Techniques

The short pentagastrin test in the investigation of gastric disease

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The output of acid gastric juice secreted during the period between 10 and 30 minutes after the intramuscular injection of pentagastrin 6 µg/kg body weight gives an estimate of maximal acid output comparable with that by other methods (Multicentre Study, 1969). We report an assessment of the value of this test in gastric disease. The results have been compared with maximal acid outputs estimated in a different population of patients with similar disease states by the histamine infusion test.

Intramuscular pentagastrin tests were carried out by the method of Johnston and Jepson (1967). After an overnight fast, a 14 or 16F nasogastric tube was passed into the stomach with the patient in the left lateral position. The position of the tube was not checked radiologically, but before each test was started the tube position was adjusted until a satisfactory flow of gastric juice was obtained. Continuous aspiration was used employing a low-pressure pump with frequent interruption and injection of a small volume of air. The stomach was emptied, and following a 15-min basal collection, 6 µg/kg pentagastrin was injected into the deltoid muscle. Gastric juice was collected at 10 and 30 minutes after injection. That produced between 10 and 30 minutes was used for the determination of acid output. The volume (ml) was measured, the concentration of acid was

determined by titration of 0.1N sodium hydroxide to a pH of 7.0, and the acid output (m-equiv) was calculated by the product of the volume and the concentration. The output per hour was assessed by multiplying the output at 10 to 30 minutes by 3. Tests were carried out in normal subjects and patients with various gastric diseases, as listed in Table I.

Histamine infusion tests were carried out by the method we have described previously (Lawrie, Smith, and Forrest, 1964). After placing the tube as above and the collection of a basal specimen, an intravenous infusion of histamine in a dose of 40 µg/kg/hr was started. At the start of the infusion 50 mg anthesisan was given intravenously. The infusion was continued until outputs of gastric juice, collected by continuous aspiration in four consecutive 15-min periods, had reached a constant level. The sum of these 15-min outputs represents the maximal secretion and was expressed in m-equiv/hr.

Histamine infusion tests were carried out in normal subjects and patients, as also detailed in Table I.

For analysis, comparisons of outputs with each test in each disease state were made by Student's 't' test. In view of the differences in the numbers of each sample, the standard error of mean differences was calculated from the pooled variance.

It is evident from consideration of Fig. 1 and Table I that the pattern of acid output following both stimuli is similar in the different groups. Analysis of the mean differences following pentagastrin and histamine in each group indicates that, in general, those following pentagastrin are less than those which follow histamine. However, these differences reach significant levels only in male patients with duodenal ulceration.

The discriminatory value of each test has been assessed by comparison of the mean differences between the outputs of acid in each group from those in normal subjects (Table II). Differences were observed between normals and patients with duodenal ulcer, and normals and patients with gastric ulcer and gastric carcinoma with both tests. These differences were significant except in the case of female patients with duodenal ulcer and

TABLE I
MEAN ACID OUTPUTS WITH INTRAMUSCULAR PENTAGASTRIN AND HISTAMINE INFUSION
IN 126 NORMAL SUBJECTS AND 506 PATIENTS WITH GASTRIC DISEASES

Series	No. of Patients	Pentagastrin (6 µg/kg)			No. of Patients	Histamine (40 µg/kg/hr)			Mean Difference	SE	t	P
		Mean Output (m-equiv/hr)				Mean Output (m-equiv/hr)						
		HCl	SD	SE		HCl	SD	SE				
Normals												
Male	15	25.1	15.7	4.05	54	25.3	7.6	1.03	0.2 ± 2.87	0.069	>0.9	
Female	7	20.6	7.9	3.00	50	21.7	6.9	0.97	1.1 ± 2.83	0.388	>0.6	
Duodenal ulcer												
Male	61	36.9	12.7	1.63	237	41.5	12.8	0.83	4.6 ± 1.83	2.525	<0.02	
Female	10	25.2	7.8	2.46	35	31.2	10.1	1.71	6.0 ± 3.46	1.639	>0.1	
Gastric ulcer												
Male	28	18.8	12.5	2.35	43	21.4	11.4	1.74	2.6 ± 2.86	0.906	>0.3	
Female	10	9.4	10.2	3.21	30	13.5	6.8	1.24	4.1 ± 3.15	1.30	>0.1	
Gastric carcinoma												
Male	13	4.8	6.4	1.78	22	5.9	10.2	2.17	1.1 ± 3.15	0.349	>0.7	
Female	10	6.9	12.4	3.93	7	7.4	8.3	3.14	0.5 ± 5.40	0.09	>0.1

FIG. 1. The pattern of acid output with intramuscular pentagastrin $6\mu\text{g/kg}$ and histamine infusion $40\mu\text{g/kg/hr}$ in normal subjects and in disease states.

TABLE II
DISCRIMINATORY VALUE OF INTRAMUSCULAR PENTAGASTRIN AND HISTAMINE INFUSION

		Mean Difference from Normal	SE	t	P
<i>Duodenal ulcer</i>					
Male	Pentagastrin (6 µg/kg)	+11.8	± 3.84	3.072	<0.01
	Histamine (40 µg/kg/hr)	+16.2	± 1.79	9.050	<0.001
Female	Pentagastrin (6 µg/kg)	+ 4.6	± 3.86	1.191	>0.2
	Histamine (40 µg/kg/hr)	+ 9.5	± 1.82	5.219	<0.001
<i>Gastric ulcer</i>					
Male	Pentagastrin (6 µg/kg)	- 6.3	± 4.36	1.440	>0.1
	Histamine (40 µg/kg/hr)	- 4.2	± 1.93	2.172	<0.05
Female	Pentagastrin (6 µg/kg)	-11.2	± 4.59	2.440	<0.05
	Histamine (40 µg/kg/hr)	- 8.2	± 1.58	5.176	<0.001
<i>Gastric carcinoma</i>					
Male	Pentagastrin (6 µg/kg)	-20.3	± 4.65	4.365	<0.001
	Histamine (40 µg/kg/hr)	-19.4	± 2.12	9.150	<0.05
Female	Pentagastrin (6 µg/kg)	-13.7	± 5.34	2.565	<0.05
	Histamine (40 µg/kg/hr)	-14.3	± 2.84	5.035	<0.001

male patients with gastric ulcer with pentagastrin. The differences were of greater magnitude with histamine than with pentagastrin in all cases.

It is concluded that the intramuscular pentagastrin test gives a similar pattern of discrimination as does the histamine infusion test. However, in all groups of patients the output of acid after pentagastrin stimulation was less than that recorded with histamine infusion, and significantly so in the case of duodenal ulcer. It has already been reported (Lawrie *et al*, 1964) that the maximum output as estimated by the augmented histamine test (Kay, 1953) is significantly less than that which follows a histamine infusion and, from the results we now report, this would also seem to be true of the pentagastrin test. It is therefore concluded that if a true maximal output of acid is desired for research purposes,

plateau responses with intravenous infusions of histamine or pentagastrin are the method of choice. However, as the intramuscular pentagastrin test is free of side effects and short in duration, we believe that it is preferable for routine clinical use when the detection of abnormally high or low secretions is all that is required.

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