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## Medical Care to Patients with Concomitant Cranio-Facial Injuries. Peculiarities of Statistics, Diagnosis and Therapy For 15 Years.

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### ABSTRACT

The article is devoted to peculiarities of medical care of patients with concomitant cranio-facial injuries. 1691 patients with concomitant cranio-facial injuries were examined and treated in the Neurosurgical Department of the City Emergency Care Hospital No.1, Voronezh, Russia, during the period from 2001 to 2015. The authors have analyzed statistical peculiarities of concomitant cranio-facial injuries: gender composition of the injured, age distribution, occurrence circumstances of concomitant cranio-facial injuries. There have been estimated relations between the severity of a cranio-facial injury and localization of facial fractures. The authors have developed diagnostic and therapeutical regimens for treatment of concomitant cranio-facial injuries; recommendations to put them into practice have been given.

**Keywords:** cranio-facial injuries, craniocerebral injuries, facial fractures, statistics.

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## INTRODUCTION

Currently diagnostics and treatment of maxillo-facial and craniocerebral injuries are considered to be a challenging issue of emergency medicine [1, 2, 4, 6]. The total number of concomitant cranio-facial injuries for the recent 15 years does not tend to decrease. Few components of cranio-facial injury are reported to be commonly known and well-researched: they are craniocerebral and maxillo-facial injuries. However, concomitant cranio-facial injuries have their own peculiarities and are less investigated. These peculiarities occur due to interaction of components of cranio-facial injuries, and collaborative work of various health care specialists in diagnostics and treatment of patients with concomitant cranio-facial injuries.

Statistics and structure of concomitant cranio-facial injuries also differ from those of cranio-cerebral and maxillo-facial injuries [1, 2, 4, 6]. Taking all the above mentioned into consideration it is necessary to determine the position of the concomitant cranio-facial injury in the structure of both - maxillo-facial and cranio-cerebral injuries, and detect its age peculiarities.

Mechanism and occurrence circumstances of concomitant cranio-facial injuries appear to be the key point in understanding the problem of pathogenesis of concomitant cranio-facial injury. Study of mechanism and occurrence circumstances of the concomitant cranio-facial injury, determination of mutual influence of its components on the clinical course and occurrence of the injury is considered to be one of the most important issues of maxillo-facial surgery and neurosurgery [1, 3, 5].

Study of pathogenesis of the cranio-facial injury allows determining the role of its components in the development of traumatic disease and traumatic shock, specifying the range of essential procedures aimed at the therapy of this severe pathology. Estimation of the relations between the severity of cranio-facial injuries and localization of facial fractures gives an opportunity to more targetedly carry out diagnostic procedures, adequately assess patient's status and timely perform treatment of these patients.

Estimation of the extent and sequence of diagnostic procedures depending on the severity of patient's condition, manifestations of the components of cranio-facial injuries, development and introduction of examination algorithm of patients with such injuries allows to reduce duration of examination, avoid aggravation of patients' condition as a result of diagnostic procedures, timely begin targeted treatment [1, 2, 6].

Up to the present moment there is no unique strategy of treatment of patients with concomitant cranio-facial injuries; a protocol for coordination between various specialists (a neurosurgeon, a maxillo-facial surgeon, a resuscitator, an otorhinolaryngologist, an ophthalmologist) to perform diagnostic and therapeutical procedures to patients with cranio-facial injuries including severe traumas has not developed yet; this adversely affects quality of treatment, results in multiple diagnostic mistakes, unreasonably long-term treatment and disability [1, 2, 4, 9].

In most cases patients with concomitant cranio-facial injuries are not given specialized neurosurgical, maxillo-facial, ophthalmological, otorhinolaryngological care due to diagnostic mistakes and incorrect therapeutical approach and site of treatment.

## MATERIALS AND METHODS

1691 patients with concomitant cranio-facial injuries were examined and treated in the Neurosurgical Department of the City Emergency Care Hospital No.1, Voronezh, Russia, during the period from 2001 to 2015. Among them there were 1327 males and 364 females; their proportion was 3.6: 1. Age distribution of the injured is given in Table 1 "Age distribution of patients with concomitant cranio-facial injuries".

Occurrence circumstances of concomitant cranio-facial injuries are shown in Table 2 "Occurrence circumstances of concomitant cranio-facial injuries".

