STUDIES ON SERUM GLUTAMIC PYRUVIC TRANSAMINASE IN HEALTH AND IN DISEASES OF THE LIVER *

By

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It has been reported that serum transaminase activity is found to be altered in certain pathological conditions which are associated with necrosis or other type of cellular damage of cardiac, hepatic or skeletal muscle tissues (5, 6 and 12). It may be that damage to the tissue results in release, from the cells, of the transaminase, which finds its way into the plasma or serum. Wroblewski and La Due (14) studied and compared the activities of glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) in different tissue homogenates. The activity of GPT was found to be relatively greater in liver than in other tissues as compared with the activity of GOT. This would perhaps suggest that the serum glutamic pyruvic transaminase (SGP-T), might possibly be a more specific index of liver cell damage than the serum glutamic oxaloacetic transaminase (SGO-T), because of its selective concentration in liver tissue. Futhermore it might be suggested that since the cardiac tissue activity of GPT is low, myocardial necrosis might not be associated with significant alterations of SGP-T activity. A study was undertaken to find out the levels of SGP-T activity in patients with diseases of the liver, in whom other liver function tests were simultaneously carried out. Normal subjects were also studied for their serum transaminase activity, as a control group for comparison. The results of this study are reported herewith.

MATRIALS AND METHODS

The techinque for analysing the activity of SGP-T is based on the transamination of alanine and α-ketogularate, as shown in the following reaction :—

α—Ketoglutarate + alanine→pyruvate+glutamic acid.

Thus the above reaction catalysed by the transaminase results in the formation of a keto-acid. The pyruvate formed is allowed to react with 2-4 dinitrophenylhydrazine. This is then extracted with alkali to give a colour. The optical density of the colour is measured on a spectrophotometer at 505 *mμ*. (8). The standard calibration curves are prepared for various concentrations within the appropriate range of the standard pyruvate solution. The activity is expressed in terms of SGP-T *units/ml.* of serum, which is defined as the activity by 1.0 *ml.* of serum that results in the formation of chromogenic material equivalent to 1 mg. of pyruvate under conditions of the test (8). One hundred and two normal healthy adult male subjects ranging in their age between 30 and 55 years were studied of their serum transminase activity. Each of the estimations was done in duplicate and the average was taken thereof. Similarly fifty male patients with diseases of the liver whose diagnosis has been given separately (Table VII) and ranging, in their age from 39 to 52 years, were similarly investigated for their serum transaminase activity. These were the patients from the S.S.G. Hospital, Baroda and Infectious Diseases Hospital. Other liver function tests, namely, Van den Bergh test and Icteric index test were also performed simultaneously in the samples of sera obtained from these patients (3). A comparision has been made between the results obtained of the SGP-T test on one hand and those of the above two

