Conclusion. 1. Patients were made acidotic with intravenous ammonium chloride during a period when they were anemic and again during a period when the red blood count and hemoglobin values were normal. 2. No significant change in range of blood pH, bicarbonate, urinary pH or titratable acidity was demonstrated during and following infused ammonium chloride during the period of anemia as compared with the period of normal red blood count and hemoglobin levels. 3. No difference in response to infusion of sodium bicarbonate during the state of compensated metabolic acidosis was noted when the patients were anemic as compared with a normal red blood count and hemoglobin level. 4. Correction of a severe anemia is not important in overcoming ammonium chloride-induced metabolic acidosis or in the correction of the ammonium chloride-induced metabolic acidosis with sodium bicarbonate.

The authors wish to thank Miss Dorothy Zoeller and Miss Evelyn Warteberg, medical technologists, Milwaukee County General Hospital, for their assistance in performing some of the determinations in this study.

1. Bland, J. H., Clinical recognition and management of disturbances of body fluids. W. B. Saunders Co., Philadelphia, p. 393, 1956.

2. Schleisinger, M. H., and Freedberg, A. S., *Circulation*, 1951, v3, 837.

Received June 29, 1956. P.S.E.B.M., 1956, v92.

Serum Transaminase Levels in Experimental Pericardial Injury.* (22626)

CLARENCE M. AGRESS, HARVEY F. GLASSNER, AND MAXWELL J. BINDER.
(With the technical assistance of Paul Rudnick.)
(Introduced by William G. Clark.)

Cardiovascular Laboratory, General Medical Research Service, Veterans Administration Center, and the Department of Medicine, School of Medicine, University of California, Los Angeles.

Because of recent interest in serum glutamic oxalacetic (SGO) transaminase determinations in the differential diagnosis of myocardial infarction, measurements of the level of this enzyme were carried out after experimental production of acute pericarditis.†

Method. Thirteen dogs were studied. Pericardial injury was produced in 9 animals, and the remaining 4 animals were used as controls. After the dogs were anesthetized with pentobarbital sodium, the chest was entered by splitting the distal 3 inches of the sternum. The following substances were placed in the pericardial sac: (1) one cc of sterile sand was used in 3 dogs; (2) one cc of sterile talc in one dog; (3) one cc of a virulent culture of alpha streptococci obtained from human blood cultures in 5 dogs; 2 of these were treated with penicillin and streptomycin to reduce the severity of the infection. The pericardial sac was then sutured with 5-0 silk and the chest was closed. The 4 control animals underwent a sham operation but without manipulation or incision of the pericardium. Twelve-lead electrocardiograms and SGO transaminase samples were taken on all dogs before operation and at 24-hour intervals over a period of 5 days after operation. The animals were then autopsied and color photographs were taken of the visceral and parietal pericardia. Tissue sections were obtained from representative areas of the pericardium and myocardium. The severity of pericarditis was estimated at autopsy and was correlated with the color photographs, microscopic pathology, and electrocardiographic findings. The severity of the pericardial changes by electrocardiogram were estimated on the basis of the amount of elevation of the ST segments. One mm elevation of the ST segments was classified as mild, while an elevation of 5 mm or more in multiple leads was classified as severe

* Aided by funds from the Smart Family Foundation.

† Reported in preliminary form at the Western Soc. for Clin. Research, Carmel, Calif., Jan. 1956.

TABLE I. Correlation of Severity of Pericardial and Myocardial Injury with SGO Levels.

Dog No.	Exp. agent	Estimation of severity of injury		Serum glutamic oxalacetic transaminase		
		Pericardial	Myocardial	Initial level (units)	Peak level (units)	Peak time after injury (hr)
1	Control			22	113	24
2	"			16	40	22
3	"			26	90	45
4	"			33	128	24
5	Sand	Mild	Mild	30	49	43
6	α Strep*	"	"	24	50	27
7	" *	"	"	20	73	20
8	Sand	Moderate	"	40	61	22
9	α Strep	"	Moderate	20	130	46
10	Sand	Severe	Mild	32	70	21
11	Talc	"	Moderate	52	206	20
12	α Strep	"	"	28	284	48
13	"	"	Severe	26	392	23

* Treated with penicillin and streptomycin.

pericardial change. The extent of myocardial injury was judged from gross and microscopic appearance; that is, the depth to which the muscle showed damage grossly, and the loss of architecture, infiltration of inflammatory cells, loss of cross striations, etc., seen on microscopic study. This was done by 2 independent observers, neither having knowledge of the laboratory data. The agreement between these 2 observers was good although not absolute. When disagreement occurred the slides were reviewed together until a composite estimate was obtained.

The serum samples were analyzed for SGO transaminase activity by the method of La Due, *et al.*(1,2) and correlated with all of the preceding data.

