# SOME OBSERVATIONS ON THE STUDY ON SERUM GLUTAMIC OXALOACETIC TRANSAMINASE IN HEALTH AND IN DISEASES OF THE LIVER*

*By*

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Serum transaminase activity has been found to be altered in certain pathological conditions, associated with necrosis or other types of cellular damage of cardiac, hepatic or skeletal muscle tissues (6, 7, 10). It would appear that damage to the tissue results in release from the cells of transaminase, which finds its way into the plasma or serum. The level of the activity of serum glutamic oxaloacetic transaminase (SGO-T) is considered to be of value in the differential diagnosis of some of these disorders, particularly, myocardial infarction and acute or viral hepatitis (8). A study was undertaken to find out the levels of serum transaminase activity in patients with diseases of the liver, in whom other liver function tests were simultaneously done. Normal subjects were also studied as a control group for comparison. The results of this study are reported herewith.

## MATERIALS AND METHODS

The technique for analysing the activity of SGO-T is based on the transamination of aspartate and $\alpha$-Ketoglutarate, the oxaloacetate formed being converted to pyruvate by aniline citrate. The pyruvate reacts with dinitrophenylhdrazine, which is then extracted with alkali to give a colour. Optical density of the colour is measured on a spectrophotometer at 490 m$\mu$. The activity is expressed in terms of SGO-T units/ml. of serum, which is defined as the activity by 1.0 ml. of serum that results in the formation of chromogenic materials equivalent to 1.mg. of pyruvate under conditions of the test (11). Fifty six normal healthy adult males ranging in their age from 23 to 53 years were studied for their serum transaminase activity according to the above technique. Each of the estimations was done in duplicate and the average was taken thereof. Similarly thirty male patients with hepatic diseases whose diagnosis has been given separately (Table VII) and ranging in their age from 39 to 52 years were investigated for their SGO-T activity. These were the patients from S.S.G. Hospital Baroda and Infections Diseases Hospital. Other liver function tests, namely, Van den Bergh test and Icteric index test were also performed simultaneously in the samples of sera of the same patients (5). These detailed results are shown in Tables VI, VII, VIII, & IX.

## RESULTS

The values obtained for the serum transaminase activity in the normal subjects ranged from 14.0 to 36.0 with a mean of 21.1 units/ml. with standard deviation value of 6.6 and standard error of mean being 0.88 (Table I).

These values are found to be well comparable with those given by other workers (2, 3, 9), (Table II).

*Research Inquiry with the assistance of Km. T.V. Joshi, research assistant.

TABLE I

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

| | SGO-T units/ml. | | | |
|---|---|---|---|---|
| No. of normal subjects | Range | Mean | S.D. | S.E. of Mean |
| 56 | 14.0—36.0 | 21.1 | 6.6 | 0.88 |
| No. of patients with liver diseases | SGO-T units/ml. | | | |
| 30 | 48.0—264.3 | 126.6 | 57.3 | 10.46 |

TABLE II

*Showing the comparison of the value for p. SGO-T in normal healthy subjects as given by different workers*