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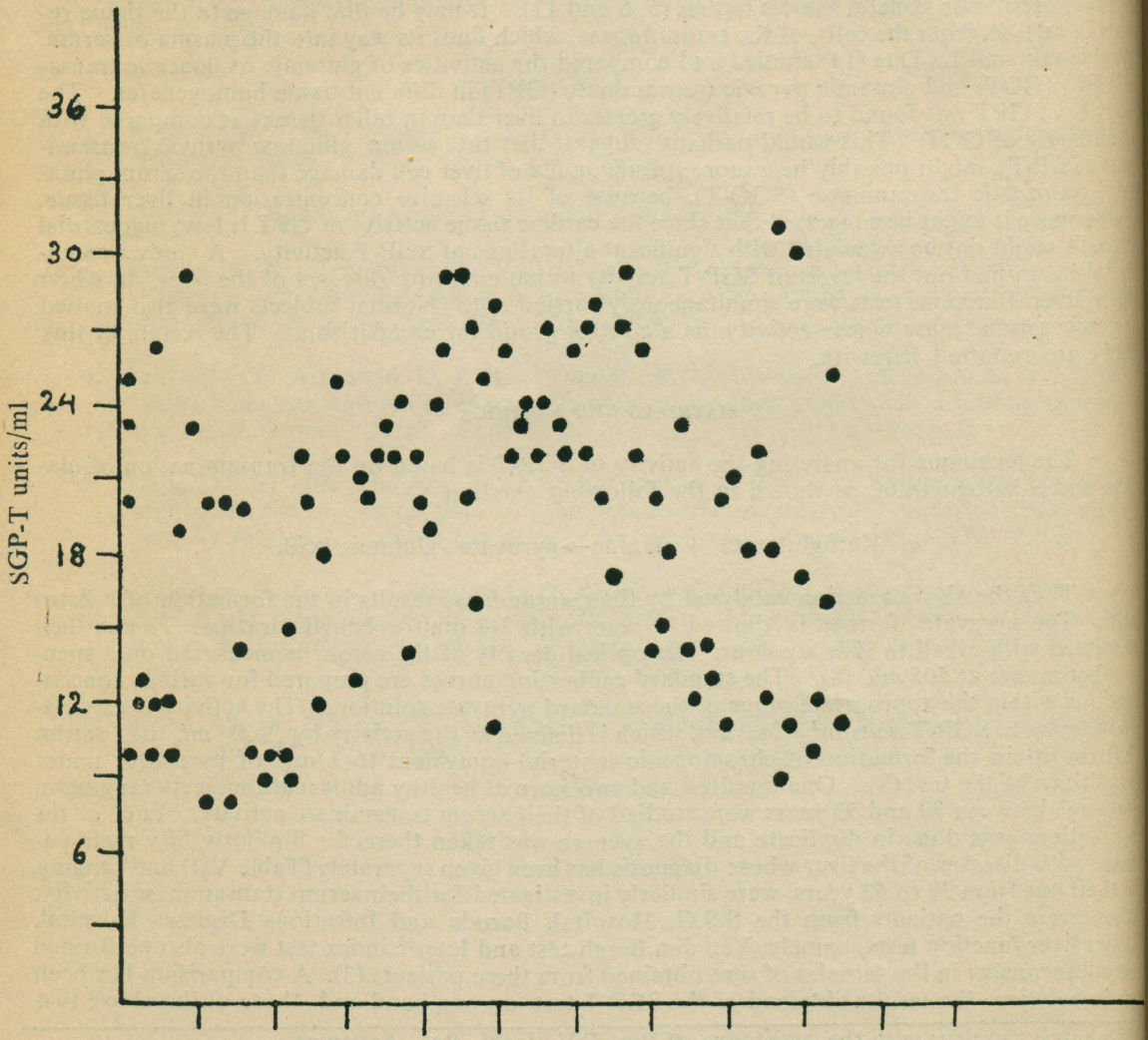
liver function tests performed on the other hand. These detailed results are shown in Tables, VI, VII, VIII, and IX and are represented in graphs.

RESULTS AND DISCUSSION

The values obtained for the serum transaminase (SGP-T) activity in the normal subjects ranged from 8.0 to 34.0 *units/ml.* with the mean value of 18.9 *units/ml.* The standard diviation value was found to be 6.4 and the standard error of mean was 0.63 (Table I).

The values obtained in the present series have been found to be well comparable with those given by other workers (Table II).

A similar comparison of the values for SGP-T in patients with liver diseases, has been shown (Table III).



Graph 1—showing the scattered points for the values of SGP-T in normal healthy subjects.

