ments with different labelled fatty acids are therefore necessary to get more information, especially about the time course curves.

Summary. 1) Carboxyl-labelled linoleic and stearic acids were fed as free acids or as triglyceride esters to patients provided with thoracic duct fistula, and incorporation of these acids into various lipid classes of lymph was followed. 2) Linoleic acid was transported and incorporated into cholesterol esters, triglycerides, phospholipids and non-esterified fatty acids in the same manner as oleic and palmitic acids. Chyle triglycerides constitute the main transport form of both oleic, palmitic, linoleic and stearic acids in man. 3) When linoleic acid was fed, only about 4% of total lymph radioactivity was obtained in the phospholipids, but after feeding stearic acid about 20% of the activity was located in lymph phospholipids. 4) After isolation of lymph lecithins, there was a difference in position of the label in lecithins of lymph according to the fatty acid used. 5) After feeding linoleic acid-1-C^{14}, approximately 75% of the label in lymph lecithins was localized in the alpha-position. However, with stearic acid-1-C^{14} about 80% of the label was found in the beta-position.

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Influence of Thyroidectomy on Experimental Ascites.* (24774)

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Production of experimental canine ascites is characteristically accompanied by derangements in water and electrolyte metabolism. An important factor in this sodium and water retention by the kidney appears to be an increased level of circulating adrenocortical salt retaining hormone, presumably aldosterone (1). Previous studies reported the salutary effect of adrenalectomy and hypophysectomy on experimental ascites(2,3,4). Since functional inter-relationships are known to exist between thyroid gland and adrenal cortex(5), the following study was undertaken to evaluate the effect of thyroidectomy on ascites formation.

Materials and methods. Ascites was created in 10 mongrel dogs, weighing 10-15 kg, by partial constriction of the thoracic inferior vena cava immediately above diaphragm by a band of polyethylene tubing(6). The at-

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TABLE I. Clinical Response, Urine Output and Urinary Sodium Excretion in Ascitic Dogs before and after Thyroidectomy.

	Dog 73	Dog 25	Dog 74	Dog 417	Dog 349
Clinical loss of ascites*	++++	++++	+++	+++	++++
Wt gain after IVC constric., kg	5.5	6.0	7.0	6.0	5.0
Wt loss after thyroidectomy, kg	4.5	6.0	6.0	5.0	4.5
Avg daily water intake					
With ascites, cc/24 hr	1693	1693	1654	1714	1286
Post-thyroidectomy, cc/24 hr	2014	2107	1539	1804	1507
Avg daily urine output					
With ascites, cc/24 hr	162.5	360.7	385.7	410.7	525.0
Post-thyroidectomy, cc/24 hr	360.7	623.2	427.8	496.7	583.3
Avg daily sodium excretion					
With ascites, meq/24 hr	9.6	18.6	54.6	34.1	76.3
Post-thyroidectomy, meq/24 hr	100.9	97.1	57.8	62.0	75.2

* This was graded on a 0 to ++++ scale, the former indicating insignificant clinical improvement in ascites, and the latter indicating improvement to the extent that ascites was no longer detectable by clinical measurements. This scale is also used in subsequent Tables.

tempt was made to constrict the cava to approximately 50% of its original diameter. Following operation, 5 animals were fed usual kennel diet until ascites became apparent by weight gain, abdominal palpation and measurements of abdominal girth. The dogs were then placed in metabolic cages and studied for 2 weeks. Water was allowed *ad lib.* to 2500 cc in 24 hours and the daily consumption was recorded. Measured fixed amounts of food and added salt were given daily. The ration provided the dogs with 80 milliequivalents of sodium day. Weights, urine volumes and urinary sodium excretions were recorded daily. Measurements of urinary sodium were determined by flame photometry. Then bilateral total thyroidectomy was performed. At time of operation, care was taken to reimplant the parathyroid glands, if they were removed. Post-thyroidectomy the animals were again fed routine kennel diet, without added salt, which allowed them 35 milliequivalents of sodium in daily ration. When significant clinical improvement in their ascites was apparent, the 2-week period of metabolic study outlined above was repeated. Three additional dogs were studied in similar manner except that metabolic observations were recorded continuously from baseline period before caval constriction until one month post-thyroidectomy. Two dogs were subjected to sham operation only. These animals were anesthetized as for thyroidectomy, the neck was opened and thyroid glands exposed, but their blood supply was not disturbed. Following sham operation the dogs were fed standard kennel diet for 2 weeks, then studied for 2 weeks on a metabolic balance, in the same manner as the first 5 dogs outlined above.

Results. The effect of thyroidectomy on the first group of 5 dogs in whom ascites was produced is presented in Table I. All animals in this group showed striking clinical improvement in their ascites, beginning about seventh to tenth day after thyroidectomy. When again subjected to a metabolic study with increased dietary sodium, they exhibited increased ability to excrete sodium and water, and did not regain their ascites. The apparent similarity in sodium excretion during ascitic and post-thyroidectomy periods in dogs Nos. 74 and 349 is discussed below.

Table II summarizes results observed on the 3 animals studied continuously. Two of the 3 dogs exhibited a natruresis and significant clinical amelioration of their ascites following thyroidectomy. As noted, the average daily sodium excretion is presented for 2 periods when ascites was present. In dog No. 607, there was a significant rise during the 2-week period immediately prior to thyroidectomy. Subsequently, there was a further rise to achieve negative sodium balance during the post-thyroidectomy period.

The results of sham operated dogs are presented in Table III. Neither dog exhibited improvement in his ascites, and one of the animals became more ascitic during the post-

TABLE II. Clinical Response, Urine Output and Urinary Sodium Excretion in Ascitic Dogs before and after Thyroidectomy.

