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Current topics

INTEGRAL CARE OF MASS-SCALE  
WOUNDS IN THE MAXILLOFACIAL REGION

INTEGRALNO ZBRINJAVANJE MASOVNIH  
POVREDA MAKSILOFACIJALNOG PREDELA  
POSLE KATASTROFE

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*Ključne reči*

Prirodne katastrofe: zemljotresi, cunami, ratovi, masovne maksilofacijalne povrede, integralno zbrinjavanje.

*Key words*

Disaster, war, maxillofacial wounds, integral care.

*Abstract*

Within the frame of general trauma connected with disaster is also to be counted the mass-scale incidence of wounds in the maxillofacial area. The general prognosis in regard to this class of injuries is positive, provided treatment is started early. Through the acquisition of scientifically based findings from the pathophysiology of traumatic shock, as well as from the mechanism of the neuroimmunohumoral regulation of stress damage, possibilities emerge in regard to the integral care of wounds in the maxillofacial region after disasters. The article below examines such therapeutic possibilities.

*INTRODUCTION*

Mass wounds occur within a short time and within a limited area. The extent to which they occur exceeds the possibilities of the medical service to care for the wounds by means of the available medical-service personnel, equipment, and working procedures. The casualties are the result of natural disaster or man-made situations in particular, war.

At no other time since the Second World War have more countries been involved in hostilities than now. Of the some 215 wars that have been fought here or there on the globe since 1945, approximately 132 were domestic conflicts. The others involved two or more countries. By the available estimates, these conflicts have cost more than 25 million lives. The total numbers of the war wounded (in Greece, Korea, Vietnam, Cambodia, Afghanistan, Egypt, Lebanon, Iraq and elsewhere) has been fivefold the deaths. Natural disasters and tsunami with disastrous earthquakes in Chile and Haiti also wounded more lives.

Chief characteristics of these wounds along with their immense number, is the extent to which they have involved tissue destruction; the primary contamination of the wounds; the variety of the flora; and the changed reactivity of the organism in the wounded person.

The injuries that result from natural disasters are primarily wounds of the concave variety, caused by the impact of a blunt object -while the wounds of war generally stem from injuries dealt by projectiles from firearms (this category accounted for some 97 percent of wounds in World War II).

Wounds in the maxillofacial region are a component of general traumas resulting from disaster. These wounds can be isolated occurrences. In most cases, however, they are combined injuries with craniocerebral lesions. The frequency with which such wounds occur is quite considerable: In war, this category ranges from 8% to 15% (Kelly, 1979).

Like the other traumas, these injuries are also among the urgent pathological conditions in medicine. Therefore, because of the discrepancy between the need for care, on the one hand and, on the other hand, the possibilities of providing it, they represent an object of study in modern traumatology.

Wounds in the maxillofacial region are also characterized by certain specifications that are anatomically determined, beyond that, by functional and biological complexity, and by the fact that aesthetic considerations play a role in the maxillofacial region.

The prospects of caring for the wounded in the event of the use of atomic/biological/chemical (ABC) weapons are uncertain.

The general outlook for successful treatment of injuries in the maxillofacial area is good, assuming that the treatment begins promptly. The most frequent causes of death in these cases are shock, asphyxia, and haemorrhage. The clinical picture of the wounds depends on the aetiology of the injuries and on the complications.

The originally occurring complications are usually pain, shock, asphyxia, haemorrhage, infection, and damage to the central nervous system. From medical science's newer

insights in the pathophysiology of traumas and from the mechanism of the neuroimmunohumoral regulation of damage from stress, possibilities arise in disaster medicine for the integral care of wounds in the maxillofacial region.

### *Circumstances and Priorities*

The organizing of the care of mass-scale occurring wounds in the maxillofacial region after disasters is subject to general principles of medical doctrine -in particular, to the circumstances of surgical measures in war. These circumstances are specifically differentiated as to type of wound; the unexpectedness and the irregular arrival of the casualties for treatment; the extent of the possibilities for specialist medical attention; the degree to which medical facilities are lacking or available; and the effort of the rescue arrangements and the other organizational aids. The medical attention ranges from triage through transport to the therapy of the wounded from the onset of the wound all the way to the final medical decision by the specialist.

