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SERUM ENZYMES IN PATIENTS WITH ASTHMA AND EMPHYSEMA

II. *A Comparative Study of Blood Enzymes in Patients with Bronchial Asthma, Myocardial Infarction and Peptic Ulcer*

By

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Earlier it has been shown (3, 4, 5) that the serum values of different enzymes in the blood (S–GOT, S–GPT, S–OCT, S–ALD) are not infrequently elevated in patients with severe asthma, especially in cases of long duration. These findings have been verified by *El-Shaboury, Thomas & Williams* (6). (For abbrevations of the enzymes see Table 1 and Method.)

Colldahl considered the cause of the elevated blood enzymes to be an insufficient gas exchange. Observations in animal experiments favoured this view (2). In these animal experiments the same changes in intermediate metabolism appeared in connexion with insufficient gas exchange, if this was provoked by an allergic reaction or in some other ways. *El-Shaboury* and co-workers (6) consider that it is possible that an allergic reaction as such contributes to the elevated enzymes values. They found that in status asthmaticus 24 cases out of 60 (40 per cent) had a rise in S–GOT, significantly in 10 patients.

Clarke (1) found focal necrosis of the liver in 9 out of 61 consecutive autopsies with recent myocardial infarction. From the same period fifty autopsies without myocardial infarction, but in which congestive heart failure was diagnosed, either clinically or at autopsy were reviewed as controls. Centrilobular hepatic necrosis was found in only one of the

control cases. The hepatic lesions had the same appearance as the lesions found in shock from any cause and were believed to be due to acute anoxia.

TABLE 1

Normal Ranges of Serum Enzyme Activities per ml.

Enzyme	Range	
	Regular units	Relative units
Aldolase (ALD)	3–8	37–100
Glutamic oxalacetic transaminase (GOT)	8–30	27–100
Glutamic pyruvic transaminase (GPT)	5–35	14–100
Lactic dehydrogenase (LD)	140–290	48–100
Malic dehydrogenase (MD)	30–80	37–100
Ornithine carbamyl transferase (OCT)	0–6	0–100
Isoitric dehydrogenase (ICD)	< 265	< 100

Killip & Payne (7) investigated 17 patients with cardiac disease who had 1 or more S–GOT determinations exceeding 500 units (regular units; normal ranges: see Table 1). All 17 developed hypotension or shock prior to high S–GOT activity. In the 8 patients who came to autopsy there was histologic evidence of acute necrosis of both heart and liver, in 4 necrosis of liver alone.

Data from a control series of patients with heart disease selected without regard to the level of S–GOT activity, showed that an increase in venous pressure in the absence of hypotension was not associated with acute central necrosis or elevated S–GOT activity. It was concluded that very high S–GOT activity in patients with heart disease is at least in part caused by acute hepatic central necrosis secondary to a drop in cardiac output and reduced hepatic blood flow. Acute circulatory changes may result in hepatic necrosis and increased blood enzyme activity without myocardial infarction.

In order to get a more clear understanding of the elevated blood enzyme values in asthma, a comparative study of blood enzyme values in asthma, myocardial infarction, and

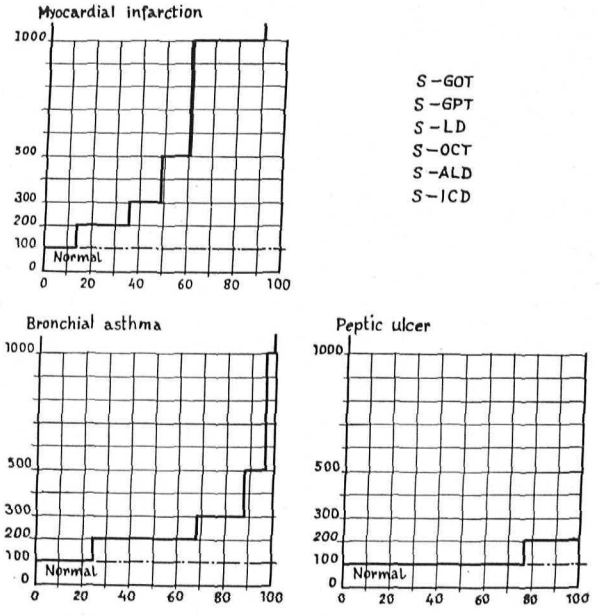

Fig. 1.

The frequency of elevated blood enzyme values (S–GOT, S–GPT, S–LD, S–OCT, S–ALD, S–ICD) in three different series of patients with asthma bronchiale, myocardial infarction, and peptic ulcer. For each patient the highest value of any of the blood enzymes investigated determined the group to which the patients should belong.

Ordinate: Enzyme value (relative units, 100 is the upper normal limit).

