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Specyfika i zawartość merytoryczna czasopisma nie ulega zmianie.

Zgodnie z informacją MNiSW z dnia 2 czerwca 2014 r., że w roku 2014 nie będzie przeprowadzana ocena czasopism naukowych; czasopismo o zmienionym tytule otrzymuje tyle samo punktów co na wykazie czasopism naukowych z dnia 31 grudnia 2014 r.

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## **DYNAMICS OF INTERLEUKIN-6 IN EARLY PERIOD IN THE EARLY PERIOD AFTER SIMULATION SKELETAL, CRANIAL AND COMBINED INJURIES**

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### **Summary**

Simulation of mechanical injuries of various localization in the early period traumatic disease leads to the accumulation in serum IL-6. After application of the skeletal injuries observed vibrational dynamics rate of increase in the first – after 1 day, reduced to the level control – 3 days and again, but smaller in amplitude – after 7 days. In the dynamics of cranial injury rate increases significantly in 7 days compared to the control. After applying the combined trauma of the content in serum blood IL-6 1 day after reaching the maximum level and remains at that level to 7 days. After 3-7 days in this group figure significantly higher than in other groups, where modeled separately and individually skeletal, cranialin juries, this effect manifested their mutual encumbrance.

**Key words: skeletal, cranial, cranoskeletal injury, interleukin-6, experiment.**

**Introduction.** Traumatism actual problem today is that due to the steady increase in the incidence of multiple and combined trauma. Its pathogenesis leading role systematic violations that occur in organs and tissues distant from the place of direct damage. The starting point of development is release in the systemic circulation of inflammatory mediators – cytokines. In terms of injury consistently secreted proinflammatory cytokines such as tumor necrosis factor interleukin-1 and interleukin-6 (IL-6).

Among them prominently IL-6, which became important in clinic prognostic factor in the course of severe injury. Today, found that increasing the level of IL-6 correlated with the severity of injuries in trauma and reflects the overall risk of fatal [7, 8]. In addition, IL-6 inherent anti-inflammatory effect, which manifests itself suppression of secretion of tumor necrosis factor- $\alpha$  and interleukin-1, activation of liver production of acute phase proteins and stimulation of the hypothalamic-pituitary-adrenal system [5, 9, 10], which contributes to the regulation of inflammatory response.

However, in the experimental mechanical injuries of various localization dynamics of blood IL-6 practically not been studied, which significantly limits the experiment to study the pathogenesis of severe injury.

**Objective:** To find out the dynamics of interleukin-6 in the early period after skeletal modeling, cranial and combined cranioskeletal injuries.

**Materials and methods.** Experiments were performed on 104 nonlinear white rats weighing 180-200 g Rats were on a standard diet vivarium. They were injured in the conditions of thiopental sodium anesthesia ( $40 \text{ mg} \cdot \text{kg}^{-1}$  weight). Modeling of cranial skeletal injury was performed according to our methodology through dosed effort on both hind legs with the aid of a specially designed device that triggered the closed fracture of both thighs and causing dosed effort on the skull with energy 0,375 J, which corresponded to the injury of moderate severity [2]. In some groups, these injuries were applied separately. The control group consisted of intact animals.

The animals that survived, were withdrawn from the experiment in terms of anesthesia after 1, 3 and 7 days of post-traumatic period by total bloodletting from the heart. For the study were used blood serum, which were tested for content main IL-6 using the analyzer Stat Fax (USA).

When working with laboratory animals we observed international requirements of humane treatment of animals under the rules of the “European Convention for the Protection of Vertebrate Animals which used for experimental and other scientific purposes” (European Convention, 1984).

The resulting digital data processed statistically. Authenticity differences between the

experimental groups was evaluated using the program STATISTICA 10.0 (“StatSoft, Inc.”, USA).

**Results and discussion.** As shown in Table 1 and Figure 1 under the influence of skeletal injuries contents IL-6 serum compared to the control group after 1 day and become significantly increased in 67,7 % higher ( $p < 0.05$ ).