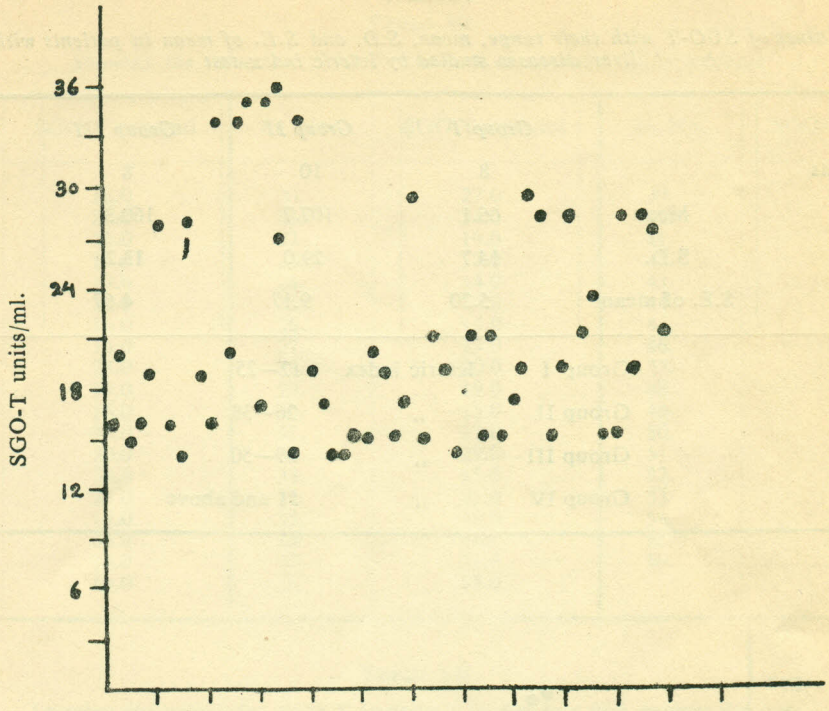
| Authors | No. of subjects | Range | SGO-T values units/ml. | |
|---|---|---|---|---|
| | | | Mean | S.D. |
| Bowers *et al.* (2) | 50 | 16.0—44.0 | 25.0 | 6.3 |
| Dewar *et al.* (3) | 25 | 10.0—34.0 | 19.0 | — |
| Steinberg *et al.* (9) | 20 | 10.0—33.0 | 16.0 | — |
| Present series | 56 | 14.0—36.0 | 21.1 | 6.6 |

The values for SGO-T in patients were also compared with those given by other workers (4, 1), (Table III).

TABLE III

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

| Authors | No. of subjects | SGO-T values units/ml. | | |
|---|---|---|---|---|
| | | Range | Mean | S.D. |
| Donate (4) | 12 | 46.5—163.0 | — | — |
| Bajpai *et al.* (1) | 55 | 60.0—231.0 | 177.0 | — |
| Present series | 30 | 48.0—264.0 | 126.6 | 57.3 |




Graph 1. Showing the scattered points for the values of p. SGO-T in normal healthy subjects.

TABLE IV

*Values of SGO-T with their range, mean, S.D. and S.E. of mean in patients with liver diseases studied by Van den Bergh reaction*

| | | *Group I* | *Group II* | *Group III* |
|---|---|---|---|---|
| No. of patients | | 9 | 11 | 10 |
| SGO-T | Mean | 193.7 | 123.5 | 69.7 |
| units/ml. | S.D. | 42.3 | 30.2 | 15.0 |
| | S.E. of mean | 14.10 | 9.11 | 4.74 |

Group I—biphasic ; Group II—delayed ; Group III—immediate.

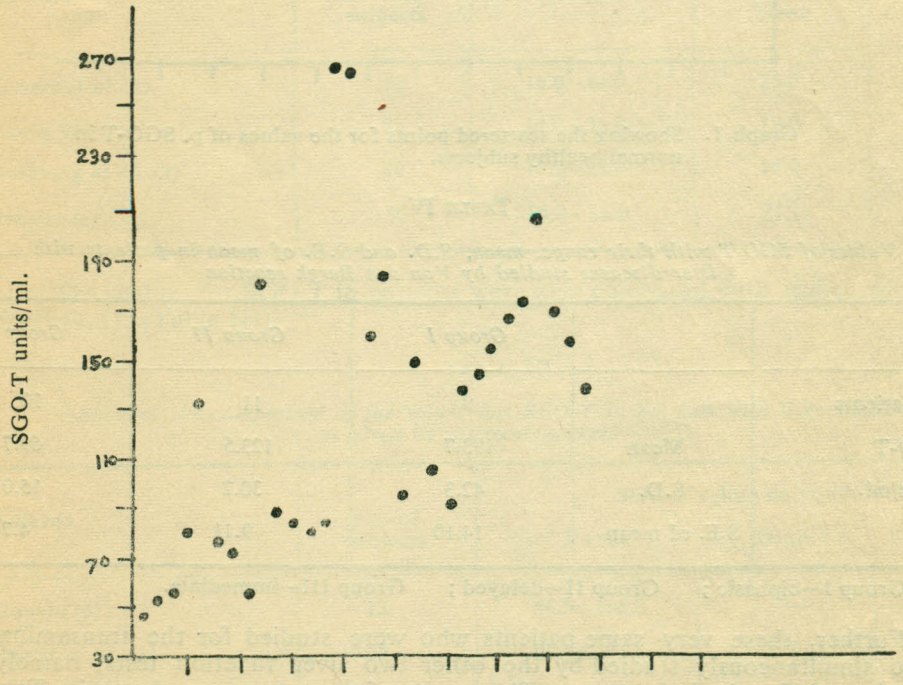
Further, these very same patients who were studied for the transaminase test were also simultaneously studied by the other two liver function tests, namely, Van den Bergh and Icteric index test. The results of these tests are shown in Tables IV and V.