### *3 Phases of Therapy*

Triage and the transport of the wounded are, of course, of basic importance. The sorting or triage procedure determines the successive stages of medical assistance. Immediate treatment of those who require non-postponable surgical handling. For the other patients, subsequent care.

The therapy of mass-scale occurring wounds is extremely complex. It comprehends optimal medical first aid, continuing care, and, ultimately, rehabilitation. The therapy is carried on in three phases: as (a) immediate therapy, (b) special therapy, and (c) late therapy.

#### *Immediate Therapy*

The immediate therapy includes first aid, general medical and general surgical treatment. The therapy aims at preserving vital functions, and in doing so preventing complications. Triage and transport decisions are made at the site where the injury was incurred. In case of acute respiratory failure, first foreign matter is removed from the air passages. If necessary the fixation of the tongue is carried out with ligation of the skin of the cervical region. Intubation is done via nose or mouth; perhaps tracheotomy.

In case of haemorrhage, haemostasis is carried out. Prophylaxis of traumatic shock starts with the administering of first aid; with haemostasis, attention is given to respiration, if necessary with the administering of atropine.

In case of temporary immobilization, compensation is necessary with blood substitutes and the quickest possible evacuation.

For the prophylaxis of infection, therapeutic measures with antibiotics are indicated.

For easing pain, the administering of an analgesic is recommendable. Infusions (intravenously) -Bion, 1984 -are advisable.

#### *Special Therapy*

Special therapy is carried through with persons of stable constitution, prevailingly with general endotracheal anaesthesia. It consists of definitive surgical medical care of the wound with observance of basic principles of wartime surgical care.

Attention must be paid to the decontamination of contaminated wounds. Because of the specificity, certain deviations have to be considered from an anatomical, functional and aesthetic point of view, as far as timing, radical surgery and the sequence of the primary suture are concerned.

With the administering of antibiotics in the course of the immediate procedure and the primary surgical care for the wound in the maxillofacial region, the optimal time for surgery is after 6-8 hours (in the exceptional case up to 48 hours).

The therapy is conducted starting from the surface to the deeper levels with very economical excision of the skin, medical care of muscles and mucosa, removal of necrosis, foreign bodies and the coagulum. In case of fractures, one only removes from cavities, the sinus, and from nose and mouth bone fragments that are small, free and periosteum-free. The sparing of each fragment is important because of osteogenesis and the prevention of a pseudoarthrosis.

Smaller blood vessels must be ligated and larger ones must be reconstructed. The nervus facialis is to be preserved and freed from possible compressions. Endings are to be vitalized and must be fixed with the suture.

If the duct of the parotid gland is injured the proximal end is sewn into the mucosa of the mouth.

Medical care of the maxillary sinuses is concluded with the drainage of the nose (iodoform/tamponade). Dislocated and fractured teeth as well as teeth on the line of the fracture are removed.

After the setting of the facial bones and the jaw, they are immobilized. The goal of this immobilization is to bring about favorable anatomical conditions and the corresponding occlusion so that the function is ensured.

In view of the great number of immobilization method and devices, in case of a mass-occurrence of injuries after disasters the universal devices (standard devices) are the most practical; they can be of a temporary or a definitive nature. Osteosynthesis done with the help of a wire ligature is the method that is applied most frequently. In case of avulsive war injuries of the lower jaw with far-going bone defects, Kirschner's wire or pre-manufactured metal implants are used. By this measure, the prolapsus of the tongue, hypersalivation, dehydration and conditions of shock are avoided. Besides the aforementioned methods, a plaster cast in the form of a double chin bandage also can be applied. In addition, metal plates or miniplates can be indicated for the immobilization in case of maxillofacial fractures as well as with the reconstruction of the floor of the orbit. Closure of the wound is done from the inside to the outside. First the mucosa of the mouth and tongue is sewn. Then after the setting of the bone, intermaxillar immobilization is carried out. After that, a rubber drainage is laid and the muscles are sewn. With lesser skin injuries, a primary skin suture is laid, and this without tensing the skin. With larger or infected wounds the primary delayed suture is recommended. In case of more pronounced defects of the mouth, Cheeks and lips, the mucodermal suture is applied. With pronounced skin defects one of the plastic methods of masking by means of free skin grafts is applied; later reconstructing operations are carried out. Particular attention must be given to postoperative treatment, above all to oral hygiene, reanimation, antibiotic therapy, the right nourishment and the medical care of the wounded person.

