DISAPPEARANCE OF IODOALBUMIN FROM PERICARDIAL SAC IN A PATIENT WITH MYXEDEMA

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While it is occasionally observed that pericardial effusion secondary to myxedema may persist after the myxedema has been eliminated, very few data on actual turnover rates of pericardial fluid are presented in the literature. We recently had the opportunity to study the rate of disappearance of radioiodinated human serum albumin injected into the pericardial sac of such a patient.

REPORT OF CASE

A 60-year-old woman came to the Mayo Clinic for the first time in July 1966. She had a history of anemia for 4 years, chest pains on exertion for 10 years and thyroid therapy for 7 years. Her menopause had occurred at age 48 years. Her family history was unremarkable.

The patient stated that she had been aware of facial puffiness since at least 1953. The thyroid therapy had been intermittent since 1958. She had noted that the exertional chest pain was more severe when she was taking larger doses of thyroid and was minimal when she was not taking thyroid. Classic effort angina had been present since at least about 1956. There was no history of myocardial infarction. A year after the anemia had been detected, she had received two units of whole blood because of anemia. Eighteen months prior to admission here she had been told that roentgenograms showed enlargement of her heart.

At examination, her blood pressure was 200 mm Hg systolic and 110 diastolic. The pulse was 80 beats/min and regular. In addition to the classic findings of myxedema, including typical facies, color, reflex and skin changes, there was cardiac enlargement and an apical systolic murmur.

The hemoglobin concentration was 10.9 gm/100 ml with 3,420,000 erythrocytes and 8,300 leukocytes/mm^3. Urinalysis gave normal results. The peripheral blood smear revealed 2% reticulocytes, anisocytosis, rouleau formation and eosinophilia (13%). Values for true blood sugar, blood urea and serum sodium and potassium were normal. Plasma lipid values were: cholesterol, 912 mg/100 ml; phospholipids, 588; fatty acids, 945; and triglycerides, 242. Roentgenographic examination of the thorax revealed marked cardiac enlargement. At cardiac fluoroscopy, no pulsation of the cardiac borders could be detected and the epicardial fat line could not be seen. The electrocardiogram was abnormal (low-voltage QRS complexes and nonspecific repolarization abnormalities). Values for blood corticosteroids were 19.6 μg/100 ml at 8:25 am and 11.0 at 3:14 pm. The protein-bound iodine (PBI) concentration was 1.5 μg/100 ml; butanol-extractable iodine (BEI) was 1.5 μg/100 ml. The hematocrit value was 36.5%. The basal metabolic rate was −25%.

The patient was admitted to the hospital for treatment with dextrothyroxine (Choloxin). The hospital course over a 2-week period was uneventful except for angina with exertion and a 4-lb loss of weight. When the patient was dismissed, a regimen of dextrothyroxine, 1 mg daily, was prescribed. The final diagnoses were primary myxedema, Hashimoto's thyroiditis (old), ischemic heart disease with angina pectoris, pericardial effusion and hyperlipemia.

The patient returned for re-examination in February 1967. She reported significant subjective improvement in the symptoms of myxedema but continued to have angina pectoris, although less easily and less frequently. Her blood pressure was 178/94 mm Hg. There was marked improvement in the facies with much less facial puffiness. The reflex return was still somewhat slow.

The laboratory data at this time were: hemoglobin, 10.6 gm/100 ml; erythrocyte count, 3,460,000/cu mm; leukocyte count, 8,300/mm^3 (3% eosinophils); erythrocytes, normochromic and normocytic; blood sugar and urea, normal; serum iron, 68 μg/100 ml; serum protein electrophoretic pattern, normal; basal metabolic rate, −6%; PBI, 9.5 μg/100