Abscissa: For Asthma 100 = 172 patients.
For Myocardial infarction 100 = 51 patients.
For Peptic ulcer 100 = 30 patients.

peptic ulcer is performed in this study. The last group was included as a control group.

METHOD

In this investigation 172 patients with asthma, 51 patients with myocardial infarction and 30 patients with peptic ulcer were investigated. For methods used see earlier paper (5). The concentration in serum of the different enzymes are abbreviated as follows: S–ALD, S–GOT, S–GPT, S–LD, S–MD, S–OCT and S–ICD. (See also Table 1).

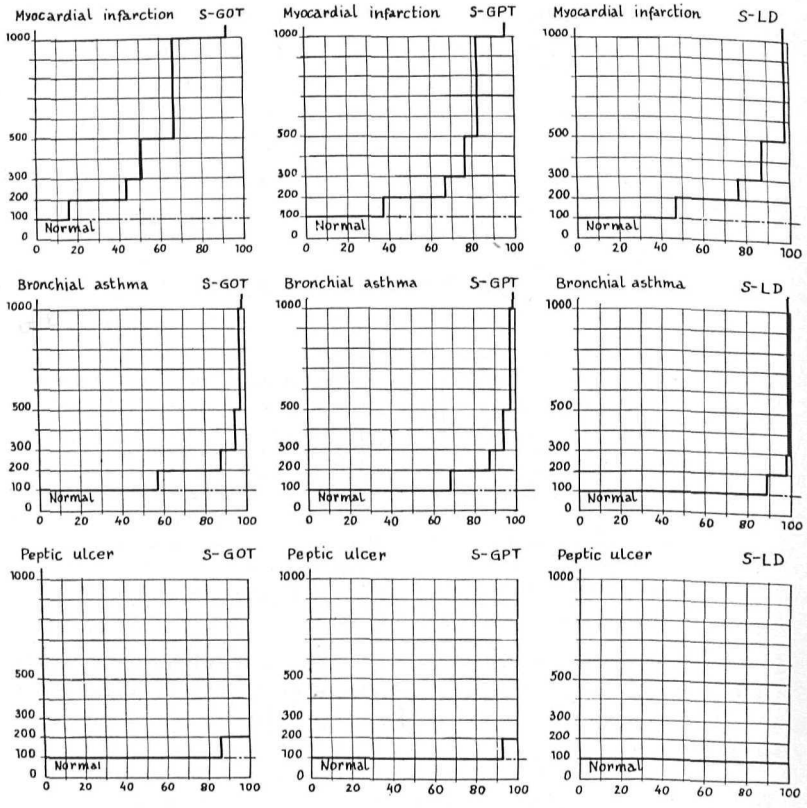

Fig. 2.

The frequency of elevated enzyme values (S–GOT, S–GPT, S–LD). For each patient the highest value of the investigated enzyme determined the group to which the patient should belong.

Ordinate and abscissa: see Fig. 1.

RESULTS

The results are presented in Fig. 1–5. At least one enzyme value (of at least one of the blood enzymes investigated) is elevated to more than double the normal value (200 per cent) in about 65 per cent of the patients with myocardial infarction, in about 30 per cent of the asthmatic patients and in none of the patients with ulcers (Fig. 1).

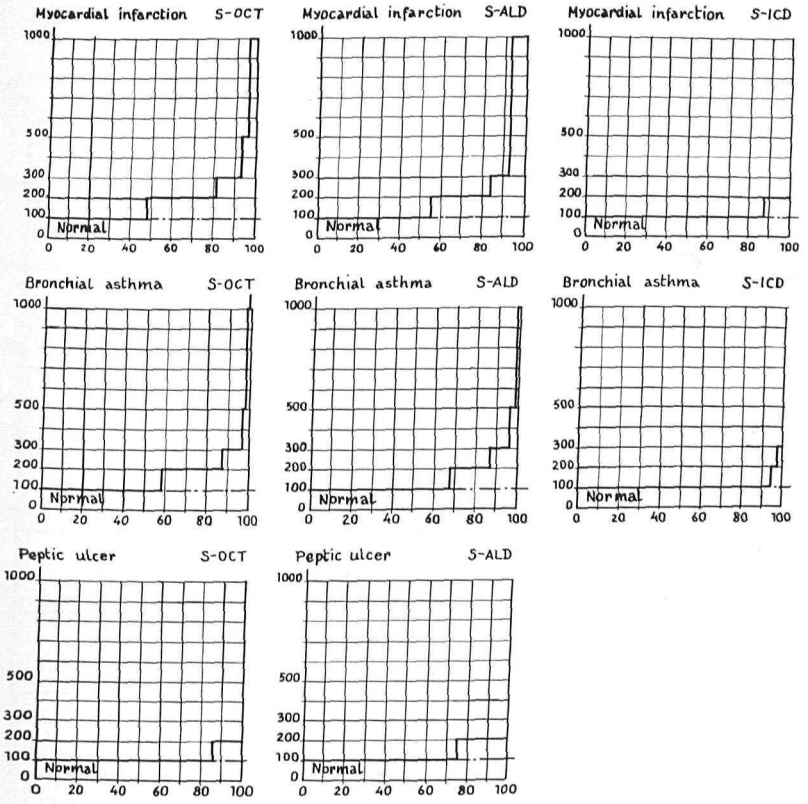

Fig. 3.
The frequency of elevated enzyme values (S–OCT, S–ALD, S–ICD). For each patient the highest value of the investigated enzyme determined the group to which the patient should belong.
Ordinate and abscissa: see Fig. 1.