### *Late Therapy*

Late therapy represents the third phase in medical care, and involves reparative operations on the soft tissue and bone tissue, with the aim of eliminating the sequelae of injuries and compensating functional damages, aesthetic defects, and deformations. Late therapy is also appropriate in treatment centers at a distance from the site of the disaster.

Adequate medical care during the earlier phases - first of all the correctly executed surgical care of the wound - is the basic prerequisite for the success of the later reconstructive operations and for the complete rehabilitation of the wounded person in the matter of dentures and in general.

### *Working Hypothesis and Goal*

Based on current conceptions in regard to medical care of persons with injuries in the maxillofacial region in cases of disaster, primarily in the event of war, it is assumed that care by a medical specialist is to be counted on only quite late and that the extent and method of therapy will be considerably restricted. These limitations are due to the mass scale of the injuries, and to the intervals between the individual phases of the evacuation system.

Thanks to further progress meanwhile in medicine and in other branches of science, especially those achievements based on findings in the field of neuroimmunology, the medical care of injured persons in the event of mass injuries can be performed considerably more efficiently and more integrally. For that reason, ambitious goals were set for the investigations, It was decided:

- 1, To investigate the most frequent aetiological factors with injuries in the maxillofacial region in disasters;
- 2, To obtain firm findings as to the most frequently occurring early complications in connection with mass-scale injuries in the maxillofacial region;
- 3, To examine the possibilities for the application of medical help and of care by specialists already in early phases of evacuation;
- 4, To check the feasibility of introducing transcutaneous electro-acupuncture stimulation (EAS) into the system of p5, To investigate the possibilities for the protection of injured persons from the effects of atomic, biological and chemical agents in the region of the head and the cervix.

### *Methods and Results*

Over a period of 30 years the author has given medical care to a total of some 3,600 persons with injuries in the maxillofacial region. Also included in this retrospective analysis are the archive material and the clinical records of a group of 1,031 patients with injuries in the maxillofacial region, wounds that were inflicted in disasters. These patients have been divided into six sub-groups:

- I. -345 injured persons from the First World War (Škokljević, 1964).
- II. -225 injured persons from the Second World War who were treated in Italy,
- III. -250 persons who were also wounded in the Second World War, but were treated in Belgrade (Škokljević, 1980),
- IV. -75 persons who were wounded in local conflicts in Africa and Asia from 1970 to 1980 (Škokljević, 1980).
- V, -106 persons who were injured in peacetime by firearms.

VI. -27 persons with injuries in the maxillofacial regions within the frame of polytrauma in peace time (Bervar, Škokljević, 1968).

### *An analysis of the investigative findings showed:*

1. That in all wars, injuries caused by firearms have dominated; the prevailing agents of these injuries were projectiles with high initial velocities and constantly increasing potential for the destruction of soft tissue and bone tissue in the maxillofacial region. In natural disasters, injuries were caused predominantly by blunt objects.

2. That early complications occurred quite frequently in cases of injuries in the maxillofacial region, and most frequently took the form of pain, infection, shock, haemorrhage, and asphyxia.

3. That various forms of medical care in all phases of evacuation were not sufficient, mainly because of insufficient familiarity with the special circumstances of the maxillofacial region.

4. That the treatment by specialists was not adequate, primarily in the field of stomatosurgery, and this because of the specialists' ignorance about and lack of appropriate experience with the maxillofacial region; and also because the treatment was not a teamwork procedure.

5. That with the injured persons of the sub-groups V and VI above, when there had been appropriate surgical treatment and adequate reanimation of the patient, very good early and late functional and aesthetic successes in treatment were achieved.

### *Recommended Therapy*

The care of mass-scale-occurring injuries in the maxillofacial region is dominated by the problems of (1) categorizing the victims according to the severity of their injury, (2) transport and (3) treatment.

If the problem of treatment is considered separately, then complications and their sequelae -primarily the syndrome of traumatic shock -play an important role. This complex pathological process takes place as a local and as a general psychosomatic reaction of the organism. In its pathogenesis several factors are involved in different combinations: pain, the wound and its reflex-like effects, haemorrhage, toxic materials, bacteria, states of exhaustion, etc. Such factors can bring on a disorder of the regulatory mechanism and of the protective and compensatory mechanism; and thus also can increase the risk of complications, especially those of an infective nature.