Further, in 3 days, the index decreased almost to the level control ( $p > 0.05$ ), which was significantly lower than in previous observation period (at 40,0 %,  $p < 0.05$ ). After 7 days figure again increased – by 15,5 % compared with the previous observation period, which was statistically significant ( $p < 0.05$ ) and 17,1 % higher than the control group ( $p < 0.05$ ).

After a brain injury reaction content was more IL-6 inert. Index slightly increased and only 7 days became statistically significantly greater than the control (17,5 %,  $p < 0.05$ ). In this observation period figure exceeded the result obtained after 1 day (15,7 %,  $p < 0.05$ ).

After combined injury rate increased by 1 day compared to the control group to 61,2 %, which was statistically significant on the control ( $p < 0.05$ ) and remained at the same level to 7 days ( $p > 0.05$ ), exceeding control respectively 52,0 and 55,6 % ( $p < 0.05$ ).

**Table 1** – Content IL-6 serum ( $\text{pg} \cdot \text{ml}^{-1}$ ) in skeletal dynamics, traumatic brain injury and combined (M±m)

Type of injury	control	1 day	3 day	7 day
skeletal	4,01±0,15 (n=8)	6,73±0,22 (n=10)	4,04±0,14 (n=10)	4,70±0,20* (n=9)
craniocerebral		4,14±0,19 (n=8)	4,14±0,19 (n=8)	4,71±0,15* (n=7)
combined		6,47±0,28* (n=8)	6,10±0,21* (n=7)	6,24±0,31* (n=7)
p <sub>1-2</sub>		<0,05	>0,05	>0,05
p <sub>1-3</sub>		>0,05	<0,05	<0,05
p <sub>2-3</sub>		<0,05	<0,05	<0,05

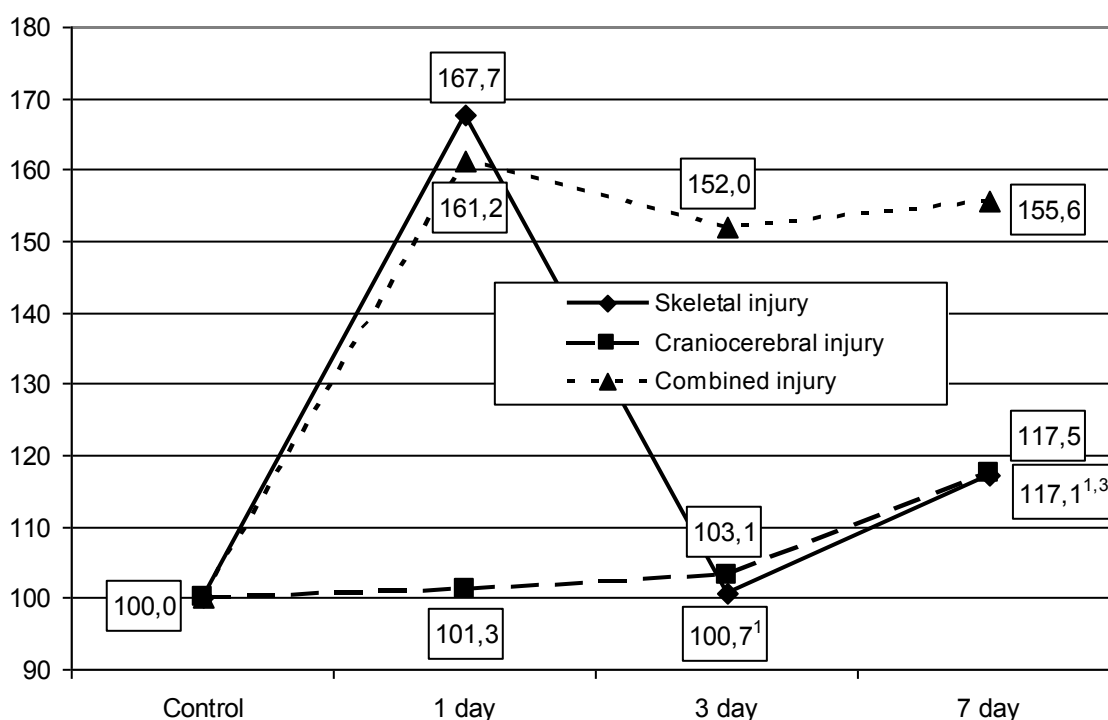
Notes:

