Vitamin B₁₂ absorption studies: effect of parenteral non-radioactive vitamin B₁₂ on serum level of ⁵⁷Co vitamin B₁₂

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SYNOPSIS The intestinal absorption of ⁵⁷Co vitamin B₁₂ has been measured by counting the radioactivity in the serum, and the effect of the parenteral administration of 1 mg. non-radioactive vitamin B₁₂ two hours after the oral dose has been studied. When parenteral vitamin B₁₂ was not given, the mean radioactivity in the serum was lower in both patients with pernicious anaemia and in control subjects, and the results in the patients with pernicious anaemia were more definitive. There was no significant difference between the results obtained with an Ekco scaler and those with an I.D.L. scaler.

This is the simplest and most convenient method of measuring vitamin B₁₂ absorption. It is suggested that the test be standardized by giving 0.5 µg. ⁵⁷Co vitamin B₁₂ with a maximal histamine stimulation of intrinsic factor secretion, but without a parenteral dose of non-radioactive vitamin B₁₂. The results are expressed most usefully as a percentage of the administered dose per litre of serum or plasma.

The intestinal absorption of vitamin B₁₂ is measured most conveniently by counting the radioactivity in the serum or plasma after an oral dose of ⁵⁷Co vitamin B₁₂ and reliable results have been obtained using British radioactive counting equipment (Forshaw and Harwood, 1966). In this previous work we measured the radioactivity in the urine (Schilling test) and serum simultaneously, as we were comparing the results obtained by these two methods. We claimed that one of the advantages of the serum counting method was that the large parenteral dose of non-radioactive vitamin B₁₂ required in the Schilling test was not necessary, and that the risk of obscuring the diagnosis was therefore avoided. More recently, however, Coupland (1966) found that the parenteral administration of 1 mg. non-radioactive vitamin B₁₂ six hours after the oral dose of ⁵⁷Co vitamin B₁₂ augmented the plasma radioactivity in control subjects but not in patients with pernicious anaemia. As the parenteral dose helped to separate the results in the control subjects from those in patients with pernicious anaemia, Coupland recommended that it should be given routinely in the plasma radioactivity test.

In this paper we report our observations on the

effect on serum radioactivity of a parenteral dose of 1 mg. vitamin B₁₂ given two hours after the oral dose of ⁵⁷Co vitamin B₁₂.

MATERIALS AND METHODS

Sixty-two patients were studied. There were 27 patients with pernicious anaemia and 35 control subjects, who were hospital patients with no evidence of vitamin B₁₂ deficiency. The ⁵⁷Co vitamin B₁₂ absorption test was carried out as we have described previously (Forshaw and Harwood, 1966), except that the parenteral dose of non-radioactive vitamin B₁₂ was not given to 11 of the patients with pernicious anaemia and 14 of the control subjects. The results were expressed both as counts per minute per 5 ml. serum and as a percentage of the administered radioactive dose per litre of serum.

An Ekco well-type scintillation counter (N. 664A) and crystal (N. 597) were used. An Ekco scaler (N. 6103) was used in the tests on 12 control subjects and nine patients with pernicious anaemia, in which a parenteral dose of vitamin B₁₂ was given. An I.D.L. scaler (1700) was used in the other tests.

RESULTS

The results are summarized in Tables I and II. In the tests in which parenteral vitamin B₁₂ was given

TABLE I

RESULTS OF ^{57}Co VITAMIN B_{12} ABSORPTION TESTS WITH PARENTERAL VITAMIN B_{12}

	Number of Subjects	Type of Scaler	Counts/min./5ml. Serum		Percentage Dose/Litre Serum	
			Range	Mean	Range	Mean
Control subjects	12	Ekco	28-64	44	0.84-1.70	1.30
Pernicious anaemia						
Histamine	9	Ekco	0-19	7	0.00-0.60	0.22
Intrinsic factor	8	Ekco	24-47	31	0.68-1.27	0.89
Control subjects	9	I.D.L.	28-57	37	0.80-1.87	1.15
Pernicious anaemia						
Histamine	7	I.D.L.	0-19	8	0.00-0.66	0.27
Intrinsic factor	7	I.D.L.	23-41	31	0.74-1.30	0.93

TABLE II

RESULTS OF ^{57}Co VITAMIN B_{12} ABSORPTION TESTS WITHOUT PARENTERAL VITAMIN B_{12}

	Number of Subjects	Counts/min./5 ml. Serum		Percentage Dose/Litre Serum	
		Range	Mean	Range	Mean
Control subjects	14	18-51	28	0.55-1.40	0.75
Pernicious anaemia					
Histamine	11	0-11	2	0.00-0.30	0.06
Intrinsic factor	9	12-40	22	0.32-1.30	0.61

there was virtually no difference between the results obtained with the Ekco scaler and those with the I.D.L. scaler in the patients with pernicious anaemia. In the control subjects there was a small difference, the mean counts being 7 per minute per 5 ml. serum higher with the Ekco scaler than the I.D.L. scaler, but this difference was less when the results were expressed as a percentage of the dose per litre of serum.

When parenteral vitamin B_{12} was not given in the test the mean radioactivity in the serum was lower, both in the control subjects and in the patients with pernicious anaemia. In the control subjects the difference was more marked when the results were expressed as a percentage of the administered dose than as counts per minute, but in the patients with pernicious anaemia both methods of expressing the results showed the same decrease in radioactivity.

The radioactivity in the serum was not above that in the background in eight of 11 patients with pernicious anaemia when parenteral vitamin B_{12} was not given, but only in five of 16 patients when the parenteral dose was given.

COMMENT

These results confirm Coupland's observations that the parenteral administration of 1 mg. non-radioactive vitamin B_{12} enhances the serum radioactivity in control subjects at eight hours. However, our results differ from those of Coupland in that the mean serum radioactivity in the patient with pernicious anaemia was also higher when parenteral vitamin B_{12} was given. We gave the parenteral dose of vitamin B_{12} two hours after the oral ^{57}Co vitamin B_{12} whereas Coupland gave it six hours afterwards, and it may be that the earlier dose blocked the hepatic uptake of the small amount of absorbed radioactive vitamin B_{12} more effectively.

As the results are quite diagnostic in patients with pernicious anaemia without giving parenteral vitamin B_{12} , we have adopted this simple test as our routine procedure.

REFERENCES

- Coupland, W. W. (1966). *Med. J. Aust.*, 1, 1020.
Forshaw, J., and Harwood, L. (1966). *J. clin. Path.*, 19, 606.