TABLE V

*Values of SGO-T with their range, mean, S.D. and S.E. of mean in patients with liver diseases studied by Icteric index test*

| | | *Group I* | *Group II* | *Group III* | *Gronp IV* |
|---|---|---|---|---|---|
| No. of patients | | 8 | 10 | 8 | 4 |
| SGO-T | Mean | 66.1 | 107.7 | 160.3 | 227.8 |
| units/ml. | S.D. | 14.7 | 29.0 | 13.2 | 42.0 |
| | S.E. of mean | 5.20 | 9.17 | 4.67 | 21.0 |

| | | |
|---|---|---|
| Group I | Icteric index | 12—25 |
| Group II | ,, | 26—38 |
| Group III | ,, | 39—50 |
| Group IV | ,, | 51 and above |




Graph 2. Showing the scattered points for the values of SGO-T in patients with hepatic diseases.

TABLE VI

*Showing the values for SGO-T (units/ml) in normal healthy subjects*

| Sr. No. | SGO-T units/ml | Sr. No. | SGO-T units/ml | Sr. No. | SGO-T units/ml. |
|---|---|---|---|---|---|
| 1. | 16.0 | 20. | 27.0 | 39. | 21.0 |
| 2. | 20.0 | 21. | 34.0 | 40. | 15.0 |
| 3. | 15.0 | 22. | 19.0 | 41. | 17.0 |
| 4. | 16.0 | 23. | 17.0 | 42. | 19.0 |
| 5. | 19.0 | 24. | 14.0 | 43. | 29.0 |
| 6. | 28.0 | 25. | 14.0 | 44. | 28.0 |
| 7. | 16.0 | 26. | 15.0 | 45. | 15.0 |
| 8. | 14.0 | 27. | 15.0 | 46. | 19.0 |
| 9. | 28.0 | 28. | 20.0 | 47. | 28.0 |
| 10. | 19.0 | 29. | 19.0 | 48. | 21.0 |
| 11. | 16.0 | 30. | 15.0 | 49. | 23.0 |
| 12. | 34.0 | 31. | 17.0 | 50. | 15.0 |
| 13. | 20.0 | 32. | 29.0 | 51. | 15.0 |
| 14. | 34.0 | 33. | 15.0 | 52. | 28.0 |
| 15. | 35.0 | 34. | 21.0 | 53. | 19.0 |
| 16. | 17.0 | 35. | 19.0 | 54. | 28.0 |
| 17. | 35.0 | 36. | 14.0 | 55. | 27.0 |
| 18. | 36.0 | 37. | 21.0 | 56. | 21.0 |
| 19. | 14.0 | 38. | 15.0 | | |