Scientific investigations showed that in the early posttraumatic period there are neuroimmunohumoral changes. They occur as a consequence of the activation of the connecting axis of sensory receptors (nociceptors) -afferent nerve fibers -synapsis -hypothalamus -hypophysis adrenal cortex.

As a result of the general reaction of the organism to the stress, a secretion of a larger number of hormones occurs. While the stress lasts the following hormones are secreted: CRF (corticotrophin releasing factor), ACTH (adrenocorticotrophic hormone) and the opioid peptides: endorphin, enkephalin and dynorphin

### *Role of Killer Cells*

Not too long ago the receptors for endorphin and enkephalin were identified at the cells of the immunological

system of the T and B lymphocytes; in a stress situation they proliferate. Investigations have shown that if the endogenous killer cells are activated there are interactions between the stress hormones and thymic hormones even the interleukin-2 (IL-2), interferon, ACTH and opioid peptides -at the level of the lymphocytes. This indicates that neuroendocrines and the immunological system inter-communicate via the mediation of a common hormone and via hormone receptors (Plotnikoff & Murgu, 1985).

With the help of this data an immunocytochemical diagram of these peptides distribution in brain and spine was made. The analysis of the opioid-melanocortin system shows the innervation and the distribution in the regions which contain the catecholamine system; in the regions which regulate sympathetic and parasympathetic secretion; in the centers for the control of cardiovascular and respiratory homeostasis; in the regions that are important in conditions of stress; in the modification of pain; and, finally, in autonomous homeostasis. These findings point to an anatomical foundation for the functioning of opioid peptides (Joseph & oth., 1985).

From the above we see that the injury to and the reactivity of the organism is an indivisible, functional whole whose individual parts are interconnected in many ways. Thus an injury confronts the organism with an almost insoluble riddle: How shall the forces of which the organism disposes unite against noxae; or, how shall they integrate themselves within the bodily processes in a way by which the organism does not inflict damage on itself?

As the investigations also show, the biological significance of stress depends on the duration and intensity of the impact of what caused the stress. This makes it possible to choose the anti-stress method that has no noxic effect and fosters adjustment. Thus the idea was born of using the multiple effect of short-time stress reactions to prevent the noxic effect of a long-lasting stress on the central nervous system (Meerson, 1984) and to enable the reaction of the organism as a whole.

#### *Other Stress Situations*

An increased secretion of endorphin-enkephalin-dynorphin was so ascertained in stress conditions of other origin, 8 afferent myelin nerve fibers (A-beta and A-delta, 30-100 m/sec) to the spine. In the synaptic area -which represents, so to speak, a huge laboratory -the neurosecretion of endorphin and enkephalin occurs as well as of 16 other neurotransmitters (serotonin, gamma-aminobutyric acid, noradrenalin, P-substance, neurotensin and others). These chemical substances, but particularly endorphin-enkephalin, exert an inhibitory effect on the painful nociceptive stimuli of the wound, which proliferate via the thinner and slower (1-2 .5 m/sec) afferent non-myelin C-nerve fibers ("Gate Control Theory of Pain", Melzack J& Wall, 1982).

The analgetic effect which is attained by the electroacupuncture stimulation is 0.5 mg/kg morphine. It is under the control of an analgetic inhibitory system in the dopaminergic, serotonergic, noradrenergic and reticular nuclei of the central nervous system (Takeshige, 1985).

#### *Electro-Acupuncture Stimulation Examined*

Our investigation of the application of electroacupuncture stimulation in combination with general endotracheal anaesthesia with 325 patients operated in the maxillofacial

region has brought quite good results. It was possible to reduce by 50% the chemicals necessary for the maintenance of the anesthesia (N<sub>2</sub>O). The postoperative analgetic period lasts longer than 24 hours, the wounds heal quicker, wound infections occur only in isolated cases, while breathing and the other vegetative functions as well as the blood picture are considerably better (Škokljevič, 1983).

Based on what has been presented here, the conclusion can be drawn that electroacupuncture stimulation applied with the goal of strengthening the anti-stress system has not only analgetic but also a preventive and a curative effect, along with, at the same time, exerting a calming influence on the psyche. Aside from its effectiveness, the method of electroacupuncture stimulation is simple, economical, portable and expedient during evacuation and treatment. For this purpose the apparatuses of the "Beta"® type are intended for electroacupuncture stimulation. They are especially well suited for coping with mass-scale injuries after disasters.

