

Changes In Biochemical And Cytokine Markers Of The Liver In The Acute Period Of Combined Facial Trauma

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Annotation

This article presents the results of an assessment of the functional state of the liver in patients with concomitant facial bone injuries. The study included 58 patients treated at the Andijan branch of the Russian Scientific Center for Emergency Medicine. Blood biochemical parameters reflecting inflammatory activity, protein-synthetic function of the liver, and the degree of cytolysis (procalcitonin , total protein, albumin, ALT , and AST) were assessed dynamically from admission to the seventh day. It was found that in the first hours after injury, a pronounced activation of the systemic inflammatory response and cytolytic syndrome is observed: a significant increase in procalcitonin , increased transaminase activity, and a decrease in protein fractions. By the fifth and seventh days, these parameters gradually normalize, indicating the restoration of metabolic liver function and the effectiveness of the therapy.

Key words: combined injury, maxillofacial region, liver, procalcitonin , transaminases, protein metabolism, cytolysis, inflammation, biochemical parameters.

Literature review of this article

Combined facial bone injuries are one of the most complex forms of polytrauma and are accompanied by significant systemic impairment affecting various organs and physiological systems. According to international epidemiological reviews (Zhang et al ., 2021; WHO, 2023) , the incidence of craniofacial injuries in multiple trauma ranges from 10% to 15%, and the combination with traumatic brain and thoracic injuries significantly increases the risk of multiple organ failure.

The liver plays a central role in the pathogenesis of traumatic injury due to its detoxifying , metabolic, and synthetic functions. Severe injuries trigger activation of systemic inflammation, leading to a pronounced cytokine response and disruption of homeostasis.

One of the most sensitive laboratory markers of the early systemic inflammatory response in trauma is procalcitonin . The work of Chappuis et al . (2022) and Liu et al . (2024) confirm its high diagnostic and prognostic value in injuries of various localizations, including the facial skeleton.

Decreased total protein and albumin levels are considered an important indicator of the severity of traumatic injury and are associated with an unfavorable post-traumatic course (Ergashev , 2022). Taken together, these data highlight the need for a comprehensive assessment of biochemical and cytokine parameters in concomitant facial bone injuries to determine the extent of systemic damage.

Introduction

Combined facial bone injuries remain one of the most pressing problems in modern maxillofacial surgery. Increased traffic volumes, along with domestic and industrial injuries, are leading to an increased incidence of craniofacial injuries, which are often associated with injuries to other areas, including craniocerebral, thoracic, and abdominal trauma.

A characteristic feature of combined injuries is the systemic nature of pathological changes, including activation of inflammatory, metabolic, and neuroendocrine responses, which determines the severity of the clinical course. The liver plays a key role in this process, participating in the regulation of protein and carbohydrate metabolism, detoxification, and cytokine synthesis.

Despite the accumulated data on the mechanisms of traumatic disease, the relationships between the clinical manifestations of combined injuries to the maxillofacial region and changes in biochemical and immunological parameters reflecting the body's systemic response remain insufficiently studied.

Purpose of the study

The aim of the study was a comprehensive assessment of the functional state of the liver in patients with combined facial bone injuries based on the analysis of biochemical, protein-metabolic and cytokine blood parameters, as well as determining their diagnostic and prognostic significance in the dynamics of the acute period of traumatic disease.

Materials and methods

The study was conducted at the Andijan branch of the Russian Scientific Center for Epidemiology and Microbiology.

Criteria for inclusion of patients in the study:

- the presence of a clinical diagnosis of combined injuries to the maxillofacial region;
- consent for the patient to participate in the study ;
- age 18-70 years;
- absence of chronic liver diseases .

Exclusion criteria for patients in the study:

- age up to 18 years and over 75 years ;
- refusal to participate in research ;
- isolated injuries of the maxillofacial region;
- the presence of acute or chronic pathological conditions of the liver;

The average age of patients was 32 ± 7 years; men accounted for 83.6%.

Research methods: biochemical and immunological blood analysis (procalcitonin , total protein, albumin, ALT , AST). Blood was collected at 4 time points: upon admission, on the 3rd, 5th and 7th days.

Results

Dynamics of changes in biochemical parameters of the liver.

