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Serum lactate dehydrogenase levels in patients with amyotrophic lateral sclerosis

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease which leads to motor neuron death and atrophy of muscle caused by denervation (8).

Lactate dehydrogenase (LDH) is an enzyme involved in anaerobic glycolysis. It catalyzes the interconversion of lactate and pyruvate (10). The experimental investigation conducted on giant sarcolemmal vesicles obtained from rat muscle showed diminished rate of lactate transport and decrease in LDH activity after deneravation of the muscle (7). According to Langohr (6) the glycolytic enzyme activities, including LDH, are important because they are the most sensitive indicators of the onset and course of neurogenic muscular atrophy. There was observed a significant correlation between severity of the muscle damage and decreased LDH activity.

The aim of the study was to measure serum LDH levels in patients with ALS and to investigate whether there is a relationship between LDH and age of patients, their clinical state and duration of the disease.

PATIENTS AND METHODS

The study involved 20 patients with ALS; nine female and 11 male with an average age of 60 (34–77) years. The average duration of the disease was 15 (four months – 3 years) months. ALS patients were diagnosed according to the El Escorial criteria of ALS. The clinical condition of the patients was measured by using Amyotrophic Lateral Sclerosis Functional Rating Scale (ALSFRS). The average points in this scale in ALS patients was 24 (five-35).

ALS patients were divided into two groups according to their age (younger – up to 60 years, older – above 60 years), and into two groups according to severity of their clinical condition (mild clinical state – above 25 points in ALSFRS, severe clinical state – up to 25 points in ALSFRS). The patients were also divided into two groups according to duration of ALS (short duration – up to 12 monts, long duration – above 12 months).

The study was performed in accordance with the ethical standards established in Helsinki.

Serum LDH levels were measured using enzymatic method and results were compared to normal values ranging from 120 to 240 U/l. For statistical analysis between groups of ALS patients the Mann-Whitney test was used. The LDH values were expressed in U/l, as median and range. P values $<0,05$ were considered statistically significant.

RESULTS

The median value of LDH levels in serum of whole group of patients with ALS was 154 U/l (16-277). Elevated serum LDH levels compared with normal range values were observed in eight patients (40%) and decreased – in four patients (20%) with ALS. There were no significant differences in LDH levels between ALS patients divided according to age, clinical state of patients and duration of the disease (p>0.05). Results are presented in Table 1 and in Figures 1–3.

Table 1. Lactate dehydrogenase levels (U/l) in patients with amyotrophic lateral sclerosis (ALS) and a comparative analysis between groups

Group of patients	N	Lactate dehydrogenase levels (U/l) Median (range)	Comparative analysis
Older patients	12	155 (116–229)	p= 0.93
Younger patients	8	148 (116–277)	
Mild clinical state of patients	10	151 (116–259)	p=1.00
Severe clinical state of patients	10	154 (116–277)	
Short duration of the disease	11	153 (116–277)	p=0.96
Long duration of the disease	9	155 (116–259)	

N – number of patients, Data are expressed as median and range, P > 0.05 statist. sign.; Mann Whitney test