TABLE VII

*Showing the values for SGO-T (units/ml) in patients with hepatic diseases*

| Sr. No. | SGO-T units/ml. | Clinical Diagnosis | Sr. No. | SGO-T units/ml | Clinical Diagnosis |
|---|---|---|---|---|---|
| 1. | 48.0 | Obst. Jaundice | 16. | 157.0 | Cirrhosis |
| 2. | 53.0 | ,, | 17. | 182.0 | Inf. hepatitis |
| 3. | 56.0 | ,, | 18. | 93.0 | Cirrhosis |
| 4. | 80.0 | ,, | 19. | 147.0 | Inf. hepatitis |
| 5. | 132.0 | Cirrhosis | 20. | 85.0 | Cirrhosis |
| 6. | 76.0 | Obst. Jaundice | 21. | 91.0 | ,, |
| 7. | 72.0 | ,, | 22. | 136.0 | ,, |
| 8. | 56.0 | ,, | 23. | 143.0 | ,, |
| 9. | 180.0 | Inf. hepatitis | 24. | 152.0 | ,, |
| 10. | 88.0 | Obst. Jaundice | 25. | 164.0 | Inf. hepatitis |
| 11. | 84.0 | ,, | 26. | 171.0 | ,, |
| 12. | 79.0 | Cirrhosis | 27. | 205,4 | ,, |
| 13. | 84.0 | Obst. Jaundice | 28. | 168.0 | ,, |
| 14. | 264.0 | Inf. hepatitis | 29. | 155.0 | Cirrhosis |
| 15. | 262.0 | ,, | 30. | 136.0 | ,, |

*Statistical analysis of the data* :—

On comparing the data for SGO-T values obtained in normals with that obtained in the patients with liver diseases, it was found that the value for the d-statistic was 9.99. On comparison of the data for SGO-T test with liver function test, namely, Van den Bergh reaction, in patients with liver diseases, the value for the variance ratio F was

TABLE VIII

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

| Group I | | Group II | | Group III | |
|---|---|---|---|---|---|
| Biphasic | | Delayed | | Immediate | |
| Sr. No. | SGO-T | Sr. No. | SGO-T | Sr. No. | SGO-T |
| 1. | 180.0 | 1. | 132.0 | 1. | 48.0 |
| 2. | 264.0 | 2. | 79.0 | 2. | 53.0 |
| 3. | 262.0 | 3. | 157.0 | 3. | 56.0 |
| 4. | 182.0 | 4. | 93.0 | 4. | 80.0 |
| 5. | 147.0 | 5. | 85.0 | 5. | 76.0 |
| 6. | 164.0 | 6. | 91.0 | 6. | 72.0 |
| 7. | 171.0 | 7. | 143.0 | 7. | 56.0 |
| 8. | 205.0 | 8. | 152.0 | 8. | 88.0 |
| 9. | 168.0 | 9. | 155.0 | 9. | 84.0 |
| | | 10. | 136.0 | 10. | 84.0 |
| | | 11. | 136.0 | | |

found to be 39, whereas the corresponding value of F was found to be 15, on comparison of the data for SGO-T test with another liver function test, namely, Icteric index test, performed quantitatively in the patients. All these values of d and F are found to be very highly statistically significant at 0.1 % level (P=0.001).

## DISCUSSION

Variations of enzyme activity in serum following the damage to the tissues *e.g.* liver *etc.* cannot be interpreted solely as consequences of enzyme leakage from the necrotic tissue cells. These changes should rather be regarded as an example of a more general phenomenon. A complex reaction of the organism begins to occur 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 the changes in enzyme activities. Thus there will be several factors influencing the enzyme level both in the cell and in the serum. Enzyme degradation and formation in the organ cells, especially in the liver, as also the permeability of the cell membranes are significant for the enzyme level in the cell. Another factor which should be considered is that certain enzymes exist in two forms, one an active form and the other its inactive or precursor form. The permeability of cell membranes, the enzyme elimination in