In Figs. 2 and 3 it can be seen that in about 55 per cent of patients with myocardial infarction and 12 per cent of patients with asthma S–GOT was elevated on at least one occasion to a value greater than double the normal value. The corresponding values for S–OCT were about 20 per cent for myocardial infarction and 12 per cent for patients with bronchial asthma.

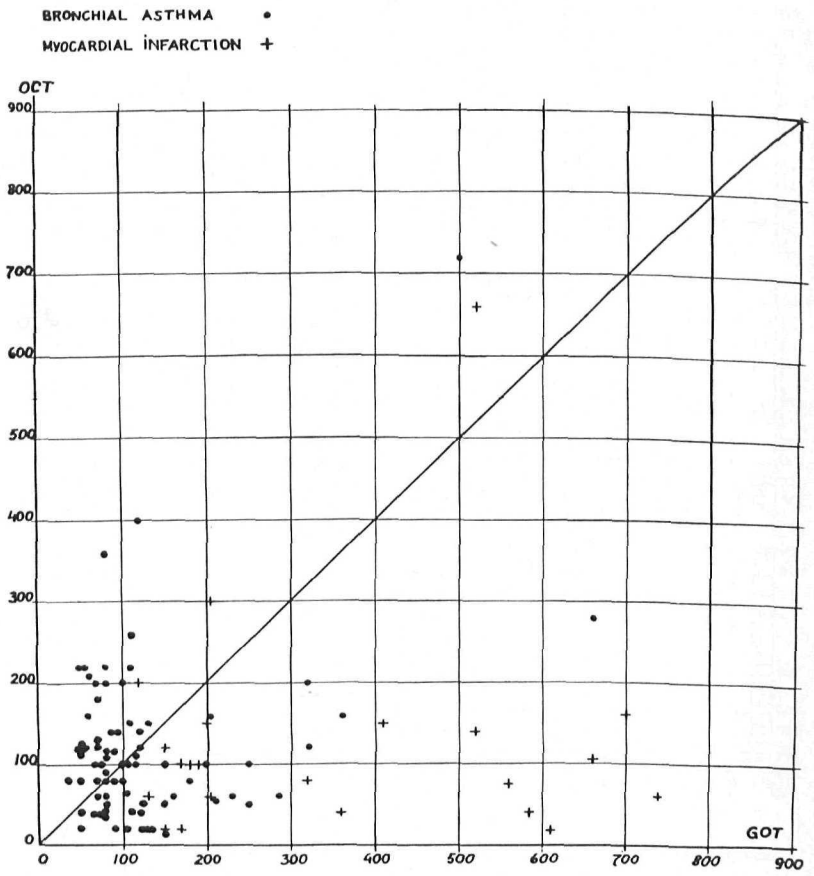

Fig. 4.

Ordinate: Value for S–OCT (100 is the upper normal limit).
Abscissa: Value for S–GOT (100 is the upper normal limit).
Only patients who had at least one value of S–GOT or S–OCT exceeding 100 (relative units, see Table 1) during the first ten days in hospital were included. No values above 900 per cent included.

Figs. 4 and 5 show the relation between S–GOT/S–OCT and S–GPT. The highest value obtained for each patient is selected. The figures show that the patients with bronchial asthma have often elevated values for both S–GOT and