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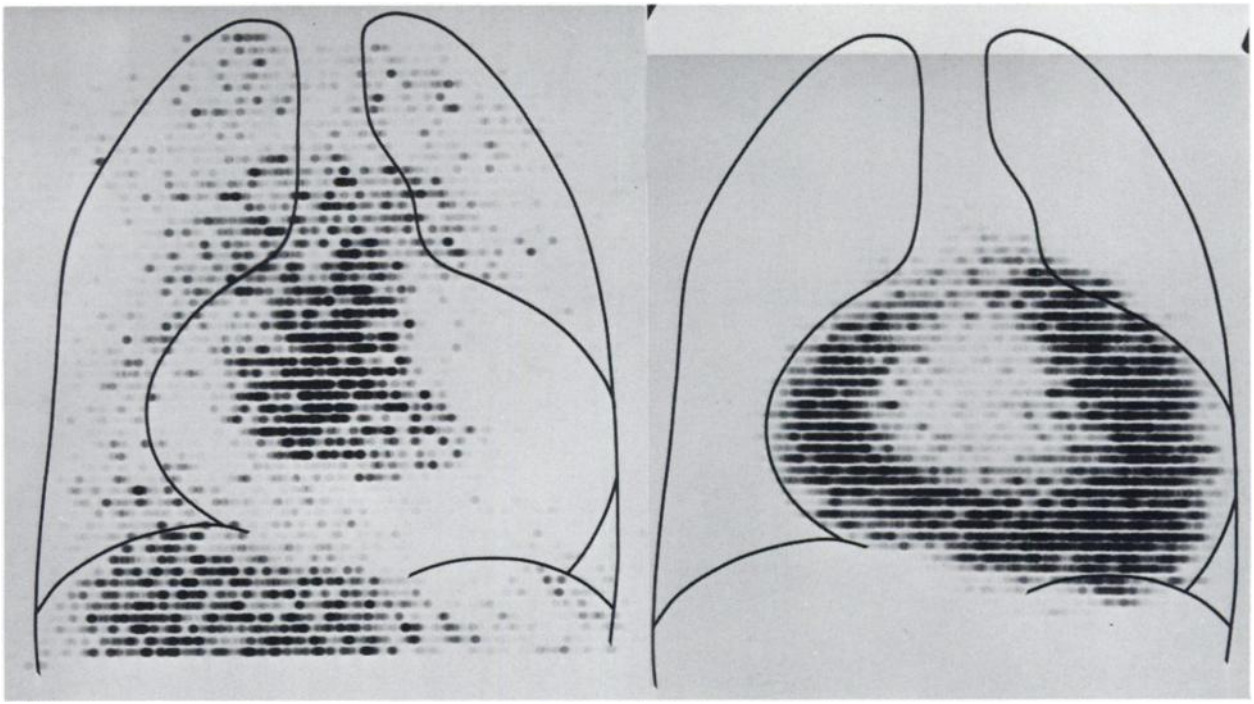

FIG. 1. Left is photoscan of chest made immediately after injection of radioiodinated human serum albumin into antecubital vein. Wide clear zone separates radioactivity within cardiac chambers and roentgenographic shadow. Right is anteroposterior photoscan of chest made after intrapericardial injection of radioiodinated human serum albumin.

ml. The plasma lipid values were: plasma cholesterol, 582 mg/100 ml; phospholipids, 365; fatty acids, 754; and triglycerides, 142. Roentgenograms of the thorax again revealed marked cardiac enlargement, essentially unchanged since the first study (August 1966). The electrocardiogram suggested no significant change from the previous one.

A scintiscan was recorded over the heart after the injection of 200 μCi of iodinated (^{131}I) human serum albumin. Four days later the patient was admitted to the hospital and on the next day, under local anesthesia, pericardiocentesis was performed. A small amount of fluid was removed for laboratory examination and some of this was replaced by 3.2 ml of a solution of radioactive human serum albumin containing 200 μCi of ^{131}I. The patient's chest was scanned nine times subsequently in the anteroposterior projection. Care was taken to ensure that no significant amount of radioactivity from the first injection of labeled albumin had persisted near the heart. The first two scans were performed 55 and 214 min after injection. She was scanned twice daily on the next 2 days and once daily on Days 5, 7 and 9 after injection.

On the 12th day after pericardiocentesis, the patient was found to be hypotensive, and subsequent examination confirmed that a myocardial infarction had occurred. Slow but satisfactory recovery was made, and the patient was ultimately dismissed after 53 days of hospitalization. One week after dismissal, the patient was found dead by her husband. No autopsy was performed.

SCINTISCANS

Methods. Scanning was performed with a locally modified scanner equipped with a 3-in. NaI(Tl) crystal (Picker Magnascanner).

In addition to the conventional film display, the scans were digitized according to previously published techniques (*1–3*). Briefly this consisted of recording the scan data along with horizontal and vertical address signals on a multichannel digitizing incremental tape recorder which records data in computer-compatible format. Data were processed on an IBM 7040 computer and typed out on a high-speed printer (IBM 1403). Type symbols were used to depict individual counting rates over small areas. Counting rates of equal intensity were also depicted by an x-y plotter (CalComp) under computer control as contour plots (similar to relief maps).

Counting rates at each level and all those above a given level were computed and printed out. Those levels which most closely corresponded with anatomic patterns were chosen as zero bases from which to sum all counts over the pericardium.

For presentation the scans were superposed in registry over magnification-free roentgenograms made by the technique of Lewall and Tauxe (*4*).