TABLE IX

*Relationship of SGO-T units/ml with liver function test—Icteric index*

| Group I | | Group II | | Group III | | Group IV | |
|---|---|---|---|---|---|---|---|
| Sr. No. | SGO-T | Sr. No. | SGO-T | Sr. No. | SGO-T | Sr. No. | SGO-T |
| 1. | 48.0 | 1. | 84.0 | 1. | 182.0 | 1. | 264.0 |
| 2. | 53.0 | 2. | 84.0 | 2. | 147.0 | 2. | 262.0 |
| 3. | 56.0 | 3. | 132.0 | 3. | 164.0 | 3. | 205.0 |
| 4. | 80.0 | 4. | 79.0 | 4. | 171.0 | 4. | 180.0 |
| 5. | 76.0 | 5. | 157.0 | 5. | 168.0 | | |
| 6. | 72.0 | 6. | 93.0 | 6. | 143.0 | | |
| 7. | 56.0 | 7. | 85.0 | 7. | 152.0 | | |
| 8. | 88.0 | 8. | 91.0 | 8. | 155.0 | | |
| | | 9. | 136.0 | | | | |
| | | 10. | 136.0 | | | | |

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

urine and bile and degradation or inhibition of the enzyme in the serum can influence the enzyme level in the serum. These influencing factors have been shown in a form of a diagrammatic illustration in Fig. 1.

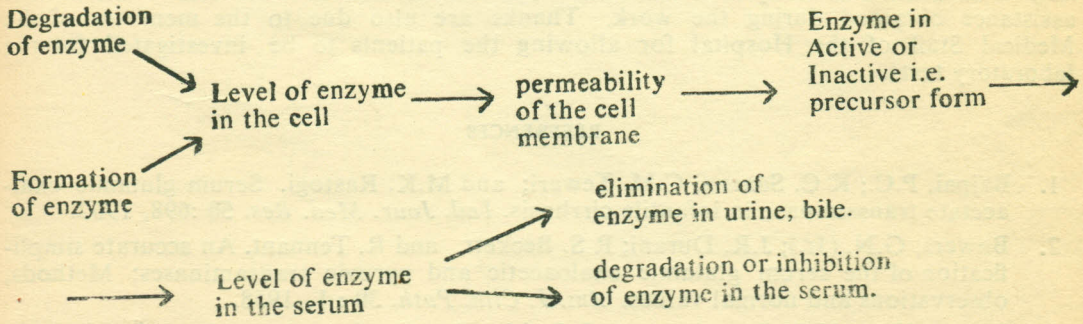



Fig. 1 Showing in the form of a diagrammatic illustration, the various factors influencing the level of enzyme in the cell and in the serum.

Thus it is possible that the above factors can help explain the nonuniform behaviour of these enzymes in respect of their levels in the serum in cases of tissue damage despite the liberation of considerable amounts of intracellular enzymes into circulation. In another study, where the levels of SGP-T have been studied both in health and in diseases of the liver, a similar finding has been observed (unpublished data).

## SUMMARY

A study was undertaken to find out the levels of serum glutamic oxaloacetic transaminase activity (SGO-T) in thirty patients with dieseases of the liver. Other liver function tests such as Van den Bergh test and Icteric index tests were also performed in the same samples of sera simultaneously and a comparison has been made between the SGO-T test and the latter liver function tests.

Fifty six normal subjects were also studied for finding out the normal levels for comparison for the serum transaminase activity. In normals the range was found to vary from 14.0 to 36.0 with a mean of 21.1 units/ml. with standard deviation value of 6.6 and standard error of mean being 0.88; whereas in thirty patients, it was found to vary from 48.0 to 264 0 with a mean of 126.6 units/ml. with standard deviation value of 57.3 and standard error of mean being 10.46.

The serum transaminase activity has been found to be increased in hepatic diseases; this was particularly so in case of infective hepatitis, where high serum transaminase activity was found to be present.

The significance of these findings has been discussed in the paper.

## ACKNOWLEDGEMENTS

The author wishes to thank the Dean, Medical College Baroda, and the Professor of Physiology, for the facilities provided to work on the problem. Thanks are due to the M.S. University of Baroda, for financial aid, and to the staff of the department for their cooperation. Thanks are also due to Dr. N.M. Bhatt, Professor and Head of the department of Statistics, M S. University of Baroda and to Shri A.V. Dongre, for their help in the statistical analysis of the data. The author thanks Shri A.K. Walli for his assistance obtained during the work. Thanks are also due to the members of the Medical Staff of the Hospital for allowing the patients to be investigated for the laboratory tests.

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