Results. Comparative data are listed in Table I. Inflammatory changes were found to be limited to the heart. In general, the microscopic picture correlated well with the electrocardiographic changes but in a few instances severe inflammatory changes by histologic study were associated with minimal injury patterns in the electrocardiogram. In the 4 control animals, peak SGO transaminase levels ranged from 40 to 128 units. A similar rise in SGO transaminase was observed to follow chest surgery by Nydick, *et al.*(3) and is presumably due to skeletal muscle damage. In the 9 experimental animals, these values were from 49 to 392 units. Peak values were reached in approximately 24 hours in 9 animals and in approximately 48 hours in 4 animals.

Animals in which both pericardial and myocardial changes were mild or moderate, showed peak SGO transaminase levels that were within the control range. Of the 4 animals with severe pericarditis, 3 had SGO transaminase levels which were significantly elevated above control values. Two of these animals showed moderate myocardial damage. The third animal showed severe myocardial damage and a peak SGO transaminase level of 392 units, the highest in the series. In contrast, the peak SGO transaminase level was well within the control range in the animal with severe pericardial but mild myocardial damage.

Discussion. The clinical and electrocardiographic differentiation of acute pericarditis from acute myocardial infarction may at times be very difficult. In such instances, it would be very desirable to have other means of distinguishing between these 2 entities. SGO transaminase levels have been shown to rise with acute myocardial infarction(1,2,4,5,6) and to be proportional to the amount of experimentally produced myocardial damage (7). Normal SGO transaminase levels have been found in experimentally produced pulmonary infarction(8). Sub-epicardial myocardial damage is known to occur in clinical and experimental acute pericarditis and is likely the main, if not the only cause for the

electrocardiographic changes seen with this disease(9,10). Although more myocardial damage would be expected to occur with severe than with mild pericarditis, this is not invariable. The ECG is therefore not always reliable in estimating degree of pericardial injury. The data indicate that SGO transaminase levels may rise when acute pericarditis is experimentally produced. Normal SGO transaminase levels were found when the associated myocardial changes were mild, regardless of the severity of pericarditis. The peak levels showed progressive rises with increase in severity of the myocardial changes. The level of SGO transaminase appears to be determined by severity of the associated myocardial damage rather than by pericardial changes *per se*.

The SGO transaminase level, when elevated, does not help in distinguishing between acute pericarditis and myocardial infarction. When the SGO transaminase level remains normal, however, differentiation can be made between these two diseases, and the clinical and electrocardiographic diagnosis of pericarditis confirmed.

Conclusions. 1. Acute pericarditis was experimentally produced in dogs using sand, talc and cultures of alpha streptococci. 2. The peak levels of serum glutamic oxalacetic transaminase were found to be proportional to the severity of sub-epicardial myocardial damage rather than to the severity of pericardial injury. 3. The serum glutamic oxalacetic transaminase levels help to distinguish between acute pericarditis and acute myocardial infarction only when the levels remain normal.

We wish to thank the following for their interest and cooperation: Udo Reinach, Jack Feldman, Phillip E. Lyon, and Dr. William G. Clark.

1. LaDue, J. S., Wroblewski, F., and Karmen, A., *Science,* 1954, v120, 497.

2. Karmen, A., Wroblewski, F. and LaDue, J. S., *J. Clin. Invest.,* 1955, v34, 126.

3. Nydick, I., Wroblewski, F., and LaDue, J. S., *Circulation,* 1955, v12, 161.

4. LaDue, J. S., and Wroblewski, F., *ibid.,* 1955, v11, 871.

5. Kattus, A. A., Watanabe, R., Semenson, C., Drell, W., and Agress, C. M., *J. A. M. A.,* 1956, v160, 16.

6. Lemley-Stone, J., Merrill, J. M., Grace, J. T., and Meneely, G. R., *Am. J. Physiol.,* 1955, v183, 555.

7. Agress, C. M., Glassner, H. F., Jacobs, H. I., Lederer, M. E., Clark, W. G., Wroblewski, F., Karmen, S., and LaDue, J. S., *Circulation,* 1955, v11, 711.

8. Agress, C. M., Glassner, H. F., and Jacobs, H. I., *Circulation Research,* 1956, v4, 220.

9. White, P. D., *Heart Disease,* New York, 1951, Macmillan Co., p. 1015.

10. Lepeschkin, E., *Modern Electrocardiography,* Baltimore, The Williams and Wilkins Co., 1951, v1, 598.

Received July 2, 1956. P.S.E.B.M., 1956, v92.

Occurrence of Bodies within Endoplasmic Reticulum of Ehrlich Ascites Tumor Cells. (22627)

MARLENE FRIEDLAENDER* AND DAN H. MOORE.

Department of Microbiology, College of Physicians and Surgeons, Columbia University, New York City.

A previous communication reported the presence of spherical particles inside the endoplasmic reticulum of Ehrlich ascites tumor cells which had been inoculated with anopheles A virus(1,2). A belief that these particles represented the elementary bodies of anopheles A virus was based on the following circumstantial evidence: 1) Consistent size and structure; 2) high opacity in the electron beam after fixation with osmium tetroxide; 3) localized occurrence in large numbers within a certain time interval following inoculation with the virus; 4) absence of similar particles in uninoculated tumor cells or those

* Present address: Sloan-Kettering Institute for Cancer Research, New York City.