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SERUM ENZYMES IN PATIENTS WITH ASTHMA AND EMPHYSEMA

I. The Frequency of Elevated Blood Enzyme Values

By

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It is a well-known fact that cardiac necrosis due to coronary obstruction results in the release of several enzymes, leading to an elevation of the serum activity of those enzymes. (4)

It has previously been shown that damage to various organs, specially to the liver, exists in guinea pigs that have suffered severe experimental asthma or that have for some time breathed gases with a low oxygen and a high carbon dioxide tension. The tissue damage was shown as a lowered tissue oxidation by both the Warburg and the methylene blue techniques. (2)

That tissue damage also exists in patients with severe asthma has been shown by studying the pattern of serum enzymes in 172 asthmatic patients with varying degrees of breathing difficulty. Preliminary reports are earlier given (3).

The following enzymes have been determined: aldolase (ALD), amylase, glutamic oxalacetic transaminase (GOT), glutamic pyruvic transaminase (GPT), isocitric dehydrogenase (ICD), lactic dehydrogenase (LD), malic dehydrogenase (MD), ornithine carbamyltransferase (OCT), phosphatase alkaline, phosphatase acid, diastase.

MATERIAL AND METHODS

Enzyme assay were performed on the same day whenever possible and in other cases the serum was separated as soon as possible and kept refrigerated

until assayed. The analyses were performed in different hospitals in Stockholm.

The different enzymes were determined as in the report of *Norberg* and *Senning* (5).

Samples for enzyme determination were as a rule taken on the first, third and fifth day of the hospital stay and thereafter about once a week.

The upper normal limit for the different enzymes was put at 100 in the table and curves, since the units of enzyme activity differ considerably numerically (5).

RESULTS

The results can be seen in Table 1. From this table we can see, that 32 % of the patients had at least one enzyme value over 200 %. 12,2 % had at least one value more than 300 %.

TABLE 1

Enzymes investigated	Number of asthma patients in per cent with a maximum enzyme value, one or more between: (The upper normal limit equals 100)						Total number of patients investigated
	0-100	100-200	200-300	300-500	500-1000	1000	
All (S-GOT, S-GPT, S-LD, S-MD, S-OCT, S-ALD, S-ICD ..	24.4	43.6	19.8	8.7	2.3	1.2	172
S-GOT	57	30.8	7.0	2.8	1.2	1.2	172
S-GPT	68.4	18.8	7.0	3.4	1.2	1.2	171
S-LD	88.9	9.9	0.6	—	—	0.6	171
S-MD	88.1	10.2	—	1.7	—	—	59
S-OCT	58.5	28.7	9.8	1.8	0.6	0.6	164
S-ALD	67.5	19.3	9.0	3.6	0.6	—	166
S-ICD	94.6	2.7	2.7	—	—	—	74

The number of patients, who had at least one enzyme value more than 200 % of the normal value where one can reckon with a significant elevation, is very different for the different enzymes studied. In this investigation the enzymes come as follows:

S-ALD 13,2 %, S-GPT 12,8 %, S-OCT 12,8 %, S-GOT 12,2 %, S-ICD 2,7 %, S-MD 1,7 %, S-LD 1,2 %.

In those cases, where the patients have elevated enzyme values these are as a rule highest when the patients are ad-

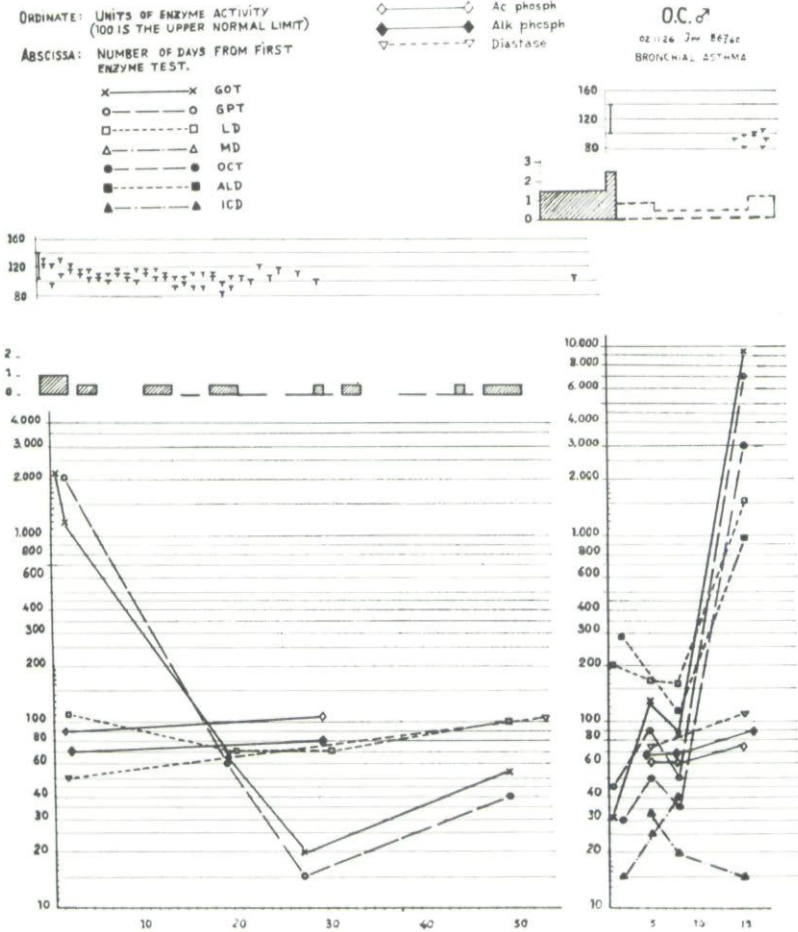


Fig. 1.