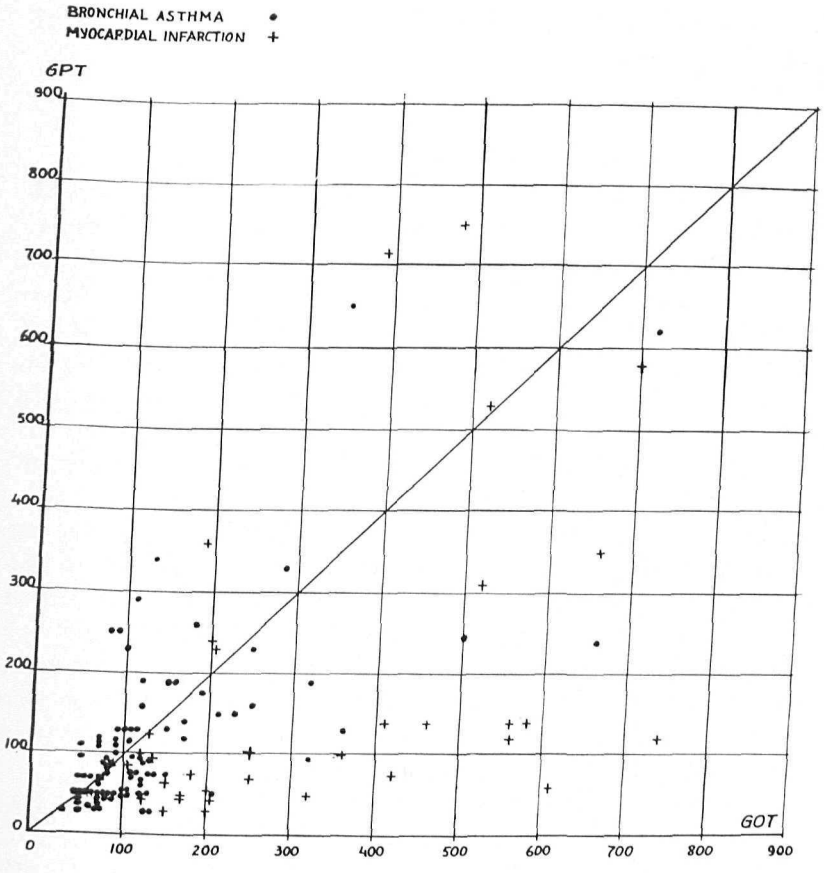

Fig. 5.
Ordinate: Value for S–GPT (100 is the upper normal limit).
Abscissa: Value for S–GOT (100 is the upper normal limit).
Only patients who had at least one value of S–GOT or S–GPT exceeding 100 (relative units, see Table 1) during the first ten days in hospital were included. No values above 900 per cent included.

S–GPT resp. S–OCT. Patients with myocardial infarction could be divided in two groups. In one group the quotient of the mentioned enzyme values is the same as in the patients with asthma. The other group of patients with myocardial

infarction is characterized by elevated S–GOT but normal S–OCT values.

DISCUSSION

The elevation of S–OCT originates from the liver, as S–OCT is only found in this organ. 12 per cent of asthmatic patients have values elevated to more than double the normal value (200 per cent) for S–OCT, and 12 per cent also have elevations of more than 200 per cent for S–GOT. It is concluded that both enzymes come from the liver in asthmatic patients. The same is true of S–GPT. The reason for the elevated blood enzymes is considered to be the changed tension of oxygen and carbon dioxide in the blood during periods of severe asthma (3, 5).

In some patients with myocardial infarction an elevation of both S–GOT and S–OCT is found which is similar to the elevation found in asthmatic patients. In this group the blood enzymes probably come only from the liver (Figs. 4 and 5) because of insufficient liver perfusion with blood. The reason for this is probably periods of hypotension (7). In another group only elevation of S–GOT is found. The blood enzymes are in this group believed to originate from the heart.

As was reported earlier (4, 5) central liver necrosis was found in one case of severe asthma with high blood enzyme values. In this patient no necrosis was found in the heart. Later it was found (10) that in patients who had died from asthma, centrilobular liver necrosis was present in 5 per cent and steatosis in 23 per cent.

As in this investigation S–GOT is elevated to more than 200 per cent of the upper normal value in about 55 per cent S–OCT in about 20 per cent of patients with myocardial infarction it may be concluded that in about 35 per cent of these patients with myocardial infarction the enzyme elevation is caused by cell damage of the heart and in about 20 per cent by damage both of the heart and the liver.

SUMMARY

A study of different blood enzymes was performed in 172 patients with bronchial asthma, 51 patients with myocardial infarction, and 30 patients with peptic ulcer.

According to this investigation in 55 per cent of patients with myocardial infarction and in 12 per cent of patients with bronchial asthma S–GOT was elevated to more than double the normal value. The corresponding figures for S–OCT were 20 resp. 12 per cent. In patients with peptic ulcer no elevations above 200 per cent were found.

Thus, in patients with asthma S–GOT and S–OCT were elevated in the same degree. The reason is considered to be insufficient gas exchange in the liver with damage of liver cells. In patients with myocardial infarction 2 groups are found to exist. One group has only elevated S–GOT values, but normal values for S–OCT and S–GPT. In this group the enzymes are considered to be connected with myocardial damage only. In the other group the elevation of blood enzymes is considered to be caused also from liver damage, and the blood enzyme pattern is as in asthma patients. This second group is about half as large as the first one.

Elevated enzyme values in a patient with asthma indicate tissue damage probably caused by insufficient gas exchange. Artificial respiration may be neccesary.

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