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Serum Transaminase
An Aid To Diagnosis

Gerald J. Crawley, B.S.*

The purpose of this report is to present a background to the understanding of transaminase reaction and its possible importance as a diagnostic aid in certain pathological conditions to the student of veterinary medicine. In a short treatise of this type, it is not possible to go into the complex mechanisms of the reaction, but it is intended to outline a few of the general principles with which the veterinarian should be familiar. For the most part contact with this subject has been limited to a very brief explanation in biochemistry and physiology, plus information which can be gained from the hospital clinicians during clinic hours.

Enzymatic transamination consists of the enzyme catalyzed reversible transfer of the α-amino nitrogen of an amino acid to an α-keto acid with the synthesis of a second amino acid and a second α-keto acid. Braunstein and Kritzman (2) first demonstrated the presence of enzymes catalyzing such reactions in pigeon breast and rabbit muscle in 1937. Subsequent studies have revealed that transamination is probably the most important metabolic mechanism in both the formation and deamination of many amino acids in various tissues. Under normal conditions these enzymes are confined almost entirely within the tissue cells although a very small amount is normally found in the blood serum. It is believed that during necrosis of these cells the enzyme is liberated into the circulation and can be a measure of the amount of tissue necrosis (10). The two transaminases found most active in animal tissues are glutamic oxalacetic and glutamic pyruvic transaminase.

Many methods have been devised to measure the level of transaminase in the serum. To date, the most practical of these methods is by using the spectrophotometer or the colorimeter. At the present time there are a number of clinical methods available and are being used routinely in human medicine (3, 12) and can be adapted to use by the veterinarian.

The tissues which contain the largest amount of these transaminases are heart muscle, skeletal muscle, liver, and the central nervous system. The latter releases its enzymes into the spinal fluid and they can not be demonstrated in blood serum. Other organs also contain transaminases, but in lesser amounts (13). Thus, it can readily be seen that although increased levels in the serum indicate a diseased state or damaged tissue, the source of this increase can not be specifically determined. Therefore, it is absolutely necessary that the entire clinical picture be evaluated carefully, using serum transaminase levels as another clinical aid.

Although much of the preliminary work was accomplished with the aid of animals, there is very little information available...
which can be used on a clinical level and most standards for animals now used have been adapted from those found in the human. However, it is known there are many species’ variabilities and there is a considerable amount of work at present to determine in which animals this reaction can be used for diagnostic purposes and within what range of values these levels can be considered normal, mildly abnormal and very serious (5, 6). Because the dog was used most often in experimental work, normal values have been tentatively established for this species and this test is being used in a few laboratories as an adjunct to diagnosis of cardiac and liver pathology.

Generally speaking, the two main enzymes of interest at the present are serum glutamic oxalacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT). However, the latest work indicates that other enzymes may be just as, or even more valuable, as diagnostic acids; notable among these is lactic dehydrogenase (LDH) (7). The normal levels of SGOT and SGPT have been established as 15–35 and 10–30 Karman units respectively. However, there is much variation among individuals. The maximum serum concentration is reached 16–28 hours following myocardial tissue damage and is usually completely gone within 4 days. Although both are considerably elevated in myocardial damage, the SCOT is much more elevated — sometimes as high as 30 times the normal values. Both are also elevated in liver necrosis, but in this case the SGPT rises considerably higher than it would in myocardial problems and the time-concentration curve is considerably changed (8, 11). It should be emphasized that an elevated concentration of serum transaminase during hepatic disease reflects actual parenchymal injury and is not a liver function test. But when used in conjunction with liver function tests and symptoms, transaminase determinations can be a great aid in establishing a diagnosis as well as a prognosis.

The determination of the levels of activity of various enzymes in the blood or serum of animals represents a major advance in the laboratory diagnosis of various disease conditions. Clinical methods are available at a small cost which require little, if any, extra equipment than is already present in the normally equipped laboratory. It must be repeated that the results of these tests cannot be considered as a specific diagnosis, but when considered in light of other clinical symptoms and tests, can be a valuable aid in diagnosis and prognosis. Any cause of tissue breakdown — trauma, infection, infarction, ischemia, neoplasia, and perhaps even nutritional deficiencies (white muscle disease (1) ) may result in elevated serum levels, presumably by the release of enzymes from the damaged tissue. Despite this limitation, serum transaminase determinations serve, in the proper clinical setting, as a highly valuable indicator of myocardial and liver necrosis. It aids especially in the early diagnosis which is so often essential if treatment is to be beneficial; failure to observe serum elevations on serial testing is an important negative finding.

As our knowledge of disease conditions continue to increase so must our methods by which these conditions are diagnosed. Many of the problems that faced the veterinarian of yesteryear have been resolved in a relatively short period of time during the past few years. The diagnosis of many of the poorly understood conditions of today may well be resolved by the use of transaminase tests. Even many of the conditions which are well understood, but in which accurate diagnosis is difficult with the methods now available, may become routinely diagnosed by transaminase studies. It is hoped that transaminase reactions may be the key to opening some of the hidden secrets of the central nervous system and the reasons for certain toxicity symptoms.

It appears that although transaminases may be a valuable adjunct to large animal disease diagnosis, their principal use will be in the realm of the small animal clinician. Small animal pets nowadays are receiving increasingly better care. This leads to greater longevity. The treatment of geriatric problems by the small animal clini-
cian has become an important phase of practice, and this phase will continue to grow (4). Many of these problems are centered around cardiac and liver pathology and the means now available for diagnosing these abnormalities in dogs often fail to give unequivocal information. Therefore, treatment is often based on intuition and past experience with no guarantee that the treatment is specific for the condition presented. By the use of transaminase determinations many of these inabilities on the part of the clinician may be alleviated.

REFERENCES

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