THE DIAGNOSTIC VALUE OF DETERMINATIONS OF PEPSIN IN GASTRIC JUICE

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In previous papers (1) we described a method for the measurement of pepsin in gastric juice and reported the results of determinations made at frequent intervals before and after stimulation of the stomach secretions by histamine. It was shown that the concentration of pepsin falls after stimulation although the total output of ferment is increased at the height of secretion. It was also pointed out that the curve of pepsin concentration closely parallels that of nitrogen concentration. Finally, a few cases of anacidity were reported in which, however, pepsin was still demonstrable.

In the previous communication the general range of pepsin output was indicated but not enough cases had been studied to set actual standards. The present paper deals with an analysis of a larger series of observations and with the diagnostic implications derived therefrom.

MATERIAL AND METHODS

Forty determinations were made on thirty-six hospital patients. Of these, twenty-one showed no evidence of disease of the stomach and were essentially normal people, five had duodenal ulcer, one had gastric ulcer, five had cancer of the stomach, two had pernicious anemia, one had sprue and two had anacidity for which no explanation was found. The determinations were made by the method previously described (2) on samples of gastric juice collected over ten-minute periods after histamine stimulation. The results are recorded in terms of milligrams of edestin digested by 1 cc. of gastric juice.

RESULTS

Chart 1 shows the shape of the curves of pepsin concentration and of total output of pepsin per ten-minute period after histamine stimula-

tion in a normal person. We wish to emphasize the fact that concentration falls whereas total output increases at the height of secretion.

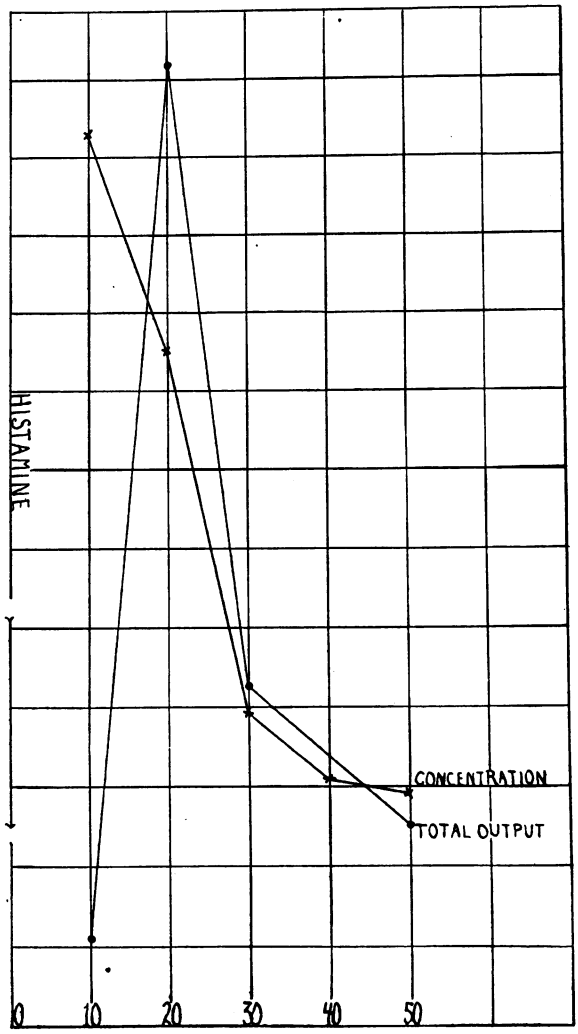

CHART 1. CURVES OF PEPSIN CONCENTRATION AND OF TOTAL OUTPUT OF PEPSIN AFTER HISTAMINE STIMULATION IN A NORMAL PERSON

It is evident, therefore, that in comparing the digestive power of gastric juice from various people the specimens which are tested must