**Table 1: Age distribution of patients with concomitant cranio-facial injuries**

15-20 years of age	20-30 years of age	30-40 years of age	40-50 years of age	50-60 years of age	60-70 years of age	70-80 years of age	Total:
103	650	469	224	143	86	16	1691

**Table 2: Occurrence circumstances of concomitant cranio-facial injuries**

Criminal-home accident	676	39,9%
Motor vehicle accident, driver or passenger	209	12,4%
Motor vehicle accident, pedestrian	122	7,3%
Fall from height	89	5,2%
Outdoor injuries	219	12,9%
Occupational injuries	27	1,7%
Sport injuries	19	1,1%
Occurrence circumstances of the injury are unknown	330	19,5%
Total	1691	100%

**Table 3: Distribution of patients with concomitant cranio-facial injuries depending on the severity of cranio-cerebral trauma**

Mild cranio-cerebral injury		Moderate cranio-cerebral injury		Severe cranio-cerebral injury		Total	
1418	83,9%	220	13,0%	53	3,1%	1691	100%

**Table 4: Localization of facial fractures in patients with concomitant cranio-facial injuries**

Lower facial area		Mid-facial area		Upper facial area		total	
Abs.	%	Abs.	%	Abs.	%	Abs.	%
529	31,3%	1107	65,5%	55	3,2%	1691	100%

Distribution of patients with concomitant cranio-facial injuries depending on the severity of cranio-cerebral trauma is given in Table 3 “Distribution of patients with concomitant cranio-facial injuries depending on the severity of cranio-cerebral trauma”.

Localization of maxillo-facial component of cranio-facial injuries is given in Table 4 “Localization of facial fractures in patients with concomitant cranio-facial injuries”.

All patients received treatment including fixation of fracture fragments with conservative-surgical or surgical approach and therapy of the cranio-cerebral injury according to the approved standard of care.

Distribution of conservative-surgical and surgical therapeutical approaches was as follows: 901 patients received surgical treatment that amounted 53.3%; 790 patients were administered orthopedic methods (fixation) that amounted 46.7%.