In preventive measures against shock, respiratory arrest, hypersalivation and secondary bleeding after injuries in the maxillofacial region, the early immobilization of the injured persons is of very great importance. This can already be achieved at the place of injury by seeing to transport immobilization with the help of manual aids. For this purpose we have developed a special method which can be applied successively in the individual phases of evacuation. It consists of an elastic chin-holder (a cap), the first bandage, and of rubber bands used in first aid. In the later phases the jaw fracture is temporarily immobilized with the help of monodontal wire ligatures, small plates, acrylate and an intermaxillary fixation. Using a certain technique, one can also change this arrangement into a device for definitive immobilization. A further problem in the mass incidence of injuries in the maxillofacial region after war disasters is how to protect the wounds against atomic, biological and chemical substances. Clinical investigations performed on 79 patients with injuries (illnesses) of head and cervix have confirmed that protection can be provided by means of especially made, individual masks which have the shape of hoods (Škokljevič & oth., 1986) (Fig. 3).

#### *Mobile Multipurpose Medical Sets*

The mobility of the phases and the expansion of the extent of medical aid in any case does present one of the big organizational problems in the medical care of mass injuries. To facilitate the early rendering of a larger extent of medical aid to a larger number of injured persons, an important aid can be the employment of mobile, variably usable medical sets (Mobile Multi-purpose Medical Sets -MMMS) (Škokljevič & oth., 1986).

These sets, because they can be transported, and because of their design, offer two possibilities of application: They can be used to store equipment (instruments, medicaments, bandages, etc.). Or they can serve in the work process, with the patient either sitting or recumbent. Depending on the intended area of use, the mobile, variably applicable medical sets can be equipped with "tools" ranging from a dental drill to a device for electroacupuncture stimulation. In other words, the sets can be employed by all types of medical men. The units are useful whether in rendering medical aid at or near the disaster scene or during the various phases of evacuation and treatment (Figs. 4a-f).

*"Injuries Are Injuries"*

Regarding the medical care of mass injuries occurring after disasters, there are certain misunderstandings whose cause can be found in the system of training and instruction in medical aid as well as in the diverging terminology.

Deep-rooted is the idea that field surgery is a special branch of surgery and that war injuries are "different". This misconception stems from the different mechanism in the genesis of injuries in war, in which the aetiological factor is generally a projectile with great initial velocity and small mass, while, by contrast, peacetime injuries are usually caused by objects with a larger mass but a lower velocity. Nevertheless, in both war and peace, a common denominator is the "traumatic epidemic". For that reason we ought to reconcile the two approaches -war medicine, peace medicine -with each other, and arrive at a uniform surgical doctrine that could be the basis of our teaching curricula and training programs.

*Many Advances Serve Modern Disaster Medicine*

Mass incidences of injuries in the maxillofacial region emerge from disasters whether of war or of peace. The life of the injured person is immediately threatened by traumatic shock, respiratory arrest, haemorrhages, infections and pain. Adequate medical care requires that health services be rationally organized, properly staffed (including specialists), and sufficiently provided with the materials of modern medicine.

Consider the progress that has been made in the medical fields of -for example

pathophysiology; the treatment of traumatic shock; making use of our new knowledge of the mechanism of neuroimmunohumoral regulations of stress damage, especially including the influence of endorphin; and the evolving technologies in emergency mobile surgery with module containers. All these developments, and more, contribute to our being able today to provide more integral, more effective and more humane medical care of disaster victims with injuries in the maxillofacial region.

*Apstrakt*

Masovnost povređivanja maksilofacijalnog predela javlja se posle katastrofa u miru i ratu. Život povređenog ugrožavaju neposredno traumatski šok, asfiksija, hemoragija, infekcija i bolovi, a njihovo zbrinjavanje zahteva posebnu organizacionu, stručnu i materijalnu osposobljenost zdravstvene službe.

Razvojem naučnih saznanja iz patofiziologije traumatskog šoka, mehanizma neuroimune-humoralne regulacije stresnih oštećenja, posebno uticaja endorfina, kao i razvojem savremene tehnologije urgentne mobilne hirurgije sa modularnim kontejnerima, stvaraju se nove mogućnosti integralnijeg i humanijeg zbrinjavanja povreda MFP posle katastrofe.

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