TABLE 1

Pepsin output and other data concerning cases studied

Name	Diagnosis	Maximum 10-minute volume of secretion	Maximum free HCl	Maximum total acid	Concentration of ferment at height of secretion (mgm. edestin digested by 1 cc.)	Total digestive power of 10-minute secretion (mgm. edestin)
		cc.				
Da	Unexplained anacidity	3	0		0	0
Sal	Carcinoma of stomach	5.5	0		21	118
La	Pernicious anemia	5.5	0		33	188
Ha	Pernicious anemia	4	0		85	240
Zi	Carcinoma of stomach	4	0		66	264
Sch	Carcinoma of stomach	5.5	0		57	285
Cr	Carcinoma of stomach	6	0		157	1,413
Gi	Unexplained anacidity	4	0		1,088	3,800
Ga	Sprue	17	60	70	272	4,624
Fi	Carcinoma of stomach	15	29	42	1,080	15,130
Al	Unexplained subacidity	16	11	32	1,325	15,900
Fl	Gastric ulcer	32	94	106	530	16,960
Mo	Normal	27	105	111	674	18,200
Ru	Normal	27.5	86	102	628	17,270
Ohr	Normal	19	126	138	860	18,540
Tal	Duodenal ulcer	55	128	133	350	19,200
Lord	Normal	26	135	145	750	19,500
Pu	Duodenal ulcer	45	142	148	462	20,800
Ros	Duodenal ulcer	38	135	140	570	21,680
Cl	Normal	25	66	79	1,164	23,280
Rob	Normal	38	122	125	660	25,100
Vi	Normal	32	117	124	899	28,780
Hu	Normal	44	97	102	668	29,400
Po	Normal	42	121	126	720	30,240
McI	Normal	26	107	116	1,242	32,292
Sc	Normal	47	63	75	853	34,400
We	Normal	30	82	96	1,204	36,100
McK	Normal	48	98	106	800	38,400
Ts	Normal	24	110	120	1,623	38,952
Hu	Normal	43	91	100	955	41,000
Pe	Normal	21.5	120	128	2,219	47,650
Ha	Normal	39	128	132	1,248	48,750
Wa	Normal	42	134	141	1,181	50,100
Jo	Duodenal ulcer	49	131	138	1,100	53,900
Sa	Normal	44	88	95	2,550	112,400
Val	Duodenal ulcer	84	140	146	2,500	210,000

represent similar points on the curve of secretion; it would obviously be useless to compare samples taken at random. In the present observations we have compared the digestive power of the total juice put out by various people during a ten-minute period at the height of secretion after a standard and powerful stimulus (histamine). This presumably gives the maximum rate of pepsin secretion of which the stomach in question is capable. The concentration of ferment (amount of edestin digested by 1 cc. of juice) was estimated on the same specimens.

The rate of pepsin secretion

Table 1 shows the cases arranged in series according to total output, i.e., rate of secretion of pepsin. The concentration of pepsin is also

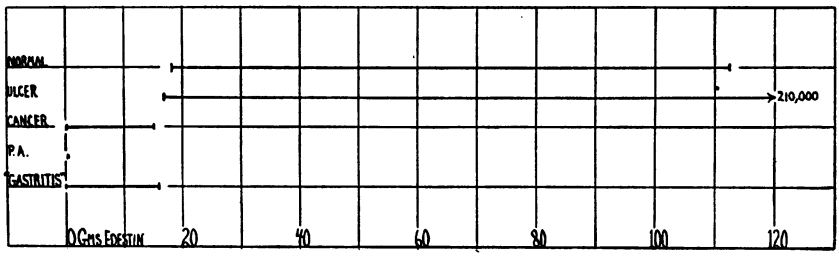

CHART 2. RANGE OF PEPSIN OUTPUT IN NORMALS AND IN PATIENTS WITH DISEASES OF THE STOMACH

recorded. A sharp line of demarcation can be drawn between the normals and the patients with ulcer on the one hand and those with diseases such as cancer, gastritis and pernicious anemia on the other. No normal person digested less than 16,000 mgm. with the maximum ten-minute output of gastric juice; no one with cancer, gastritis or pernicious anemia digested over 16,000 mgm. The relations are shown graphically in chart 2. The normal range, which coincides closely with that shown by the peptic ulcer cases, varied from 18,200 mgm. to 112,400 mgm. The extremely high output of pepsin in Val. (210,000 mgm.) is associated with the remarkable volume of secretion (84 cc.) which is nearly double the usual maximum. All but one of the juices from normals digested from 18,000 to 54,000 mgm. of edestin. Turning now to the abnormal cases with low pepsin outputs it is of

interest that in only one of eleven cases was it impossible to demonstrate the secretion of some pepsin even though the amount was small. Eight of these people failed to secrete free HCl (tested by dimethyl) even after histamine stimulation. It appears, then, that pepsin meas-