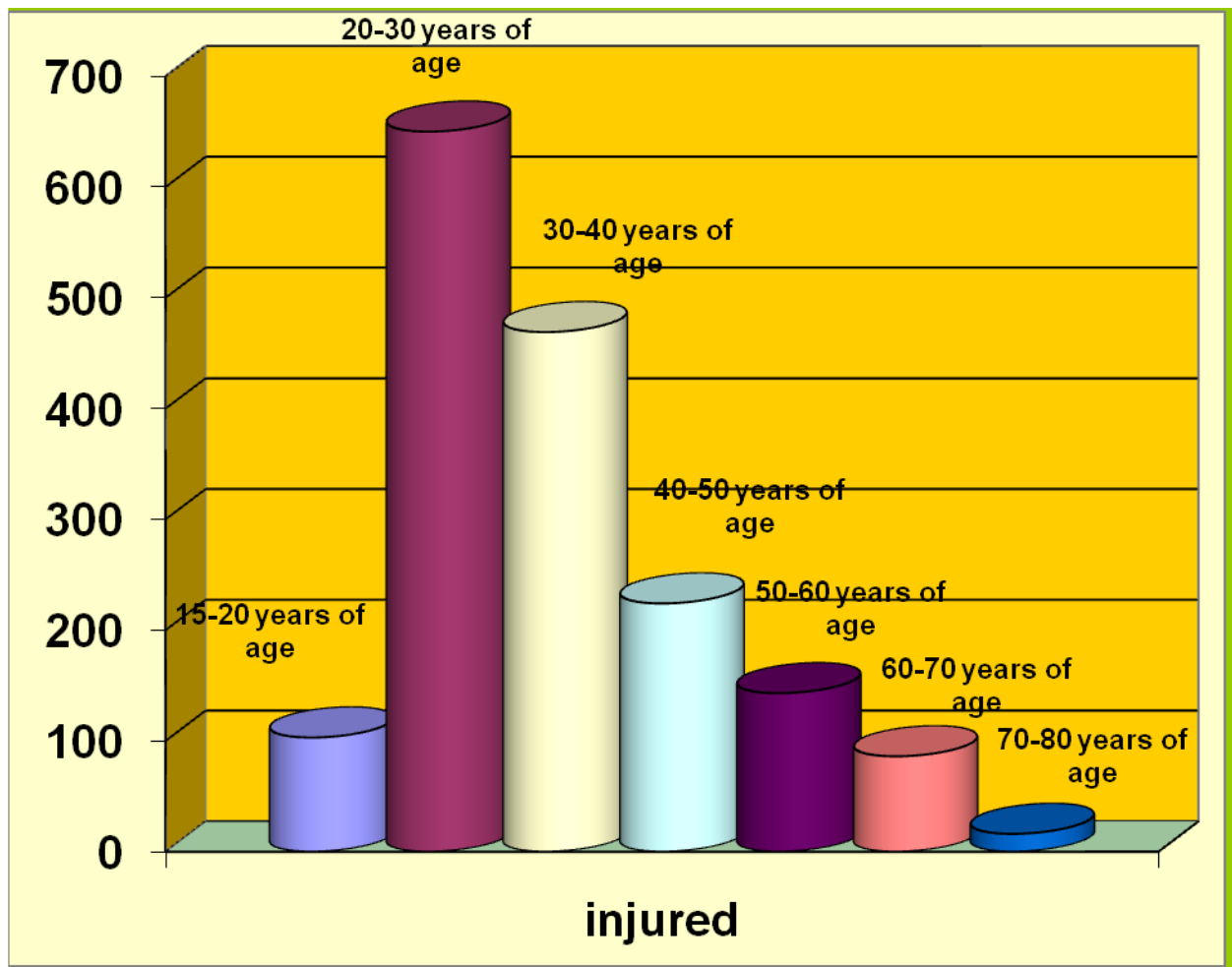
## RESULTS AND DISCUSSION

Analyzing the obtained data it is possible to estimate certain regularities and peculiarities of concomitant cranio-facial injuries.

Thus, gender composition of the injury differs from that of maxillo-facial injuries – proportion of males to females is 7: 1, and of cranio-cerebral injuries – proportion of males to females is 2:1 - and is determined at the level of 3.6: 1. This proportion definitely results from the occurrence circumstances of injuries: criminal-home accidents prevails (up to 40%); the most severe, so termed “high speed” traumas (motor vehicle accidents, fall from height) amounts to 25%; 60% of the injured are admitted in the condition of the alcohol intoxication.

Age distribution of concomitant cranio-facial injuries is graphically presented in Figure 1 “Age distribution of concomitant cranio-facial injuries”.

**Figure 1: Age distribution of concomitant cranio-facial injuries**



It is evident that most of the injured are people of working age from 20 to 40 years of age – their number amounts to 66.2% - therefore, treatment and rehabilitation of patients with concomitant cranio-facial injuries are considered to be an acute social problem.

Concomitant cranio-facial injuries, as injuries of other types, may be divided into so-termed “low-speed” (criminal-home accidents, outdoor injuries, sport injuries) and “high speed” injuries (motor vehicle accidents, fall from height) depending on the occurrence circumstances. The authors consider that it is possible to define so-termed “middle speed injury”, which occur under the following circumstances: fall from a bicycle, a criminal home accidents – a kick in a face or other facers.

Peculiarities of pathogenesis of concomitant cranio-facial injuries are considered to be a cushioning factor of facial bones resulted from both - their arch structure (causing force decomposition of the damaging factor) and their structure similar to a grid. As a result, mild cranio-cerebral injuries prevail in the structure of concomitant cranio-facial injuries.

Undoubtedly, there exists a dependence of facial fractures localization on the severity of cranio-cerebral injuries in patients with concomitant cranio-facial injuries. Various forces are needed for various facial bones to be broken; localization of these bones in relation to brain structures is also varied. The correlation range revealed by the authors is given in Table 5 “Dependence of the severity of cranio-facial injuries on facial fractures localization”.

**Table 5: Dependence of the severity of cranio-facial injuries on facial fractures localization**

Cranio-cerebral injury Facial area	Mild cranio-cerebral injury	Moderate cranio-cerebral injury	Severe cranio-cerebral injury
Upper	3	17	33
Middle	912	175	20
Lower	501	28	-

The authors have developed and successfully put into practice the scheme of diagnostic procedures in patients with concomitant cranio-facial injuries. The application of this scheme allows to perform diagnostic procedures not aggravating patients' condition, concentrating on the mostly significant diagnostic and non-invasive therapeutical procedures.