TABLE I

Showing the values for SGP-T in normals and in patients with liver diseases

No. of normal subjects	SGP-T *units/ml*			
	Range	Mean	S.D.	S.E. of mean
102	8.0—31.0	18.9	6.4	0.63

No. of patients with liver diseases	SGP-T *units/ml.*			
	Range	Mean	S.D.	S.E. of mean
50	42.0-229.0	79.4	25.4	3.59

TABLE II

Showing the comparison of the values for SGP-T in normal healthy subjects as given by different workers

Authors	No. of subjects	SGP-T *units/ml*		
		Range	Mean	S.D.
1. Chinsky (2)	..	3.0-30.0	..	..
2. Reitman and Frankel (8)	22	5.0—30.0	..	..
3. Wroblewski and La Due (14)	..	5.0—35.0	16.0	..
4. Albaum *et al* (1)	26	..	17.0	1.0
5. Sacks *et al* (10)	20	5.0—35.0	21.3	
6. Present series	102	8.0—31.0	18.9	6.4

TABLE III

Showing the comparison of the values for SGP-T in patients with liver diseases as given by different workers

Author	No. of subjects	SGP-T *units/ml*		
		Range	Mean	S.D.
1. Mosley *et al* (7)	13	26—260	..	..
2. Wroblewski and La Due (14)	..	24—224	..	..
3. Wroblewski (13)	..	26—258	..	..
4. Rymenant *et al* (9)	..	45—350	..	..
5. Present series	50	42—229	79.4	25.4

These patients were studied for their SGP-T levels during the onset of the disease before any treatment was started and during their stay in the wards of the Hospital, where they were admitted for their complaints and for further investigations. Two other liver function tests, namely, Van den Bergh reaction and Icteric index, were also simultaneously performed in the samples of their sera. The results of these tests are shown in Tables IV and V.

TABLE IV

Showing values of SGP-T with their range, mean, S.D. and S.E. of mean in patients with liver diseases, investigated with Van den Bergh reaction

		Group I	Group II	Group III
No. of patients		18	19	13
S.GP-T *units/ml*	Mean	99.6	73.2	60.6
	S.D.	39.9	10.8	13.8
	S.E. of mean	7.05	2.48	3.83

Grp. I—Biphasic Grp. II—Delayed Grp. III—Immediate

TABLE V

Showing the values of SGP-T with their range, mean, S.D. and S.E. of mean, in patients with liver diseases, investigated with Icteric index test

		Group I	Group II	Group III	Group IV
No. of patients		8	23	13	6
SGP-T *units/ml*	Mean	57.1	70.3	84.5	133.3
	S.D.	12.7	11.7	17.1	13.7
	S.E. of mean	4.49	2.44	4.74	5.59

Grp I	Icteric index	12—25
Grp II	„ „	26—38
Grp III	„ „	39—50
Grp IV	„ „	51 and above