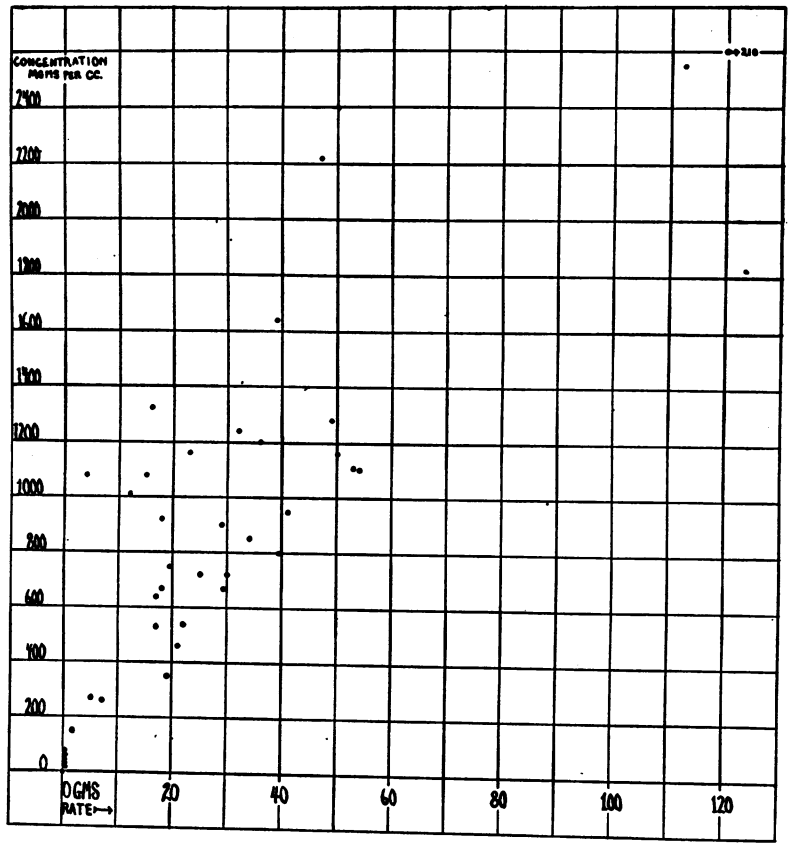

CHART 3. RELATION OF OUTPUT OF PEPSIN (RATE) TO CONCENTRATION OF PEPSIN

urements furnish a more delicate indication of deficiency of gastric secretion in some cases than determinations of acid, a consideration which may have some practical application.

The concentration of pepsin in the gastric juice

A consideration of the values for the concentration of pepsin set down in table 1 shows these figures to be of much less practical significance than the total rates of secretion. Both normal patients and those with advanced disease of the stomach showed high and low concentrations of pepsin; in only a few cases of cancer and gastritis were the values very much below those encountered in normals. There is, however, a general relationship between rate of pepsin secretion and concentration insofar as when the rate was great the concentration was usually high also (see chart 3).

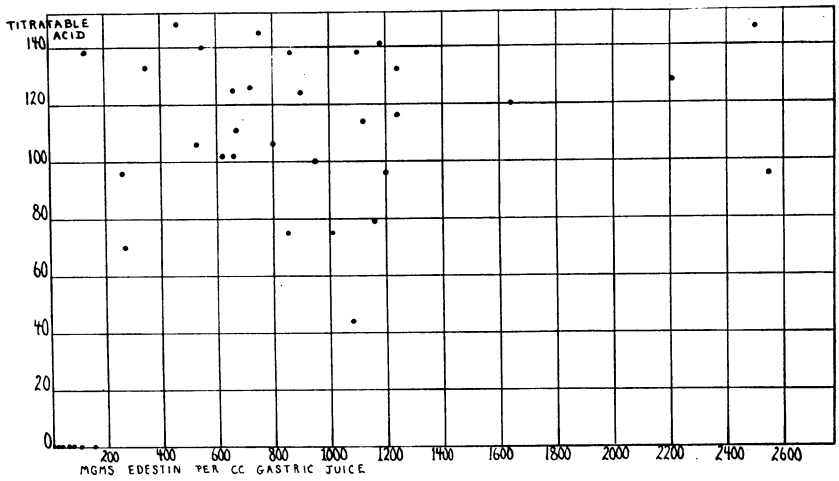

CHART 4. RELATION OF CONCENTRATION OF PEPSIN TO TITRATABLE ACIDITY

Relation of acidity to output of pepsin

A study of chart 4 in which the pepsin concentration is plotted against the titratable acidity reveals an interesting lack of correlation between the two. The cases with anacidity all showed low outputs of pepsin although the concentration of ferment was fairly high in some (see table 1), but it is evident that aside from such stomachs as are the seat of very extensive lesions pepsin is secreted without close relationship to acid. The whole subject of the secretory relationship of the various constituents of the gastric juice is not completely

understood as yet, but observations being made in our laboratory indicate that separate mechanisms control the secretion of water and of chloride as well as of ferment. The point is well illustrated by cases Al and Fi (table 1), who, with greatly reduced secretion of acid put out practically normal amounts of ferment. Gi, also, with no secretion of free HCl put out pepsin in normal concentration although the total quantity was low. The correlation of these relationships with exact histological studies would be of great value.

SUMMARY

The concentration and total output of pepsin have been studied in a series of normals and in people with various gastric lesions. It was found that in normals the maximum ten-minute volume of stomach juice digested from 16,900 mgm. to 112,400 mgm. of edestin. The ulcer cases fell within the same general range. In people with pernicious anemia, cancer of the stomach, and severe gastritis, the pepsin output was diminished, in some cases to extremely small amounts, but in only one person was pepsin completely undemonstrable. No correlation was found between pepsin output and acidity and it is suggested that the secretory mechanisms of the two are independent. Finally, it seems that very low pepsin output is a more delicate index of gastric damage than low acid values.

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