Effect of Cardiac Catheterization and Angiography on the Serum Glutamic Oxaloacetic Transaminase

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THIS STUDY concerns the effect of cardiac catheterization and angiography on the serum glutamic oxaloacetic transaminase (SGO-T). It was prompted by the finding of an elevation of this enzyme in a patient whose heart wall was inadvertently punctured during transseptal left heart catheterization and in whom the possibility of traumatic myocardial infarction was entertained.

To our knowledge, only one study of the effect of cardiac catheterization on the serum transaminase has been published. Abnormal elevation of SGO-T was reported by this group in two of 25 patients studied.

Material and Methods

The subjects were 25 patients undergoing cardiac catheterization and 21 having angiography at the University of Oregon Medical School. Patients receiving anticoagulants or exhibiting clinical evidence of liver disease, congestive heart failure, or active carditis, and those undergoing combined cardiac catheterization and angiography were excluded. No other criterion for selection was used. All were hospitalized for the entire period of the study with the exception of three who were followed as outpatients.

The nature of the cardiac lesion, age and sex of the patients, type of procedure, and complications are listed in tables 1 and 2.

Premedication consisted of 50 to 100 mg. of sodium pentobarbital; opiates were avoided. Two per cent lidocaine hydrochloride with 0.15 per cent tetracaine hydrochloride was used for local anesthesia, Coomassie blue for indicator-dilution studies, and Angio-Conray (sodium iothalamate) or Hypaque (sodium diatrizoate) for angiography. All patients received prophylactic procain penicillin parenterally before and after the procedure.

The following data were recorded: duration of the procedure; number of catheters used; number of catheter insertion and arterial puncture sites with degree of associated trauma (graded 1 to 4+); duration of exercise; amount of dye or contrast agent injected; number of injections, pressure, duration, and site of delivery of contrast agent.

The patients were observed in particular for hypotension, angina pectoris, electrocardiographic changes, fever, rash, phlebitis, arterial thrombosis, hematoma, and wound infection. Radiographs were examined for evidence of extravasation of contrast agent.

Because serum enzyme activity fluctuates during the day, morning and afternoon blood samples were drawn for 1 to 2 days preceding the procedure. At least two controls were obtained. Samples were taken before, immediately after, approximately 8, 12, 24, and 32 hours from the beginning of the procedure and then daily for a total of 4 to 6 days. The 12-hour specimens were not obtained after angiography. Several patients could be followed for only 1 to 3 days.

Sera were stored at -10 C. Simultaneous determinations were made within 4 days of the time of collection of the final specimen. The colorometric method of Reitman and Frankel was used with blank controls for all samples. Although such controls are not routinely recommended, we have noted that turbidity of serum and Coomassie blue may cause falsely high values.

In 70 normal adults studied in our laboratory, the SGO-T activity ranged from 9 to 42 units, with a mean of 18.1 ± 6.9 units. Values between 43 and 50 units were considered borderline and above 50 units abnormal for this study.

Results

The SGO-T responses* to cardiac catheterization and angiography were similar and divisible into five patterns:

1. No abnormal SGO-T elevation: Nine of

*The serial SGO-T values for each patient studied are available on request from the authors.
Data on Patients Undergoing Cardiac Catheterization

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AI, rheumatic aortic insufficiency; AS, rheumatic aortic stenosis; ASD, atrial septal defect; ASHD, arteriosclerotic heart disease; CAo, coarctation of aorta; CP, cor pulmonale; IM, innocent murmur; LH, transseptal left heart catheterization; MI, rheumatic mitral insufficiency; MS, rheumatic mitral stenosis; RH, right heart catheterization. Exercise consisted of straight leg raising.
the 25 patients undergoing cardiac catheterization and 11 of the 21 studied by angiocardiography did not show abnormal elevation of the enzyme. Fluctuations within normal and borderline limits were observed.

2. Abnormal SGO-T elevation in the early post-procedure period: Five times with cardiac catheterization and twice with angiocardiography, transient abnormal elevations of SGO-T occurred during the 24 to 48 hours following the procedure (fig. 1A). Peak elevations were: cardiac catheterization, 109, 64, 57, 56, and 51 units and angiocardiography, 65 and 57 units.

3. Late abnormal SGO-T elevation: Between the third and sixth post-procedure days, abnormal elevation of SGO-T was observed in two patients undergoing cardiac catheterization and two having angiocardiography (fig. 1B). Peak values were 146 and 60 units for the former, and 57 and 51 for the latter. The highest elevation in this group occurred in a patient who had transseptal left heart catheterization complicated by thrombophlebitis and myositis of the right lower extremity.

