

Gastric acid secretion in patients with duodenal ulcer and benign gastric outlet obstruction

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Summary

With the standard dose of histamine acid phosphate 40 $\mu\text{g}/\text{kg}$ body weight, the peak and maximal acid outputs were calculated in 102 patients with uncomplicated duodenal ulcer disease, forty-seven controls and forty-seven patients with benign gastric outlet obstruction. The results obtained for maximal acid output showed significant differences between the control group and the other two groups separately. These figures are much lower than values from Western countries, but similar to those reported from studies in non-Caucasians.

Résumé

Avec la dose classique d'histamine acid phosphate 40 μg , le pic et le maximum d'acid réalisées sont été calculés dans 102 malades qui ont l'ulcère duodénal non compliqué, 47 contrôles et 47 malades qui ont l'obstruction bénin d'issue gastrique. Les résultats obtenus pour le maximum d'acid réalise ont montre les différences significatives entre le groupe de contrôle et les deux autres séparément. Ces figures sont bien plus bas que les valeurs de pays de l'ouest mais pareil aux celles rapportées sur les études parmi les non Caucasiens.

Introduction

The dose of gastric stimulants producing maximal acid output has always been expressed in relation to the body weight, based on dose response curves established in Western countries. Using the standard dose of histamine acid phosphate (40 $\mu\text{g}/\text{kg}$) in Indian controls and duodenal ulcer patients, the

maximal acid output recorded was about half the Western values (Desai *et al.*, 1969). There appears to be some geographical and racial differences in the results obtained with the augmented histamine test (Vakil & Mulekar, 1965; Fung, 1968; Desai *et al.*, 1969). The aim of this study is to estimate the acid output in Nigerians using the augmented histamine test.

Materials and methods

Stimulated secretion test was carried out in three groups of patients—a control group, patients with uncomplicated duodenal ulcer and those with benign gastric outlet obstruction (duodenal stenosis) confirmed radiologically and at operation. Patients diagnosed clinically as duodenal ulcer or stenosis but not confirmed at operation were excluded from the study.

The patient was given a light evening meal and at 2100 h a Ryle's tube was passed through the nose. Continuous aspiration by means of an electric suction pump was continued until 0800 the following morning.

The tube was regularly cleared and detached from the gastric mucosa by instillation of a little air. The patient was told to expectorate all saliva. The total amount so collected was labelled overnight secretion. One hour basal gastric secretion was collected from 0800; and at 0840 100 mg of mepyramine maleate was given intramuscularly. Histamine acid phosphate in a dose of 0.04 mg/kg body weight was injected subcutaneously at 0900. Four 15 min samples were collected over the next hour. All collections were made with the subject in the left lateral position. The volume of each sample was noted and the total acidity determined by titration with 0.01 N NaOH

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to pH 7.4 using bromthymol blue as indicator. The maximal acid output per hour was determined by multiplying by two the sum of the highest outputs of the consecutive 15 min periods. The peak acid output per hour was calculated by multiplying by four the highest 15 min output.

Results

The control group of forty-six patients were subjects not suffering from dyspepsia or peptic ulcer and who were admitted to a surgical unit of the University College Hospital, Ibadan, Nigeria, with diagnoses of hydrocele, inguinal hernia, lipoma, fibroadenoma of breast, undescended testes and fistula-in-ano. There were 102 patients with uncomplicated duodenal ulcer and forty-seven patients with benign gastric outlet obstruction due to chronic duodenal ulcer.

There were twelve females in the control group of forty-seven patients. Eighty-six of the 102 patients with duodenal ulcer were males, and twelve of the forty-seven patients with benign gastric outlet obstruction were females. The mean ages (male and female) in the control group, duodenal ulcer group

and gastric outlet obstruction group were 35.9, 39.1 and 38.8 years respectively. There were no significant differences between the ages in the three groups. There were significant differences between the weights of the various groups (males and females) whose mean weights were 57.18 kg, 52.16 kg, 46.36 kg respectively for the control, duodenal ulcer and gastric outlet obstruction groups (Table 1). The mean basal outputs in the control, duodenal ulcer patient and gastric outlet group were 1.42 mEq, 4.68 mEq and 7.19 mEq respectively and the differences were significant except between the duodenal ulcer patients and those with outlet obstruction (Table 1). The mean values for 1 hour histamine stimulated acid output were 7.87 mEq (male 7.24, female 11.17), 19.20 mEq (male 20.18, female 14.56) and 20.23 mEq (21.63 male, 14.49 female) for the control, duodenal ulcer and gastric outlet obstruction groups respectively. The differences were significant between the control group and the other two groups separately. The mean overnight acid outputs were 7.37 mEq (M: 7.34, F: 7.45), 23.32 mEq (M: 24.67, F: 16.04) and 41.08 mEq (M: 48.52, F: 26.50) in the control duodenal ulcer and gastric outlet obstruction groups. The mean

