

(7-day LAK cells). The detected suppressor effect of rIL-2 - activated macrophages - appears to play a significant role in the regulation of the biological activity of LAK cells.

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Rheumatoid Factors of the Blood and Cerebrospinal Fluid in Patients with a Complicated Spinal Injury

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The levels of rheumatoid factors (RF) of IgM-RF and IgG-RF classes were measured by enzyme immunoassay (EIA) in the sera of patients with spinal injuries. Analysis showed that 46% of patients with spinal injuries were seropositive for IgG-RF and 40% for IgM-RF; no IgG-RF was detected in the cerebrospinal fluid (CSF), whereas the IgM-RF content was 37.6 µg/ml. Results of RF measurements in the sera make it possible to qualify the systemic involvement of the body in the late period of a spinal injury as a rheumatic disease. The findings point to the presence of independent mechanisms of immune control in the CSF.

Key Words: *spinal injury; rheumatoid factors*

Neurological deficit in a spinal injury is regarded as the cause of impaired motor activity and systemic visceral involvement. Spinal injuries are associated with disorders in the hemo- and CSF dynamics. Changes in the basic parameters of the blood and immunological shifts during an injury are sufficiently well documented in the literature

[1]. Traumatic disease of the spine in the long term is classified by many signs among the autoimmune diseases. The presence of chronic inflammations and disturbances in the immune system suggest that antibodies to the patient's own immunoglobulins (RF) contribute to the development of the disease.

To elucidate the role played by RF in the pathogenesis of traumatic spinal disease, we measured RF levels in the serum and CSF.

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TABLE 1. Measurements of Serum IgG and IgM RF

Group of patients	Seropositive for IgG-RF, %	Seropositive for IgM-RF, %
1. Spinal injury, late period (n=47)	46	40
2. Spinal injury, early period (n=7)	14	0
3. Craniocerebral injury (n=7)	12	0
4. Nontraumatic spinal diseases (n=7)	33	14

MATERIALS AND METHODS

Serum and CSF levels of IgM and IgG RF were measured by EIA [8]. The patients examined were as follows: group 1, patients with long-term spinal injuries (over 4 months after the injury); group 2, those with recent spinal injuries (up to 2 weeks after the injury); group 3, patients with craniocerebral injury; and group 4, with nontraumatic spinal diseases. Blood samples were collected in groups 1-4, CSF samples in groups 1, 3, and 4. Serum and CSF samples were stored frozen. The procedure of RF measurement was described previously [8]. The results were statistically processed using White's *T* test [2].

RESULTS

Results of RF measurements in the blood of patients are summarized in Table 1. Analysis of the results with consideration for the discriminant parameter estimated during investigation of 10 donor sera showed that 46% of patients with traumatic disease of the spine (group 1) were seropositive for IgG-RF and 40% were seropositive for IgM-RF. The IgG-RF levels in patients with recent injuries to the central nervous system (CNS) (groups 2 and 3) were lower (12-14%), but nonetheless twice as high as in donors. In group 4, 33% of patients were seropositive for IgG-RF. Analysis of the CSF (Table 2) in patients showed the absence or just trace amounts of IgG-RF in all the samples tested. The level of IgM-RF was the highest in group 1, although its difference from other groups was unreliable.

The patients with spinal injuries were screened for RF for the following reason. The clinical pictures of traumatic disease in the long term and of rheumatic diseases (rheumatoid arthritis, acute rheumatic fever, reactive arthritis) have much in common. Far advanced traumatic disease may be associated with complications which are observed in rheumatic diseases as well: massive inflammatory processes, heterotopic ossification, tissue fibrosis, and visceral involvement [7]. The clinical observations carried out in the present study showed

