival of the revascularized segment, the reconstructive of other structures should be on next stages of surgery [3, 14].

Determination of terms and methods soft tissue defect plastic depending on the viability of injured tissues, the degree of microbial contamination of the wound, the presence of undamaged surrounding areas and the general condition of the patient. Reconstructive surgery to improve the function of the hand should be performed after the patient recovered and wound healing.

Conclusion

The use of damage control technology in patients with severe polystructural hand injuries and in polytrauma patients with hand injuries primarily allows saving the lives of severely injured patients. In addition, the division of surgical treatment into stages allows to obtain good both functional and aesthetic results.

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CORRELATION BETWEEN TEMPERATURE OF THE MUCOUS MEMBRANE AND SECRETION OF THE HARD PALATE MINOR SALIVARY GLANDS IN DIFFERENT TERMS OF USING THE FULL REMOVABLE DENTURES

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The paper considers correlation between dental structures and the condition of oral tissues, namely: changes in temperature and secretion of the minor salivary glands of the hard palate at different time periods of use of full removable laminar dentures made of acrylic resin. The findings of the studies of temperature rates of the mucous membrane of the hard palate and the condition of secretion of the minor palatine salivary glands show the significant changes in them under the action of the full removable denture base, made of acrylic resin. The increase in temperature beneath the denture base contributes to the phenomena of "greenhouse effect", which causes inflammatory processes of various kinds in the tissues of the prosthetic bed, which can further cause destructive and atrophic changes in the minor salivary glands of the hard palate, which in turn leads to their impaired secretion – hyposalivation. Obviously, there is a directly proportional relationship between the change in temperature of the mucous membrane of the prosthetic bed beneath the denture base and the condition of secretion of the minor palatine salivary glands at different times of use of the full removable dentures.

Keywords: minor salivary glands, full removable dentures, hard palate, secretion, temperature.

Є.С. Хілініч, М.Я. Нідзельський, В.Ю. Давиденко, Г.М. Давиденко, В.В. Кузнецов **ВЗАЄМОЗВ'ЯЗОК ТЕМПЕРАТУРИ СЛИЗОВОЇ ОБОЛОНКИ ТА СЕКРЕЦІЇ МАЛИХ СЛИННИХ ЗАЛОЗ ТВЕРДОГО ПІДНЕБІННЯ У РІЗНІ ТЕРМІНИ КОРИСТУВАННЯ ПОВНИМИ ЗНІМНИМИ ПРОТЕЗАМИ**

Стаття присвячена питанню взаємозв'язку стоматологічних конструкцій і стану тканин порожнини рота, а саме: змін температури та секреції малих слинних залоз твердого піднебіння у різні терміни користування повними знімними пластинковими протезами, виготовленими з акрилової пластмаси. Результати проведених досліджень температурних показників слизової оболонки твердого піднебіння та стану секреції малих піднебінних слинних залоз свідчать про суттєві зміни в них під дією базису повного знімного протезу, виготовленого з акрилової пластмаси. Підвищення температури під базисом протезу сприяє явищу «парникового ефекту», що стає причиною запальних процесів різного характеру у тканинах протезного ложа, які в подальшому можуть бути причиною деструктивних та атрофічних змін у малих слинних залозах твердого піднебіння, що, в свою чергу, призводить до порушення їх секреції – гіпосалівації. Тому можна стверджувати про пряму пропорційний зв'язок між зміною температури слизової оболонки протезного ложа під базисом протеза та станом секреції малих слинних залоз піднебіння у різні терміни користування повними знімними протезами.

Ключові слова: малі слинні залози, повні знімні протези, тверде піднебіння, секреція, температура.

The paper is a fragment of the research project "The effect of dental constructs and material on the prosthetic bed and adaptive abilities of the body", state registration No. 0116U004188.

A specific barrier that is crucial for oral homeostasis is the minor salivary glands, one of the functions of which is the ability to produce antigens for cellular structures involved in the immune response [4]. Moreover, the mucous membrane plays a very important role, through which metabolic processes occur in the oral cavity; hence, changes in the secretory activity of the minor salivary glands can significantly affect the nature and features of pathological processes in this environment [90].