

FRACTION OF INTRAVENOUSLY INJECTED ^{99m}Tc -SULFUR COLLOID IN THE SPLEEN OF CHILDREN

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In ten cases, spleens surgically removed from children were counted to determine the fraction of intravenously injected ^{99m}Tc -sulfur colloid which had accumulated. Values for the percent uptake and percent uptake per gram of splenic tissue were obtained.

Intravenously injected ^{99m}Tc -sulfur colloid normally accumulates principally in the liver with smaller amounts going to the spleen and bone marrow. There are, of course, few chances to quantify the amount in each organ in human subjects. We have had the opportunity to examine surgically removed spleens from ten children after ^{99m}Tc -sulfur colloid had been given intravenously. The quantity of radioactivity in each spleen and the activity per unit weight of tissue is reported in this communication.

MATERIALS AND METHODS

These studies had the approval of the Human Investigation Committee. The intravenous injection of ^{99m}Tc -sulfur colloid (E. R. Squibb Co.) was made 1–3 hr before removal of the spleen. The quantity injected varied from 10 to 30 $\mu\text{Ci}/\text{kg}$ of body weight. In most cases, a scintiscan or rectilinear scan was also obtained just prior to surgery.

Each surgically removed spleen was weighed and a model quickly constructed (from flexible plastic and water) to match the exact size and shape of the spleen. Any major intrasplenic defects (shown on a scan of the specimen) were mimicked by plastic inserts in the model. The model was filled with the injected dose of ^{99m}Tc -sulfur colloid and served as a standard for counting (correction was made for activity retained in the syringe). The model, spleen, and background support were each counted 40 cm from a probe with a 3-in. NaI crystal and short cylindrical collimator. For confirmation, in most cases the counting of the model and the actual spleen

was repeated under a Nuclear-Chicago Pho/Gamma II camera (with background correction) using a parallel-hole collimator. Since the spleens had to be brought to surgical pathology, they could not be homogenized for counting purposes.

RESULTS

Table 1 summarizes the indications for splenectomy in each case as well as other pertinent data. The actual fraction of injected radioactivity which was present in the spleen varied from 0.5% (in an accessory spleen removed from a child with ITP) to 53.7% in a spleen grossly enlarged by Gaucher's disease. The ten cases are arranged in the table in terms of increasing percent of radioactivity per gram of splenic tissue.

DISCUSSION

The range of uptake of radiocolloid was 0.5–53.7% of the injected dose in the spleen whereas the range of spleen weights was from 23 gm to 2,800 gm. When calculated on the basis of percent of ^{99m}Tc -sulfur colloid in the spleen per gram of tissue, three distinct classes could be noted.

1. Three spleens had a low value for this measurement. These were an enlarged spleen (with multiple infarcts) seen in S-thalassemia, a spleen grossly involved with Gaucher's disease, and a small accessory spleen removed from a girl who had a prior splenectomy for ITP.
2. Six spleens had values of 0.100–0.197% / gm of tissue.
3. One spleen had a greatly elevated value (0.422% / gm) and a marked shift in the spleen-to-liver uptake of radiocolloid on scintiscan. This child had a splenic rupture, and

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TABLE 1. DATA ON TEN CASES SHOWING PERCENT OF INJECTED ^{99m}Tc-SULFUR COLLOID WHICH ACCUMULATED IN SPLEEN

Case	Reason for splenectomy	Sex	Age (yr)	Spleen weight (gm)	Percent uptake	Percent/gm
1	S-thalassemia	M	14	495	3.8	0.008
2	Gaucher's disease	M	14	2,800	53.7	0.019
3	Accessory spleen in ITP	F	14	23	0.5	0.022
4	Hereditary spherocytosis	F	8½	200	20.0	0.100
5	Trauma	F	11	174	17.5	0.100
6	Thalassemia major	F	4½	260	27.9	0.107
7	ITP	F	14	130	17.1	0.131
8	Hodgkin's disease	M	12	113	15.7	0.139
9	Hodgkin's disease	F	13	138	27.2	0.197
10	Trauma*	M	4	54	22.8	0.422

* Marked shift of radiocolloid to the spleen noted on scan.

either the insult or an as yet unknown pre-existing disease may have contributed to this value.

It must be recognized that slight changes in the formulation of the ^{99m}Tc-sulfur colloid might account for variations in splenic uptake. Each batch used in the present study was used in at least one other patient with apparently normal distribution as judged by scanning.

A mean uptake value in this varied group of children may have little significance. The mean uptake in the spleen was 20.4% of the injected ^{99m}Tc-sulfur colloid. Exclusion of the highest and lowest values only changes this to 19%. This result is higher than we would expect if there was a direct parallelism between animal data on radiocolloid (1) or ^{99m}Tc-albumin microsphere (2) uptake and that in human subjects. The spleens reported here, however, cannot be considered normal and the subjects had not reached adult height or weight.

The parameter percent uptakes per gram would be expected to be higher in spleens of smaller weight if the fractional distribution of radiocolloid between liver and spleen was constant. The highest value was seen in the spleen of a 4-year-old boy. However, the elevated value was much greater than could be accounted for on the basis of the small spleen. Ex-

pressing uptake of radiocolloid not only in absolute amount but also in terms of splenic weight might be a useful tool in searching for deranged splenic function. A number of formulas have been proposed for estimating splenic weight from scan data (3-6).

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