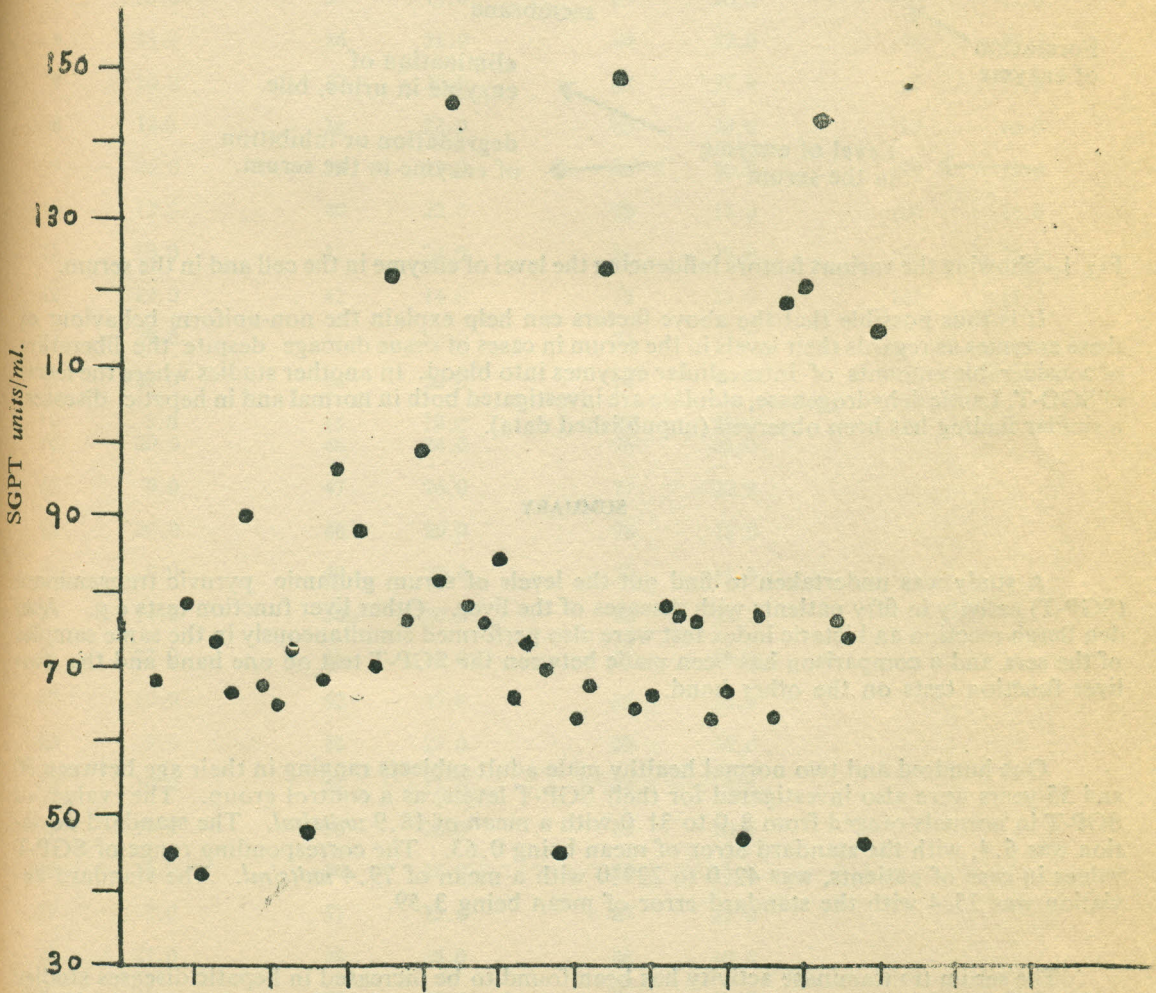
STATISTICAL ANALYSIS OF THE DATA

On comparing the data for SGP-T values obtained in normals with that obtained in patients, it was found that the value for the d.statistic was 14.00. When the data for the SGP-T test in patients was compared with that of the liver function test, namely, the Van den Bergh reaction, the value for the variance ratio F was found to be 46. When the data for the SGP-T levels obtained in the patients was compared with that of the other liver function test, namely, Icteric index test, the corresponding value of F was found to be 42. All these above values of d-statistic and F were found to be very highly statistically significant, even at 0.1% level ($p=0.001$).

Marked alterations in the serum levels of GO-T and GP-T have been observed during cardiac, hepatic and other muscular diseases (13, 4, and 11). Wrobleski *et al* (14) reported relatively greater activity of GP-T in liver tissue than in other tissues, as compared with the activity of GO-T. The principle of the use of the estimations of the levels of these enzymes in serum, which are generally found to be increased, as diagnostic tests, primarily in the diseases of the damage to the

tissues of cardiac, liver or skeletal muscle, has been based on the postulated release of these enzymes into the blood stream from the damaged cells of the respective tissues. , It is, therefore, usually believed that SGP-T is more sensitive than SGO-T as an index of hepatocellular damage, and also it is further believed to be more specific for hepatic necrosis. But this has not been found to be nniformly true. It has been thus reported that the SGP-T assay, although more specific for hepatic disease as compared to myocardial necrosis, is neither specific for hepatic necrosis nor necessarily more sensitive than SGO-T as an index of hepatic injury (4, 2).