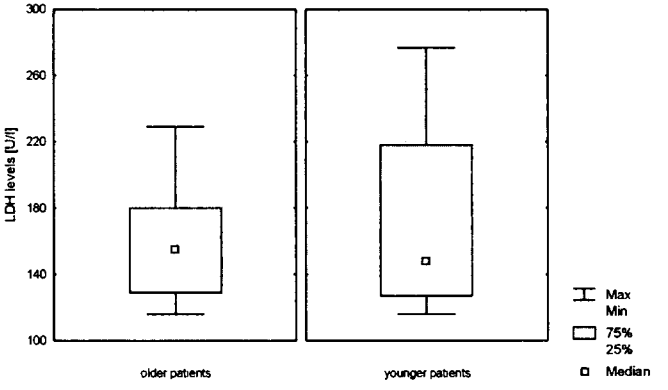

Fig. 1. Lactate dehydrogenase (LDH) levels in ALS patients

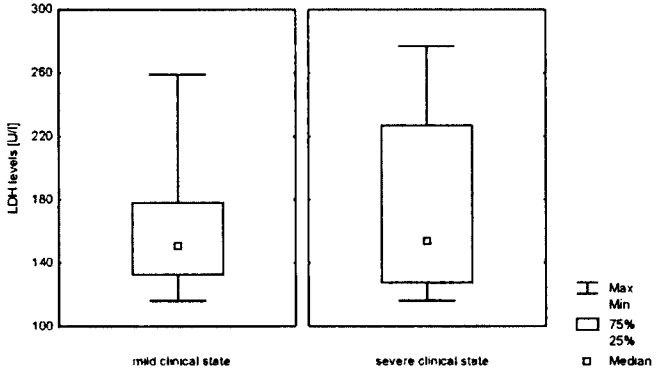

Fig. 2. Lactate dehydrogenase (LDH) levels in ALS patients

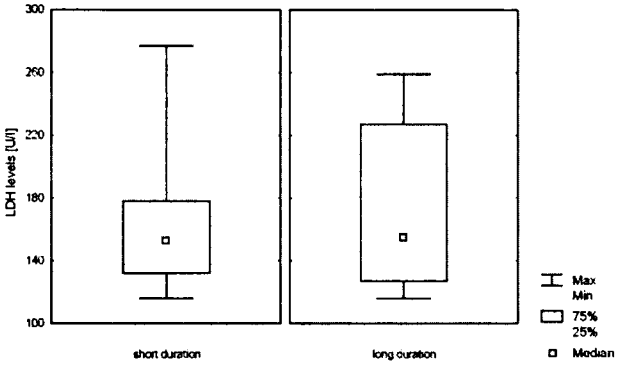

Fig. 3. Lactate dehydrogenase (LDH) levels in ALS patients

DISCUSSION

The study showed increased serum LDH levels in 40% of patients and decreased – in 20% of patients with ALS. However, serum LDH levels were not dependent on age of patients, their clinical state and duration of the disease.

In Dioszeghy et al. (1) study, the LDH levels in the serum and CSF of patients with ALS were within a normal range but CSF LDH levels were elevated in patients with spinal muscular atrophy. A significant elevation of LDH levels were found in serum of patients with Duchenne type of muscular atrophy, in patients with polymyositis, and in patients with limb-girdle type of muscular dystrophy (9).

Hayashi (3) measured the activity of LDH in single motoneurons in relation to ALS and concluded that the motoneurons in the LDH activity group may be resistant to ALS. Other study showed that LDH activity in posterior root ganglion cells in ALS is within normal ranges (2). Data from the literature indicate that histochemical, biochemical and molecular mitochondrial changes in muscle are not specific for ALS but may be seen in other neurogenic atrophies (4). Werneck (11) studied a relationship of serum LDH levels and electromyography (EMG), and concluded that there is a significant correlation between increase in LDH levles and myopathic changes in EMG, and an inverse correlation with the denervation presented in EMG study. Langohr (5) observed the difference in LDH activity in the muscles. The LDH was increased in the normal brachial biceps muscle and decreased in the normal deltoid and anterior tibial muscle. The author suggests that the differences in LDH may be dependent on impulse activity in the motor nerves of the muscles. Moreover, it was also observed that denervation of the muscles leads to decrease of LDH levels.

CONCLUSIONS

1. Serum LDH levels are increased in 40% of patients and decreased in 20% of patients with ALS.

2. Serum LDH levels in patients with ALS are not dependent on age of patients, their clinical state and duration of the disease.

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SUMMARY

Amyotrophic lateral sclerosis (ALS) leads to denervation and atrophy of the muscle. Data from the literature showed that deneravation of the muscle can affect lactate dehydrogenase (LDH) expression and levels. Our study showed that LDH levels were elevated in 40% of patients, and diminished in 20% of patients with ALS. However, there were no significant differences in LDH levels between patients divided according to age, their clinical state and duration of the disease.

Stężenie dehydrogenazy kwasu mlekowego w surowicy krwi chorych na stwardnienie boczne zanikowe

Stwardnienie boczne zanikowe (SLA) powoduje odnerwienie i zanik mięśni. Dane z piśmiennictwa wykazują, że odnerwienie mięśni może zmieniać ekspresję i stężenie dehydrogenazy kwasu mlekowego (LDH). Badanie wykazało, że stężenie LDH było podwyższone u 40% chorych i obniżone u 20% chorych na SLA. Nie stwierdzono istotnych różnic w stężeniu LDH pomiędzy grupami chorych na SLA, wyodrębnionymi w zależności od wieku, stanu klinicznego chorych i czasu trwania choroby.