4. Early and late abnormal SGO-T elevations: Four patients studied by cardiac catheterization and three by angiocardiography showed an early and a late abnormal elevation of the enzyme (fig. 1C). Peak elevations were
## Table 2

### Data on Patients Undergoing Angiocardiography

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Abd Ao, abdominal aorta; AC, Angio-Conray 80%; AI, rheumatic aortic insufficiency; AS, rheumatic aortic stenosis; AS*, congenital aortic stenosis; Asc Ao, ascending aorta; ASHD, arteriosclerotic heart disease; H, Hypaque 50%; Cor Art, right and left coronary arteries; IV, intravenous; LV, left ventricle; man., manual injection of contrast agent; MI, rheumatic mitral insufficiency; MS, rheumatic mitral stenosis; PS, congenital pulmonic stenosis; RV, right ventricle; Tetrad, tetalogy of Fallot; VSD, ventricular septal defect.
79, 70, 66, and 66 units for cardiac catheterization, and 64, 63, and 60 for angiocardio-
graphy.

5. Abnormal SGO-T elevation prior to pro-
cedure: SGO-T was abnormally elevated in the
control samples of five patients undergo-
ing cardiac catheterization and three having
angiocardiology (fig. 1D). Peak values ranged from 57 to 91 units. Usually this ele-
vation was sustained; further increases fol-
lowed the procedure in three cases. The
subjects were all adults with long-standing heart
disease (rheumatic heart disease in seven and
atrial septal defect in one). Although none
was in overt heart failure at the time of the
study, all had been in failure in the past.

Discussion
The foregoing data indicate that SGO-T
may be abnormally elevated following cardiac
catheterization or angiocardiology. The in-
cidence* of elevation was higher in the former
(55 per cent) than the latter (39 per cent); this
difference was not statistically significant.
Although the elevations were modest in most
cases, some were in the range seen with myo-
cardial infarction.

There was no correlation between enzyme
level and cardiac lesion, type or duration of
procedure, trauma, exercise, amount of dye
or contrast agent used, or number, pressure,
duration and site of injections of contrast
agent. Of the six complications observed, only
in the patient who had thrombophlebitis and
myositis was a correlation noted. The SGO-T
rise paralleled the development of this com-
plification and was probably due to skeletal
muscle involvement, since thrombophlebitis
per se is not a cause of SGO-T elevation.5

The etiology of abnormal enzyme elevation
is not clear. Whether it is cardiac or extra-
cardiac in origin cannot be determined from
this study. It cannot be attributed to Coomas-
sie blue or the contrast substance, since a
significant number of patients receiving these
agents did not show any elevation of the en-
zyme. We have no explanation for the early
and late patterns of elevation.

An attempt was made in this study to ex-
clude factors known to cause SGO-T rise, i.e.,
use of opiates6,7 as premedication, anticoagu-
lants,8 presence of congestive failure,9,10 or
active carditis.11,12 Certain complications such
as hypotension13,14 and rapid arrhyth-
mias,12,13,15 not observed in our cases, can
also alter the enzyme level. Since these fac-
tors may be present in routine cardiac cath-
erization or angiocardiology, it is conceiv-
able that more significant elevations of the
enzyme could be encountered.

Despite the absence of the aforementioned
factors, abnormal levels of SGO-T may be seen
prior to the procedure as demonstrated by
group 5 (fig. 1D). These patients had long-
standing heart disease and a history of con-
gestive heart failure. Although they exhibited
no clinical evidence of cardiac failure or
hepatic disease at the time of the study, we
believe the SGO-T elevation was due to occult
hepatic disease of cardiac origin. The diag-
nostic limitations of SGO-T determinations in
cardiac catheterization or angiocardiology
therefore cannot be overemphasized.

Summary
The effect of cardiac catheterization and
angiocardiology on the SGO-T was studied in
46 patients. Abnormal enzyme elevations
occurred in a significant number of subjects.
Such procedures constitute an addition to the
known causes of SGO-T elevation.

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The doctor occupies a seat in the front row of the stalls of the human drama, and is constantly watching, and even intervening in, the tragedies, comedies and tragi-comedies which form the raw material of the literary art. If the doctor is to be capable of his work, he must be a man of feeling; and if he is to do his work, his feelings must often in great measure be denied expression. Perhaps this is partly the reason why doctors express themselves in writing, but it does not explain why they so often express themselves well, nor why so many authors, some among the most distinguished, have come to the writing of poetry, plays or novels by way of medicine.—W. RUSSELL BRAIN. Foreword. The Quiet Art: A Doctor’s Anthology. Compiled by Dr. ROBERT COOPE. Edinburgh & London, E. & S. Livingstone Ltd., 1952.
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