Variations of enzyme activity in serum following the damage to the tissues like liver etc. are not to be interpreted solely as consequences of enzyme leakage from the necrotic tissue cells. These changes should rather be regarded as a more general phenomenon. A commplex reaction of the organism sets in after the damage of the above type, as it does after many other acute diseases. It is this complex reaction that gives rise to a number of symptoms and also that causes



Graph—Showing the scattered points for thc values of SGPS in patients with hepatic diseases.

the changes in enzyme activities. Thus there will be several factors influencing the enzyme level both in the cell and in the serum. The permeability of cell membrane, the enzyme elimination in urine and bile, degradation or inhibition of the enzyme in the serum, may be some of these factors influencing the enzyme level in the serum. These factors have been summarized in the following Fig. (1.)

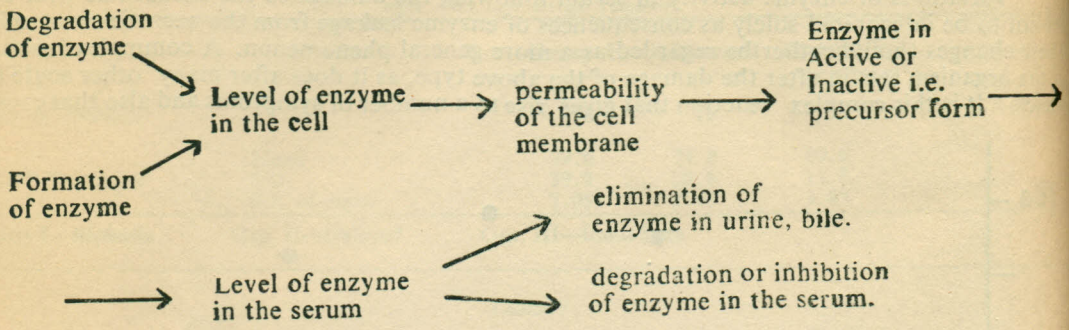


Fig. 1—showing the various factors influencing the level of enzyme in the cell and in the serum.

It is thus possible that the above factors can help explain the non-uniform behaviour of these enzymes as regards their levels in the serum in cases of tissue damage despite the liberation of considerable amounts of intracellular enzymes into blood. In another studies where the levels of SGO-T, Lactic dehydrogenase, aldolase are investigated both in normal and in hepatic diseases, a similar finding has been observed (unpublished data).

SUMMARY

A study was undertaken to find out the levels of serum glutamic pyruvic transaminase (SGP-T) activity in fifty patients with diseases of the liver. Other liver function tests e.g. Van den Bergh reaction and icteric index test were also performed simultaneously in the same samples of the sera and a comparison has been made between the SGP-T test on one hand and the two liver function tests on the other hand.

One hundred and two normal healthy male adult subjects ranging in their age between 30 and 55 years were also investigated for their SGP-T levels, as a control group. The values of SGP-T in normals ranged from 8.0 to 31.0 with a mean of 18.9 *units/ml.* The standard deviation was 6.4, with the standard error of mean being 0.63. The corresponding range of SGP-T values in case of patients, was 42.0 to 229.0 with a mean of 79.4 *units/ml.* The standard deviation was 25.4 with the standard error of mean being 3.59.

The serum transaminase activity has been found to be increased in hepatic diseases studied and the difference as compared to the normals has been found to be statistically significant. This was particularly so in case of infective hepatitis, where high serum transaminase activity was found to be present. The significance of the above findings has been discussed in the paper.