	Dog 596	Dog 607	Dog 636
Clinical loss of ascites	++	++++	0
Wt gain after IVC constric., kg	5.5	3.0	2.0
Wt loss after thyroidectomy, kg	2.0	2.0	.0
Avg daily water intake, cc/24 hr			
Baseline*	1556	1400	1382
With ascites†	1529	1464/1457	1607/1410
Post thyroidectomy‡	1570	1364	1371
Avg daily urine output, cc/24 hr			
Baseline*	417	172	164
With ascites†	211	178/191	535/153
Post thyroidectomy‡	442	241	155
Avg daily sodium excretion, meq/24 hr			
Baseline*	37.2	10.5	12.2
With ascites†	10.5	1.1/18.3	1.4/0.6
Post thyroidectomy‡	60.0	42.6	18.8

* Avg value for 7 to 10 day period prior to caval constriction.

† Avg value for 2-wk period immediately prior to thyroidectomy. Where 2 figures are given under this column, the first is the avg for the 2-wk period following caval constriction, and the second is avg for the 2-wk period prior to thyroidectomy.

‡ Avg value for 2-wk period from seventh to 21st day following thyroidectomy.

sham period. There was no appreciable increase in sodium and water excretion following the sham operation.

Discussion. The results indicate significant improvement in experimentally induced ascites following thyroidectomy in 7 of 8 dogs. All of these animals were hypothyroid as measured by usual parameters of thyroid function (serial protein bound iodine and radioactive I^{131} uptake determinations), but did not exhibit clinical myxedema.

An increase in sodium and water excretion concomitant with improvement in ascites occurred. The apparently high sodium excretion with ascites seen in dogs No. 74 and 349 (Table I) can be accounted for by the phenomenon noted by Davis(7) and others, *i.e.*, an animal can reach a stage of such tense ascites that sodium will no longer be avidly retained, and his output will tend to approach his intake. To a lesser extent, this effect was also seen in dog No. 607 (Table II) during the 2-week period immediately prior to thyroidectomy. In addition, post-thyroidectomy metabolic study was undertaken in these 2 animals (Nos. 74 and 349) after the ascites was almost completely relieved, and time of maximal diuresis had passed.

We are unable at present to explain the mechanism responsible for results outlined above. Canine ascites induced by caval constriction may remit spontaneously after 4 to 6 months(8). Our animals exhibited improvement in their ascites within 3 weeks after thyroidectomy, which was generally performed approximately 4 to 5 weeks following caval constriction. The fact that this does not represent a spontaneous remission is also supported by lack of response of the sham-operated dogs after an equal passage of time.

That an increased level of aldosterone is present in animals with ascites produced by this method is well documented, either due to hypersecretion by the adrenal cortex(9), or to impaired hepatic inactivation by the congested liver(10,11). In the 4 animals in whom serial aldosterone levels§ have been determined, there has been a fall to normal range following thyroidectomy, concomitant with improvement in the ascites. This may simply reflect

TABLE III. Clinical Response, Urine Output and Urinary Sodium Excretion in Ascitic Dogs before and after Sham Operation.

Dog	Clinical loss of ascites	Avg daily water intake (cc) Before sham	Avg daily water intake (cc) After sham	Avg daily urine output (cc) Before sham	Avg daily urine output (cc) After sham	Avg daily sodium excretion (meq) Before sham	Avg daily sodium excretion (meq) After sham
24	0	1443	1336	101	101	4.1	12.2
259	0	1507	1491	176	221	14.5	4.7

§ Performed by paper chromatographic method by Bio-Science Labs., Los Angeles, Calif.

subsidence of the secondary aldosteronism, or may indicate a thyroid-adrenal interaction. A simpler explanation is that thyroidectomy effects a decrease in hepatic blood flow to this previously congested organ causing the ascites to form at a slower rate, and enabling gradual absorption of the accumulated fluid. Investigation of hepatic blood flow during the period of formation of ascites, and during recovery phase following thyroidectomy is now in progress.

Summary. Amelioration of experimental canine ascites produced by supradiaphragmatic caval constriction occurred in 7 of 8 dogs following total thyroidectomy. This improvement was accompanied by increase in sodium and water excretion. Dogs treated by a sham operation exhibited neither a natruresis nor relief of their ascites. Possible mechanisms to explain these results are discussed.

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Factors Affecting Liver Pyridine Nucleotide Concentration in Hyperthyroid Rats.* (24775)

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Severe hyperthyroidism affects concentration of tissue pyridine nucleotides and activities of certain pyridine nucleotide-dependent enzyme systems. Concentrations of pyridine nucleotides (PN)‡ in tissues of severely hyperthyroid rats are low according to several groups of investigators(1-3), but in one instance(4) PN concentrations above normal have been reported. A low rate of oxidation of D-β-hydroxybutrate by liver mitochondria from hyperthyroid rats has also been observed; however, the rate is increased markedly if DPN is added to the *in vitro* assay system(2). The rate of choline oxidation in livers of severely hyperthyroid rats is also low and this, too, is increased if a high level of DPN is added to the *in vitro* assay system (5). A variety of natural products and methyl donors, methionine and betaine, prolong survival of rats receiving high level of a thyroid-active substance(6,7). Pork, which is particularly effective in prolonging survival, also prevents to some extent the fall in rate of choline oxidation in livers of hyperthyroid rats(5). This investigation was undertaken to study effects of a number of dietary components, such as thyroid-active substances, protective factors, and PN precursors on liver

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‡ The following abbreviations will be used: PN, pyridine nucleostide(s); DPN, diphosphopyridine Nucleotide; TPN, triphosphopyridine nucleotide; TAP, adenosine, triphosphate.