Indicator	Norm	Deviations (n=58)
Upon admission (12 hours)		
Procalcitonin , ng /ml	Up to 0.05	2.670 - 9.110
Total protein, g/l	60 - 80	66.64
Albumin, g/l	35 - 55	37.21
ALT , U /L	Up to 37/31	55.4 ± 8.1
AST , U /L	Up to 47/31	51.1 ± 7.5
3 days		
Procalcitonin , ng /ml	Up to 0.05	1.825 ± 0.61
Total protein, g/l	60 - 80	64.21 ± 4.5
Albumin, g/l	35 - 55	35.15 ± 3.2

ALT , U /L	Up to 37/31	42.5 ± 6.2
AST , U /L	Up to 47/31	41.3 ± 5.9
Day 5		
Procalcitonin , ng /ml	Up to 0.05	0.980 ± 0.22
Total protein, g/l	60 - 80	67.58 ± 4.2
Albumin, g/l	35 - 55	38.65 ± 3.0
ALT , U /L	Up to 37/31	36.1 ± 5.5
AST , U /L	Up to 47/31	35.2 ± 5.1
Day 7		
Procalcitonin , ng /ml	Up to 0.05	0.350 ± 0.11
Total protein, g/l	60 - 80	70.15 ± 3.8
Albumin, g/l	35 - 55	40.50 ± 2.8
ALT , U /L	Up to 37/31	31.9 ± 4.8
AST , U /L	Up to 47/31	30.7 ± 4.5

At the time of admission, all indicators demonstrate significant deviations from the norm: the level of procalcitonin is significantly higher than the reference range, the concentrations of total protein and albumin are reduced, and the activity of transaminases exceeds the limits of physiological values.

On the third day, partial improvement is noted: procalcitonin levels decrease, but total protein and albumin levels remain below normal. Liver enzyme activity decreases but remains elevated.

By the fifth day, further positive dynamics are observed. Procalcitonin levels continue to decline, while protein and albumin levels increase and approach normal values. Transaminase activity decreases more significantly, but still does not fully meet reference values.

On the seventh day, most parameters show recovery: procalcitonin reaches normal levels, total protein and albumin concentrations stabilize within normal limits, and ALT and AST activity returns to the physiological range.

ABOUT the discussion

The study's findings confirm that combined facial bone trauma is accompanied by severe systemic inflammation, metabolic disturbances, and significant liver involvement in the pathological process. Within the first hours after injury, a significant increase in procalcitonin levels was observed, reflecting the activation of the early systemic inflammatory response. Concurrently, decreased total protein and albumin concentrations indicate impaired protein-synthetic function of the liver, while increased ALT and AST activity indicate the development of cytolytic syndrome and compromised hepatocyte integrity .

Laboratory parameter dynamics during the first week demonstrate gradual restoration of liver function. On the third day, a decrease in transaminase activity and procalcitonin are noted , although protein metabolism parameters remain depressed . By the fifth day, enzymatic activity further decreases and protein fractions increase, and by the seventh day, most parameters have returned to normal, reflecting stabilization of

metabolic processes. This trend indicates the presence of a pronounced compensatory potential in the liver, allowing for gradual restoration of function with timely and adequate therapy.

A comparison of the obtained data with literature data confirms that the liver is one of the key target organs in systemic inflammation following combined trauma. Elevated transaminases and decreased protein fractions are also considered early prognostic markers of traumatic disease severity, which is fully consistent with the results of this study. By the seventh day, recovery of these parameters is observed in most patients, emphasizing the importance of regular monitoring of laboratory markers over time.

Conclusion

In patients with combined facial bone trauma, significant disturbances in biochemical and cytokine parameters are detected in the early stages, reflecting the activation of systemic inflammation, cytolysis, and a decrease in the protein-synthetic function of the liver.

Dynamic observation shows that during the first week, a gradual normalization of the main parameters occurs: the levels of procalcitonin, ALT and AST decrease, and the total protein and albumin levels are restored.

The obtained data confirm that biochemical and cytokine markers are informative criteria for assessing the severity of the condition and monitoring the effectiveness of treatment in the acute period of combined facial trauma.

The study results highlight the need for comprehensive laboratory monitoring of the liver in this category of patients and demonstrate its key role in the pathogenesis of the systemic response to injury.

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