**Scheme 1: Sequence of diagnostic procedures in patients with concomitant cranio-facial injuries**

Systemic condition of a patient	Criteria of health index	Extent of obligatory diagnostic procedures	
		Neurosurgical	Maxillo-facial
Compensation	<ol style="list-style-type: none"> <li>1. Hemodynamics – stable (deviations from norm do not exceed 20%)</li> <li>2. Shock index — 0,5 - 1,0</li> <li>3. Gradient of temperature — 2 - 4 grades.</li> <li>4. Consciousness of a patient — clear</li> <li>5. Neurological symptoms — cerebral</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical examination</li> <li>choencephalography (middle brain structure)</li> <li>X-ray, two projections (frontal and lateral)</li> <li>4.X-ray CT, Nuclear MR tomography</li> <li>5.Lab tests</li> <li>6. Lumbar puncture</li> <li>7. Dynamic observation</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical examination.</li> <li>2.X-ray, three views (frontal, lateral, frontal half-axial)</li> <li>3.X-ray in special set ups, zonography.</li> <li>4. X-ray CT (bone window)</li> <li>5. Lab tests</li> </ol>
Subcompensation	<ol style="list-style-type: none"> <li>1. Hemodynamic stable, deviations exceed 20%, hypotension is frequent.</li> <li>2. Shock index — 1,0 - 2,0</li> <li>3. Gradient of temperature — 2 - 4 grades.</li> <li>4. Consciousness of a patient— clouding of consciousness superficial or deep, sopor.</li> <li>5. Neurological symptoms — cerebral, appearance of focal symptoms.</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical examination</li> <li>choencephalography (middle brain structure)</li> <li>X-ray, two projections (frontal and lateral)</li> <li>4.X-ray CT</li> <li>5. Lumbar puncture</li> <li>6. Dynamic observation</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical examination</li> <li>2. X-ray in the most important projection</li> </ol>
Decompensation	<ol style="list-style-type: none"> <li>1. hemodynamics – de-stabilized, expressed hypodynamia is frequent.</li> <li>2. Shock index — more than 2,0</li> <li>3. Gradient of temperature — 8 - 15 grades.</li> <li>4. Consciousness of a patient— coma superficial or deep, irreversible.</li> <li>5. Neurological symptoms — both cerebral and focal.</li> </ol>	<ol style="list-style-type: none"> <li>1. .Physical examination</li> <li>choencephalography (middle brain structure)</li> <li>3.X-ray CT</li> <li>4.Diagnostic trephination</li> </ol> <p>Note: in 2, 3, 4 X-ray CT is preferable.</p>	<ol style="list-style-type: none"> <li>1. Physical examination</li> </ol>

The authors have also developed and effectively applied the scheme of maxillo-facial surgical care to the injured, which takes into account cooperation of various specialists. The authors consider the cranio-cerebral injury to be the leading component of concomitant cranio-facial injuries and the scheme of maxillo-facial surgical care to the injured have been developed based on this point of view.

**Scheme 2: Sequence of maxillo-facial surgical care to patients with concomitant cranio-facial injuries**

Type of aid	Aid characteristics
Urgent	Is given at the moment of admission: 1. In case of massive bleeding in the maxillo-facial area 2. In case of traumatic asphyxia
Medical emergency	Is given during the first 24 hours: 1. In case of mild cranio-cerebral injury 2. In case of severe cranio-cerebral injury and necessity of urgent neurosurgical intervention (from one narcosis)
Medical emergency postponed	Is given to patients with moderate or severe cranio-cerebral injury under: 1. Clear consciousness 2. Positive neurological dynamics.

**CONCLUSION**

- Males prevail in the structure of patients with concomitant cranio-facial injuries; most of them are of the working age from 20 to 40; their number amounts to 66.2%.
- Concomitant cranio-facial injuries most often result from criminal-home accidents.
- Severity of the cranio-cerebral injury directly depends on facial fractures localization, i.e. a place of application of a damaging factor. The most severe injuries occur in case of multiple upper jaw fractures and fractures of upper facial area.
- Fractures of upper facial area are accompanied by at least mild brain contusions in practically 100% of cases; fractures of mid-facial area excluding nasal bones and alveolar process of the maxilla are accompanied by brain contusions in 80% of cases.
- Formation of hemispherical subdural hematomas under brain contusion is typical for concomitant cranio-facial injuries.
- Examination of the patients with concomitant cranio-facial injuries includes assessment of the severity of systemic condition and local manifestations of an injury. Extent of diagnostic procedures depends on the status of vital body functions and in no form should aggravate patient’s condition. Application of the scheme of diagnostic procedures in patients with concomitant cranio-facial injuries allows within a short time to evaluate the severity of an injury not affecting the systemic condition of a patient.
- Complex approach to pathogenetic treatment, its directional effect, performance of major therapeutical principles of concomitant cranio-facial injuries give an opportunity to restore anatomical and functional integration of facial skeleton, provide complete rehabilitation of patients in optimal terms, reduce percentage of mortality and disability in the injured.
- Treatment of patients with cranio-facial injuries should be carried out in multi-field hospitals with high level of facilities; it will be helpful to organize a special centre to provide care for such patients.

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