The measurement of gastrointestinal protein loss by ^{131}I -labelled protein and resin¹

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EDITORIAL SYNOPSIS The authors suggest that their observations show that the method of giving oral anion-binding resins with the injection of ^{131}I -labelled albumin does not give a precise measure of protein loss from the alimentary tract; nevertheless the method may be useful in the diagnosis of disease.

Since protein-losing or 'exudative' enteropathy has been described (Gordon, 1959; Schwartz and Jarnum, 1959), all workers have wanted to have a quantitative method for the estimation of gastrointestinal protein loss. A method involving the injection of ^{131}I -labelled albumin and the oral administration of an anion-binding resin has recently been elaborated by Jeejeebhoy and Coghill (1961). The investigations presented here, however, show that this method does not fulfil the demands for exact measurement of gastrointestinal protein loss.

MATERIAL AND METHODS

Two investigations were employed on two groups of patients. In group 1, 50 to 100 μC . ^{131}I -labelled human protein (albumin and gamma globulin) was injected intravenously, and the urinary clearance of ^{131}I was measured before and during the oral administration of resin, which was given as Amberlite from the tenth to the fifteenth day, in doses of about 7 g. every four hours. In group 2, about 10 μC . Na^{131}I was injected subcutaneously, and the percentage faecal activity of ^{131}I of the total excreted in the urine and faeces before and during the oral administration of resin was measured. Resin was given for five days after a five-day control period.

The age, sex, and diagnosis of the patients are listed in Tables I and II. Several were suspected of suffering from protein-losing enteropathy. To prevent uptake of ^{131}I by the thyroid, 1.3 g. potassium iodide was given twice daily, commencing one or two days before the day of injection, between doses of resin. Protein was labelled according to McFarlane's (1956) method, except in one

patient (KM, Table I), to whom radioiodinated human serum albumin from the Radiochemical Centre at Amersham was given.

Plasma activity was followed by taking daily blood samples, and activity was measured in homogenized faeces and 24-hour samples of urine. All radioactivity was measured in a well-type scintillation counter, connected with a Tracerlab Superscaler.

RESULTS

GROUP 1 The results (Table I) agree with those of Jeejeebhoy and Coghill (1961) and Jeejeebhoy (1962). About one-third of the excreted ^{131}I activity apparently comes from the gastrointestinal tract.

GROUP 2 Here again 20 to 30% of the total excreted ^{131}I was excreted with the faeces (Table II). Apparently, almost the same ratio of faecal ^{131}I to urinary ^{131}I is found in subjects during administration of resin whether Na^{131}I or ^{131}I -labelled protein is injected. Group 2 contained no patients with protein-losing enteropathy whereas cases 7 and 8 in group 1 were suffering from this condition. A comparison between the two groups, omitting these two patients, showed no statistically significant difference.

DISCUSSION

The results indicate that about one-fourth of subcutaneously injected ^{131}I is excreted with the faeces during administration of resin, and excretion of roughly the same magnitude is seen in the faeces when ^{131}I -albumin is injected intravenously. The findings suggest that wherever in the organism

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TABLE I

FINDINGS IN PATIENTS RECEIVING ¹³¹I-LABELLED PROTEIN

Patient, Age, and Sex	Diagnosis	Administered Protein	Metabolic Clearance of ¹³¹ I-protein before Resin (ml./24 hr.)	Metabolic Clearance of ¹³¹ I-protein during Resin (ml./24 hr.)	Decrease in Metabolic Clearance (%)
1 F.L. ♂58	Diverticula coli	¹³¹ I-albumin	272	196	28.0
2 H.A. ♂68	Osteo-arthritis	¹³¹ I-albumin	251	144	42.5
3 H.W. ♀44	Prolapsed intervertebral disc	¹³¹ I-albumin	285	180	37.0
4 A.M. ♀70	Gastric cancer with metastasis	¹³¹ I-albumin	180	120	33.3
5 F.P. ♀70	Gastric cancer	¹³¹ I-albumin	200	154	23.0
6 K.M. ♂49	Gastro-duodenitis	¹³¹ I-albumin			
		R.I.H.S.A.	463	360	22.2
7 E.T. ♀33	Hypertrophic gastritis	¹³¹ I gamma globulin	160	82	48.8
8 R.L. ♂41	Protein-losing enteropathy	¹³¹ I gamma globulin	913	520	43.0

¹Metabolic clearance: $\frac{\text{urinary activity} \times \text{diuresis}}{\text{plasma activity}}$

TABLE II

FINDINGS IN PATIENTS RECEIVING NA¹³¹I

Patient, Sex, Age	Diagnosis	Activity in Faeces as Percentage of Total Excretion before Resin	Activity in Faeces as Percentage of Total Excretion during Administration of Resin
J.M. ♂ 30	Duodenal ulcer	0.09	21.07
F.P. ♂ 63	Arteriosclerotic heart disease	0.09	19.67
I.W. ♂ 21	Rheumatic fever	0.22	32.50
J.B. ♂ 37	Chronic renal disease	0.74	28.79
A.M. ♂ 66	Partial gastrectomy		25.53 ¹
Mean			25.51

¹—¹³¹I injected only on the first day. The patient received resin during the whole period.

¹³¹I-labelled albumin (or gamma globulin) is degraded to ¹³¹I about one-third of the total excretion in the faeces is found while resin is being given. Hence it seems unjustifiable that gastrointestinal breakdown of protein can be measured quantitatively by the method of Jeejeebhoy and Coghill (1961), who found that about 60% of the radioactivity of jejunal juice originating from intravenously injected ¹³¹I-albumin may be precipitated with trichloroacetic acid (about 35% is non-ionic iodine) whereas only about 5% is free iodine. In another investigation, Wetterfors, Gullberg, Liljedahl, Plantin, Birke, and Olhagen (1960) drew attention to the tremendous iodine-clearance of the stomach. Nevertheless, patients with gastrointestinal protein loss show a greater faecal excretion of ¹³¹I than normals when investigated according to the method of Jeejeebhoy and Coghill (1961). Their method, therefore, is useful in diagnosis of the disease but our results suggest that the method does not measure this protein loss exactly. Our results for the excretion of ¹³¹I from ¹³¹I-labelled protein are based on urinary clearance calculations made possible after investigations (Høedt and Munck, unpublished observations) showing that after a four days' lag period after the injection of ¹³¹I-labelled albumin no difference in clearance was found between the two following six-day periods. A decrease in clearance in

the 'resin investigations' must therefore be equivalent to a correspondingly raised faecal output.

SUMMARY

When anion-binding resin is administered by mouth, the excretion of ¹³¹I in the faeces is roughly of the same magnitude whether ¹³¹I is given parenterally as Na¹³¹I or as ¹³¹I-labelled albumin. Methods which measure protein breakdown in the gastrointestinal tract by the use of resin and ¹³¹I-labelled albumin are therefore not valuable in determining whether faecal ¹³¹I originates from gastrointestinal protein breakdown or from ¹³¹I-labelled albumin broken down in other sites of the body.

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