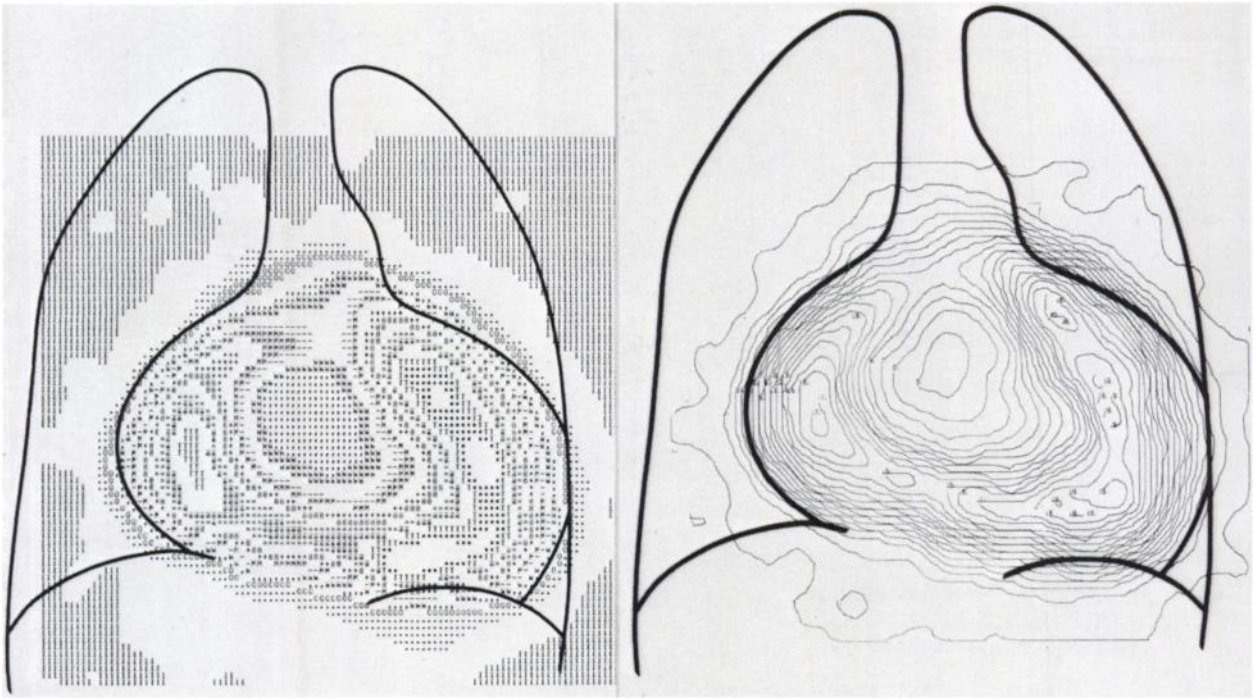

FIG. 2. Computer-processed plots of scintigraphic data shown in Figure 1. Left is digitized plot typed by high-speed printer. Right is isointensity contour plot drawn by x-y plotter, depicting 20 levels of activity.

KEY TO COUNTING RATES IN FIGURE 2 LEFT

Symbol	Range (cpm)	Gamma rays/char	% of peak	Symbol total	Counts at this level	Counts at this level and above
I	0– 507	0.95	5	2,636	17,201	331,657
Blank	507– 1,013	2.84	5	1,843	20,758	314,457
.	1,013– 1,520	4.73	5	427	8,758	293,699
0	1,520– 2,026	6.63	5	235	6,919	284,941
Blank	2,026– 2,533	8.52	5	169	6,371	278,021
,	2,533– 3,040	10.41	5	350	16,324	271,651
W	3,040– 3,546	12.30	5	245	13,414	255,327
Blank	3,546– 4,053	14.20	5	247	15,614	241,912
—	4,053– 4,559	16.09	5	209	14,965	226,298
M	4,559– 5,066	17.98	5	192	15,393	211,333
Blank	5,066– 5,573	19.88	5	183	16,211	195,940
+	5,573– 6,079	21.77	5	172	16,723	179,728
8	6,079– 6,586	23.66	5	156	16,493	163,005
Blank	6,586– 7,092	25.56	5	154	17,585	146,512
=	7,092– 7,599	27.45	5	189	23,172	128,926
a	7,599– 8,106	29.34	5	192	25,027	105,755
Blank	8,106– 8,612	31.24	5	165	22,960	80,728
T	8,612– 9,119	33.13	5	133	19,582	57,767
*	9,119– 9,625	35.02	5	147	22,933	38,185
Blank	9,625–10,138	36.93	5	93	15,252	15,252

Scan speed = 47.7 cm/min.

Total radioactivity over the pericardium was corrected for radioactive decay over the period of the nine scans. This was plotted on semilog paper.