TABLE 1. Overnight, basal, histamine-stimulated secretion, weight and ages in three groups of patients (males and females)

	A Control (46)	P (A vs B)	B Duodenal ulcer (102)	P (B vs C)	C Benign gastric outlet obstruction (47)	P (C vs A)
Overnight secretion (mEq)						
Mean, s.e.	7.37, 1.05	< 0.001*	23.32, 3.12	0.001 < P < 0.005*	41.08, 6.81	0.001*
Range	0.27-29.02		0.27-222.70		0.96-159.80	
Basal secretion (mEq/h)						
Mean, s.e.	1.42, 0.21	< 0.001*	4.68, 0.90	0.20 < P < 0.30	7.19, 1.97	0.001 < P < 0.005*
Range	0.06-5.15		0.14-83.04		0.06-87.49	
Stimulated secretion 1 h output (mEq)						
Mean, s.e.	7.87, 0.75	< 0.001*	19.20, 1.17	0.6 < P < 0.70	20.23, 1.99	0.001*
Range	1.80-19.86		4.24-73.70		0.00-50.06	
Peak acid output (mEq/h)						
Mean, s.e.	9.82, 0.96	< 0.001*	24.63, 1.57	0.50 < P < 0.60	26.42, 3.01	0.001*
Range	2.72-35.44		4.92-68.4		0.00-79.56	
Weight (kg)						
Mean, s.e.	57.18, 1.63	0.005 < P < 0.01*	52.16, 0.83	P < 0.001*	46.36, 1.52	< 0.001*
Range	41.73-83.91		24.49-73.94		32.66-65.32	
Age (year)						
Mean, s.e.	35.85, 1.85	0.10 < P < 0.20	39.10, 1.15	0.80 < P < 0.90	38.79, 1.74	0.20 < P < 0.30
Range	16-65		9-66		15-65	

* Significant.

TABLE 2. Overnight, basal, histamine-stimulated secretion, weight and ages in three groups of male patients

	A Control (43)	P (A vs B)	B Duodenal ulcer (86)	P (B vs C)	C Benign gastric outlet obstruction (35)	P (C vs A)
Overnight secretion (mEq)						
Mean, s.e.	7.34, 1.81	<0.001*	24.67, 3.50	0.01 < P < 0.02*	48.52, 8.71	<0.001*
Range	0.27-29.02		0.27-222.70		0.96-159.80	
Basal secretion (mEq/h)						
Mean, s.e.	1.36-0.24	<0.001*	5.11, 1.5	0.20 < P < 0.30	8.14, 2.64	0.01 < P < 0.02*
Range	0.06-5.15		0.38-83.04		0.13-87.49	
Stimulated secretion 1 h output (mEq)						
Mean, s.e.	7.24, 0.77	<0.001*	20.18, 1.27	0.50 < P < 0.60	21.63, 2.31	<0.001*
Range	1.80-19.86		4.79-73.70		1.24-50.06	
Peak acid output (mEq/h)						
Mean, s.e.	8.03, 0.80	<0.001*	25.73, 1.68	0.03 < P < 0.40	29.09, 3.48	<0.001*
Range	2.72-21.36		7.20-57.2		1.76-79.56	
Weight						
Mean, s.e.	58.07, 1.85	0.01 < P < 0.02*	52.97, 0.90	0.05 < P < 0.10	49.83, 1.51	<0.001*
Range	31.75-87.09		24.49-75.95		26.99-65.32	
Age (year)						
Mean, s.e.	35.28, 3.91	0.30 < P < 0.40	35.14, 1.33	0.08 < P < 0.90	39.68, 2.06	0.40 < P < 0.50
Range	27-50		9-66		15-65	

* Significant.

TABLE 3. Overnight, basal, histamine-stimulated secretion, weight and ages in three groups of female patients

	A Control (12)	P (A vs B)	B Duodenal ulcer (16)	P (B vs C)	C Benign gastric outlet obstruction (12)	P (C vs A)
Overnight secretion (mEq)						
Mean, s.e.	7.45, 2.29	0.20 < P < 0.30	16.04, 6.47	0.20 < P < 0.30	26.50, 6.86	0.01 < P < 0.02*
Range	0.91-23.80		0.56-80.08		1.16-75.71	
Basal secretion (mEq/h)						
Mean, s.e.	1.50, 0.45	0.20 < P < 0.30	2.34, 0.57	0.10 < P < 0.20	5.26, 1.67	0.01 < P < 0.02*
Range	0.23-4.97		0.14-7.39		0.06-19.20	
Stimulated secretion (mEq/h)						
Mean, s.e.	11.17, 1.93	0.20 < P < 0.30	14.56, 2.53	0.98 < P < 0.99	14.49, 3.51	0.40 < P < 0.50
Range	4.56-23.86		4.24-44.59		0.00-38.32	
Peak acid output (mEq/h)						
Mean, s.e.	14.12, 2.61	0.20 < P < 0.30	20.08, 4.04	0.80 < P < 0.90	18.85, 5.71	0.40 < P < 0.50
Range	6.40-35.44		4.92-68.4		0.00-66.08	
Weight (kg)						
Mean, s.e.	54.34, 3.31	0.10 < P < 0.20	48.34, 1.95	<0.001*	36.36, 1.03	<0.001*
Range	42.18-84.03		41.28-58.29		32.43-42.75	
Age (year)						
Mean, s.e.	37.62, 3.91	0.80 < P < 0.90	38.89, 1.84	0.95 < P < 0.975	39.8, 3.28	0.70 < P < 0.80
Range	27-50		21-52		17-50	