TABLE VI

Showing values for SGP-T (units/ml.) in normal healthy subjects

Sr. No.	SGP-T *units/ml.*	Sr. No.	SGPT- *units/ml.*	Sr. No.	SGP-T *units/ml*	Sr. No.	SG-PT *units/ml.*
1	25.0	31	18.0	61	24.0	91	12.0
2	10.0	32	11.0	62	27.0	92	18.0
3	23.0	33	25.0	63	23.0	93	31.0
4	20.0	34	22.0	64	22.0	94	9.0
5	12.0	35	13.0	65	26.0	95	11.0
6	13.0	36	21.0	66	22.0	96	30.0
7	10.0	37	20.0	67	27.0	97	17.0
8	12.0	38	22.0	68	28.0	98	10.0
9	26.0	39	23.0	69	20.0	99	12.0
10	12.0	40	22.0	70	17.0	100	16.0
11	10.0	41	24.0	71	27.0	101	25.0
12	19.0	42	14.0	72	29.0	102	11.0
13	29.0	43	22.0	73	22.0		
14	23.0	44	20.0	74	26.0		
15	8.0	45	19.0	75	14.0		
16	20.0	46	24.0	76	29.0		
17	9.0	47	26.0	77	20.0		
18	20.0	48	29.0	78	15.0		
19	8.0	49	29.0	79	18.0		
20	14.0	50	20.0	80	23.0		
21	23.0	51	16.0	81	14.0		
22	10.0	52	27.0	82	12.0		
23	9.0	53	25.0	83	14.0		
24	10.0	54	11.0	84	13.0		
25	10.0	55	28.0	85	20.0		
26	15.0	56	26.0	86	11.0		
27	9.0	57	22.0	87	21.0		
28	22.0	58	25.0	88	10.0		
29	20.0	59	24.0	89	18.0		
30	12.0	60	22.0	90	22.0		

TABLE VII

Showing SGP-T units/ml. in patients with hepatic diseases

Sr. No. *units/ml.*	SGPT-	Disease	Sr. No. *units/ml.*	SGP-T	Disease
1	75	Inf. hepatitis	26	66	Obst. jaundice
2	73	,,	27	73	Cirrhosis
3	68	Cirrhosis	28	70	Inf. hepatitis
4	45	Obst. jaundice	29	45	Obs. jaundice
5	78	Inf. hepatitis	30	63	Cirrhosis
6	42	Obst. jaundice	31	67	,,
7	73	Cirrhosis	32	123	Inf. hepatitis.
8	66	Obst. jaundice	33	229	Inf. ,,
9	90	Inf. hepatitis	34	64	Obst. jaundice
10	67	,,	35	66	,,
11	65	Obst. jaundice	36	78	,,
12	72	Cirrhosis	37	77	Cirrhosis
13	48	Obst. juandice	38	76	Obst. jaundice;
14	68	Cirrhosis	39	63	Cirrhosis
15	96	Inf. hepatitis	40	66	,,
16	88	Cirrhosis	41	47	,,
17	70	Inf. hepatitis	42	77	,,
18	122	,,	43	63	Inf. hepatitis
19	76	Cirrhosis	44	119	,,
20	99	,,	45	121	,,
21	81	Obst. jaundice	46	143	,,
22	145	Inf. hepatitis	47	76	Cirrhosis
23	78	Cirrhosis	48	74	Inf. hepatitis
24	76	,,	49	46	Obst. jaundice
25	84		50	115	Inf. hepatitis.

TABLE VIII

Relationship of SGP-T (units/ml.) with liver function test Van den Bergh reaction

Group I Biphasic		Group II Delayed		Group III Immediate	
Sr. No.	SGP-T *units/ml.*	Sr. No.	SGP-T *units/ml.*	Sr. No.	SGP-T *units/ml.*
1	75	1	68	1	45
2	73	2	73	2	42
3	78	3	66	3	51
4	90	4	72	4	48
5	76	5	68	5	81
6	96	6	88	6	66
7	70	7	76	7	45
8	122	8	99	8	64
9	145	9	78	9	78
10	70	10	76	10	76
11	123	11	84	11	66
12	229	12	73	12	46
13	63	13	63	13	66
14	119	14	67		
15	121	15	77		
16	143	16	47		
17	74	17	77		
18	115	18	63		
		19	76		

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