Ordinate 1. Units of serum enzyme activity (100 is the upper normal limit).

Ordinate 2. The severity of asthma (1 = mild, 2 = medium and 3 = severe).

Ordinate 3. Blood pressure.

Abscissa. Dates.

mitted to hospital and during the first week of the hospital stay. When the patients get better the enzyme values go down. If the patient later gets more severe asthmatic troubles the values may rise again.

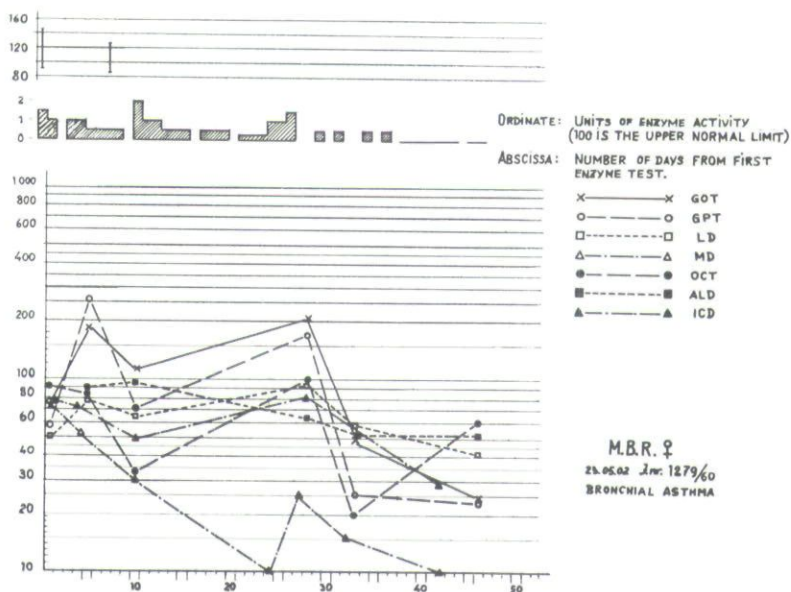


Fig. 2.

Ordinate 1. Units of enzyme activity (100 is the upper normal limit).

Ordinate 2. The severity of asthma (1 = mild, 2 = medium and 3 = severe).

Ordinate 3. Blood pressure.

Abscissa. Dates.

In asthmatic patients it is not only the degree of breathing difficulty that is of importance for the enzyme pattern but also the duration of respiratory insufficiency. One of our patients, who had a sudden and very severe attack of asthma and died within the first 24 hours after the breathing trouble started, had no elevated enzyme values. Further, patients with severe emphysema need only slight aggravation of breathing difficulty in order to obtain a pathological enzyme pattern.

Two patients of special interest will be mentioned separately.

During a period of severe asthma a patient with considerable elevation of S-GOT (the only enzyme that was examined in this patient) died six months later from an attack of asthma. The autopsy did not show any signs of previous coronary ob-

struction. Another had had severe asthma in his home for some days and was in a very bad condition when he entered the hospital. He was treated in different ways, and he was also given artificial respiration in order to make his breathing more efficient. After some time he improved and the enzyme values became quite normal. One year later he had a new attack of asthma. His condition deteriorated and he subsequently died during an asthmatic attack. At this time the enzyme values were again elevated, Fig. 1. When this patient was examined post mortem we could not find any myocardial infarction, but there were changes in the liver (centrilobular necrosis). We think that these liver changes are caused by insufficient gas exchange.

Fig. 2 illustrates the serum enzyme activity in a patient who was in a better general condition than the patient in Fig. 1.

DISCUSSION

In this investigation it has been possible to show for the first time, as far as I know, that tissue damage occurs in connection with severe asthmatic troubles of longer duration, just as it had been possible to show 1943 that this was the case in experimental asthma in guinea pigs. A definite elevation of S-OCT proves the existence of liver damage (7).

It is of interest, that, according to the only earlier report of enzyme determination in asthma I know (*Steinmann, Widmer, Kammer*), the diastase, the only enzyme investigated by the authors mentioned, was elevated in asthmatic attacks. I have never found any elevation of the diastase. The patient in Fig. 1 referred to earlier, who had a troublesome and long standing asthma before he died during an attack of asthma, had strongly elevated values of S-GOT, S-GPT, S-LD, S-OCT and S-ALD but not of S-ICD, acid and alkaline phosphatase and diastase. This patient also had liver necrosis (3b).

SUMMARY

The serum values of such enzymes as S-ALD, S-GPT, S-OCT, S-GOT, are not infrequently elevated in patients with severe asthma, especially in cases of long duration. Generally this indicates tissue damage, caused by the insufficient gas exchange.

An elevated S-GOT value in a patient with severe asthma does not primarily indicate that there is simultaneous coronary obstruction, but usually indicates tissue damage caused by insufficient gas exchange.

Strongly elevated enzyme values in patients with insufficient gas exchange often indicate that the patients are in a bad condition and may need artificial respiration in order to have the pulmonary gas exchange normalized.

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