* Significant.

peak acid outputs were 9.82 mEq/h. (M: 8.03, F: 14.12), 24.63 mEq/h (M: 25.73, F: 20.08) and 26.42 mEq/h (M: 29.09, F: 18.85) for the control, duodenal ulcer group and the patients with gastric outlet obstruction respectively (Tables 1-3).

Discussion

In the present study, there were significant differences in the values for gastric acid output for the overnight secretion, basal secretion, and histamine stimulated secretion between the control and the uncomplicated duodenal ulcer group and similarly between the control group and patients with benign gastric outlet obstruction.

The maximal acid output (MAO) of 19.20 mEq/h in 102 patients with uncomplicated duodenal ulcer was lower than those reported from Britain and America, but similar to figures obtained by workers in India, and the Far East (Table 4). These variations have been ascribed to differences in age, body build, length of history and race. In addition some reports

do not distinguish between results from men and women and the validity of the diagnosis of chronic duodenal ulceration is open to doubt in patients not subjected to operative confirmation. From Table 1 it will be seen that patients with acid secretory capacities as low as 1.80 mEq per hour have been found in this series, even though such patients had surgically proven duodenal ulcers.

The results in this study once again confirm the findings of all previous authors that acid output in normals is distributed over a wide range. Basal acid output in the present study is low when compared with results from other centres which vary from 2.2 and 2.99 mEq in controls, but is fairly comparable with results (3.72-6.8 mEq/h) for duodenal ulcer subjects (Table 4). In addition, the maximal acid output in the controls in our study is also lower than the values from other centres. The slightly lower results of the maximal acid output in male subjects in our series compared with those from Lagos and Ghana could be due to the differences in the weights of the subjects studied (Table 5). The maximal acid

TABLE 4. Basal and histamine-stimulated maximal acid output from various centres

Centre	Basal acid output (mEq/h)		Maximal acid output (mEq/h)	
	Control	Duodenal ulcer	Control	Duodenal ulcer
(1) Edinburgh (Bruce <i>et al.</i> , 1959)	2.5	6.0	22.0	37.5
(2) Glasgow (Kay, 1953)	2.2	6.8	22.2	37.0
(3) Philadelphia (Marks <i>et al.</i> , 1961)	2.7	5.4	28.2	39.6
(4) Arizona (Sun <i>et al.</i> , 1967)	—	3.72	—	26.44
(5) Delhi (Goyal, Gupta, Chuttani, 1961)	2.99	5.46	14.48	24.38
(6) Singapore (Fung, 1968)	1.1	5.5	4.4	15.3
(7) Kurnool (India) (Devi <i>et al.</i> , 1969)	2.49	4.64	15.44	19.80
(8) India (Vakil & Mulekar, 1965)	2.64	—	8.74	18.0
(9) Accra (Wosonu, 1971)	3.2	5.7	10.7	23.8
(10) Lagos (da Rocha-Afodu & Adesola, 1972)	1.9	3.5	13.4	24.8
(11) Ibadan (Present series)	1.36	5.1	7.24	20.18

TABLE 5. Comparison of ages, weight and maximal acid output in males from centres in West Africa

	Controls						Duodenal ulcer					
	Age (years)		Weight (kg)		MAO (mEq/h)		Age (years)		Weight (kg)		MAO (mEq/h)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Lagos												
da Rocha Afodu & Adesola (1972)	21-70	38.4	52-87	62.3	3.4-40.5	13.4	21-68	35.9	39.5-92.5	62.1	6.4-60.8	24.8
Accra												
Wosornu (1971)	21-70	34.8	41.1-74.5	55.4		10.7 ± 0.8	12-59	35.4	24.1-93.2	57.3		23.8 ± 1.9
Ibadan												
Present series	27-50	35.3	31.75-87.09	58.07	1.8-19.86	7.24	9-66	39.1	24.49-75.95	52.97	4.79-73.7	20.18

output quoted in standard textbooks (Irvine, 1972) which are indicative of duodenal ulceration do not appear to be applicable to Nigerians in the light of this study.

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