1. \* – differences concerning the control group statistically significantly ( $p < 0.05$ );
2. p<sub>1-2</sub> – the likelihood of differences between the research groups of skeletal and brain injury;
3. p<sub>1-3</sub> – the likelihood of differences between the research groups of skeletal and associated trauma;
4. p<sub>2-3</sub> – the likelihood of differences between the research groups of craniocerebral trauma and combined.

Comparing research groups together, it turned out that after 1 day figure was statistically significantly higher after the very skeletal and combined injuries compared to cranial and traumatic injuries (by 65,4 %,  $p_{1-2}<0,05$  and 59,0 %,  $p_{2-3}<0,05$ ).

After 3 days the figure clearly prevailed after combined injury: relation skeletal – to 51,0 % ( $p_{1-3}<0,05$ ) in respect of a brain – by 47,3 % ( $p_{2-3}<0,05$ ). After 7 days post-traumatic period situation was similar – the content of IL-6 in serum is much higher than other research groups, compared to skeletal trauma – 32,8 % ( $p_{1-3}<0,05$ ), brain – on 32,5 % ( $p_{2-3}<0,05$ ).

In the dynamics of craniocerebral injury figure virtually unchanged for 1-3 days, but after 7 days significantly increased compared with control.



**Figure 1** – The dynamics of IL-6 in serum (percentage of level control) after skeletal, craniocerebral and combined injuries. (<sup>1,3</sup> – differences compared to under 1 and 3 day statistically significant,  $p<0,05$ ).

After applying the combined trauma of the content in serum IL-6 1 day after reaching the maximum level and remains there until 7 days. After 3-7 days in this group figure significantly higher than in other groups, where modeled separately and individually skeletal traumatic brain injury. Obtained the experiment results confirm the clinical data regarding the substantial role of IL-6 in the pathogenesis of traumatic disease caused skeletal trauma [3, 4].

In dynamics content violations IL-6 evident mutual burdening effect after simultaneous application of skeletal and brain injuries, indicating its great sensitivity to the severity of injuries. Causes discussion at its maximum increase mechanical trauma of various locations in 7 days

post-traumatic period. On the one hand, this is evidence of the maximum system response against inflammation, as evidenced by our previous results and those of other authors on the dynamics of lipid peroxidation process violations and antioxidant protection in the application of these injuries that after 7 days were highest [1, 11]. On the other hand impossible to eliminate anti-inflammatory effect of IL-6 because its accumulation inhibits the formation of other proinflammatory cytokines due to stimulation of the hypothalamic-adrenal system pituitary [5, 9, 10].

Our results indicate the general patterns of inflammatory response in the body as post-traumatic period in humans and in laboratory animals, allowing greater use of combined model we developed cranioskeletal injury to study the mechanisms of traumatic disease course and testing various methods of correction.

**Conclusions.** 1. Modelyuvannya mechanical injuries in various localization early period of traumatic disease leads to the accumulation in serum IL-6.

2. After applying skeletal injuries observed vibrational dynamics indicator to the first increase – after 1 day, reduced to the level of control – in 3 days and again, but smaller in amplitude – after 7 days.

3. In the dynamics of brain injury rate increases substantially after 7 days compared to the control.

4. After causing injury combined content in serum IL-6 are 1 day reaches the maximum level and remains there until 7 days. After 3-7 days in this group figure significantly higher than in other groups, where modeled separately and individually skeletal traumatic brain injury, the effect appears their mutual encumbrance.

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