that traumatic injuries to the spine (group 1) were associated in many patients with disturbances of cardiac activity, such as lability of the pulse and arterial pressure, tachycardia and bradycardia, and extrasystole. Many patients developed kidney stones, regarded by some authorities as a manifestation of degenerative disorders [3]. Our study showed that the development of visceral disorders went along with a rise of the IgM-RF level in the blood (40% of patients were seropositive), which is a prognostically unfavorable factor [7]. The blood IgG-RF level has been linked to the activity of a rheumatic disease [14]. The activity of the disease in spinal patients is largely determined by the intensity of inflammatory complications. Our research revealed a clear-cut correlation between the severity of the inflammatory process and the blood IgG-RF level. According to published data [11], IgG-RF is detected in the blood after a secondary infection, and RF formation is preceded by an increase in the level of circulating immune complexes (CIC). CIC have been proved to contribute to the development of an inflammatory process [10]. The formation of IgG-RF following a rise of the CIC level seems to be conducive to the progress of inflammation. Previously we revealed an elevated CIC level in patients with a complicated course of traumatic disease (with inflammations) [10]. The present study showed that the development of inflammatory complications in spinal patients (group 1) was associated with an increase of the IgG-RF level and of such parameters as urinary protein and leukocytes, erythrocyte sedimentation rate, and blood fibrinogen. In some patients the levels of both IgG-RF and IgM-RF were elevated, and this corresponded to the most severe forms of the disease. The study revealed a similarity between the patients with a fresh spinal injury (group 2) and with a craniocerebral injury (group 3): no IgM-RF and low levels of IgG-RF. Such findings are explained by the fact that only in the late period of the disease can the conditions for the development of autoimmune disorders emerge. Noteworthy is the increase of the IgG-RF level in group 4 patients, 33% of whom were found to be seropositive. This group consisted of patients with nontraumatic dis-

TABLE 2. Content of IgM-RF in the CSF ($M \pm m$)

Group of patients	IgM-RF, $\mu\text{g/ml}$
1. Spinal injury, late period ($n=11$)	37.6 ± 15.3
2. Spinal injury, early period	not tested
3. Craniocerebral injury ($n=10$)	22.5 ± 9.5
4. Nontraumatic diseases of the spine ($n=6$)	19.3 ± 7.4

eases of the spine (osteochondrosis, disk hernias, etc.). These patients developed such visceral disturbances as fibrous degeneration of the kidneys, changes in the urinary system, and cardiac disorders, which were assumed to be caused by involvement of the autonomic nervous system [3]. Our findings suggest that in patients with nontraumatic diseases of the spine the severity of the condition, related to a deep-seated degenerative restructuring of the viscera, is reflected in the level of IgG-RF.

Difficulties in pinpointing the cause of RF formation do not preclude the use of tests for RF detection in the blood of patients with many diseases. The data about RF levels in the CSF in various diseases are scant. We detected differences between IgM-RF levels in patients of groups 1 and 3, which may be indicative of different routes of accumulation of the factor in the CSF of patients with various diseases. In group 2 patients the levels of IgM-RF varied from 0 to 90 $\mu\text{g/ml}$, which may be due to different degrees of injury to the blood-brain barrier (BBB). The process of repair of the blood-brain barrier is known to be sometimes complete as soon as by the end of the second week after injury [12]. In spinal patients in the late period of the disease (group 1) the level of IgM-RF in the CSF was 37.6 $\mu\text{g/ml}$, whereas its level in the blood was 149 $\mu\text{g/ml}$. In the long term, when the cicatrization of the spinal tissue

defect is complete, the accumulation of IgM-RF may be caused by activation of immunocompetent cells of the CSF which are responsible for immunological control [5]. If the BBB is intact, pathogenic bacteria are not propagated in the CSF, and this may account for the absence of IgG-RF, whose formation is usually attributed to the development of an inflammatory process. The study failed to detect a correlation between RF levels in the CSF and the intensity of inflammatory processes in the patients, but the results are new evidence that the CSF harbors independent mechanisms mediating immunological control. The findings indicate that RF measurement in the serum is a reliable serological test to assess the severity of the patient's state in traumatic disease of the spine.

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