Results. Figure 1 (left) depicts photoscans of the chest after antecubital vein injection of radioiodinated human serum albumin. The heart shadow is 9 cm in its transverse axis, compared to 20 cm for the heart and pericardial shadow on the magnification-free roentgenogram. There is no evidence of significant cardiomegaly.

Figure 1 (right) depicts the anteroposterior photoscan made 55 min after intrapericardial injection of the radioiodinated human serum albumin. The heart is seen as a clear space in the center of the pericardial radioactivity.

Figure 2 depicts the computer-processed scans.

The isointensity contour plot (20 levels of activity made under computer control) was made with the boundary of the pericardium selected as the contour between the second and third levels. This is shown as line 2 in Fig. 2 (right). The key to counting rates in the pericardium is given in the Table. On the digitized plot (Fig. 2, left), the boundary of the pericardium is represented by dots. From the plot of the scan made 55 min after injection, the pericardium contains 293,699 cpm.

Figure 3 is a semilogarithmic plot of the decay-corrected counting rates obtained from the computer printouts. From the slope of this line, the disappearance rate is 1.5%/day. It appears to be a single exponential.

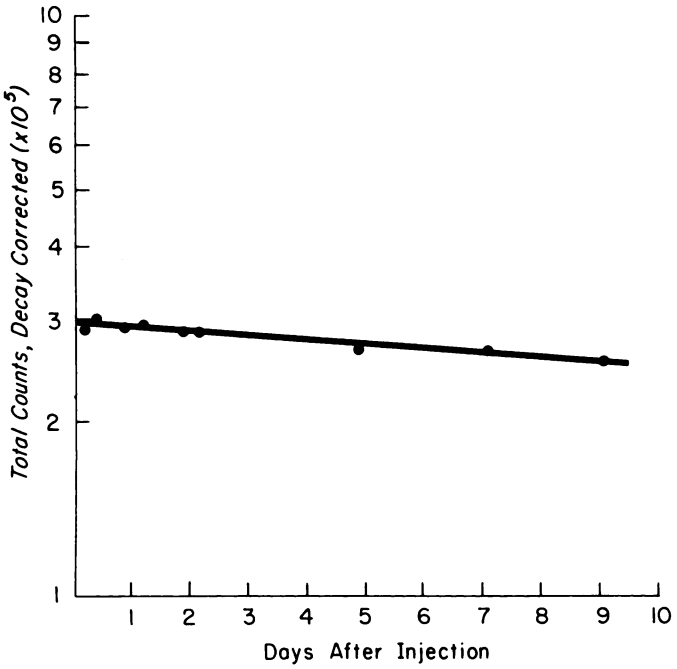

FIG. 3. Semilogarithmic plot of disappearance rate of ^{131}I-labeled human serum albumin from pericardial sac.

DISCUSSION

From our data it is not clear whether myxedema actually caused or was merely associated with the pericardial effusion in this case. In either event, its prolonged duration after the patient returned to a euthyroid status was associated with prolonged retention of radioiodinated human serum albumin injected into the pericardial sac. In fact, what disappearance of label there was, at the unexpectedly low rate of 1.5%/day, may not have been due to the release of albumin but to a deiodination process.

This low turnover of a large molecule injected into a diseased pericardial sac is in contrast to reported rapid turnover values of electrolytes (*5,6*) and dyes injected into the normal pericardial sac (*7*). Also, whole blood has been found to be removed rapidly from the traumatized pericardium of dogs (*8*).

Doherty and coworkers (*9*) reported a disappearance rate of 1.16%/day for ^{14}C-labeled cholesterol in a case of pericardial effusion caused by cholesterol pericarditis. Although similar to our value of 1.5%/day, this turnover value was based on determinations of radiocholesterol made after oral administration of the tracer so the two studies are not precisely comparable.

Although efforts to quantify radioactivity from scintiscans have been reported (*10–12*), to our knowledge this is the first attempt to quantify those from the pericardial sac. It appears to be a very simple method for estimating disappearance rates of gamma-emitting substances from the pericardial sac.

SUMMARY

The rate of disappearance of radiodinated human serum albumin from the pericardium was determined in a patient with pericardial effusion which had accompanied myxedema but which did not clear after appropriate thyroid replacement therapy. Sequential scintiscanning was performed, and the data were digitized and computer processed. The total counting rates over the pericardium were obtained from the computer plots of the scintiscan matrices. Net counts were corrected for decay and plotted against time on semilogarithmic paper. A single exponential was obtained, the slope of which indicated a disappearance rate of 1.5%/day. It was not clear from our data whether the slow clearance of labeled albumin had been caused by or associated with a prior myxedematous state.

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