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ON THE COMPARATIVE VALUE OF CLINICAL INVESTIGATION RADIOLOGY AND FRACTIONAL ANALYSIS IN THE DIAGNOSIS OF PEPTIC ULCER AND CARCINOMA VENTRICULI.

I N T R O D U C T I O N

The accessibility of the human stomach has allowed full scope to the ingenuity of physiologist, chemist, physician, surgeon, and radiologist. Abdominal surgery has made such progress within the present century that it is to the "physician doomed to the practice of surgery" that we owe most of our knowledge of the pathology of the stomach. With increasing skill and improved technique, the radiologist has recently thrown much light on our darkness.

The past decade has shown medicine to be re-entering upon a physiological phase, less dependent than formerly on knowledge, of normal and abnormal function, gleaned from the post-mortem room or from animal experiment.

Although having a comparatively low mortality rate, the group of diseases, embraced in the term "dyspepsia", is responsible for much misery and sick wastage.

Our predecessors had perforce to depend upon their clinical skill and acumen for their diagnosis in this group. Are we, then, with modern methods and advantages, any more skilled or accurate in our

diagnosis of the same conditions? It would seem so.

In 1919, in England and Wales, the deaths from gastric carcinoma totalled seven thousand and seventy eight, while in 1921 they had increased to eight thousand, one hundred and thirty five. I hold that this increase cannot be completely accounted for by the supposed increase in the prevalence of this dread malady - some little credit is due to the increased diagnosis of the condition. Then again, in the case of duodenal ulcer, Forsyth(1) states that in an insurance society, whose policies are issued almost exclusively to medical men, and where, therefore, an early and accurate diagnosis can best be commanded, the sickness and death claims for this disease during the first twenty years of the Society's existence, were nil. In the following twenty years, however, the number of claims under this heading had steadily increased. No one will maintain that duodenal ulceration is a new disease - the increased claims on the Society can be accounted for only by more accurate diagnosis of the condition.

We have now at our disposal three chief methods of investigation in the diagnosis of gastric ulceration, both malignant and non-malignant. These are:-

(a) Clinical: In the true sense of that word. In this the interrogation of the

patient holds prime place.

(b) Laboratory: Including chemical analysis of stomach contents and examination of faeces for the presence of occult blood.

(c) Radiological: In this, the examination, under the fluorescent screen, of a patient who has had an opaque meal, is of much more value than serial photography.

S C O P E

In the investigation of a series of sixty-two patients, suffering from gastric or duodenal ulceration or from carcinoma ventriculi, and conducted at Swansea General and Eye Hospital, I was afforded the opportunity of estimating the comparative value of each of these methods. Undoubtedly, the only certain evidence of a lesion in the stomach is to see the lesion. In twenty-nine of my cases the lesion was shown either at operation or autopsy. In the remaining thirty-three cases, however, conclusive evidence was obtained; e.g., the niche was seen radiologically; melaena was present along with a definite history; haematemesis had been present along with definite history and no other cause of haematemesis discovered.

Of the sixty-two cases, twenty-five had gastric ulcer: thirty had duodenal ulcer: seven had carcinoma. One patient had both duodenal and gastric ulcers present.

The sex distribution was as follows:-

Sex	Gastric Ulcer	Duodenal Ulcer	Carcinoma	TOTAL.
Male	17	30	6	53
Female	8	0	1	9

TABLE I.

This outwardly undue proportion may be ascribed to the fact that there were twice as many beds available for males as for females, the result being that the beds for females were usually occupied by more pressing cases.

I do not include any cases of acute ulceration in my series.

CLINICAL INVESTIGATION.

GASTRIC FUNCTIONS

The gastric functions may be classed under three headings- sensory, motor, and secretory.

It is of derangement in the sensory function that the patient first, and almost exclusively, complains. In health, the stomach does not make its presence felt unless to inform the individual as to his state of hunger or repletion. In disease, with consequent derangement in the sensory function, abnormal sensations begin to appear, and, of these, pain is certainly the most important.

PAIN. Than Peptic ulcer, no disease calls for more investigation as to the cause of pain. Hurst (2) has conclusively shown that the gastric mucosa is insensible to ordinary tactile, chemical and thermal stimuli. Yet we know from personal experience that this viscus possesses a sensibility peculiar to itself.

The theory, long held, that the pain in peptic ulcer was due to physical contact of the ulcer itself with ingested food or chemical irritation by hydrochloric acid, has been proved false. No longer is it believed that the beneficial effect of alkalies

lies in their neutralising power. If physical contact were the cause, then pain would be present as long as the stomach or duodenum contained food, i.e. for a period of two and a half hours after ingestion, since food commences to leave the stomach almost immediately it is swallowed. Ryle(3) maintains, moreover, that simple contact of the ulcer with the opposite wall would be just as effective in causing pain, if the physical contact theory were tenable. As for chemical irritation by Hydrochloric Acid, Hurst (2) failed, in several cases of peptic ulcer, to produce pain by introduction of four ounces of 0.5 per cent Hydrochloric Acid into the stomach. He therefore maintains that pain is an expression of gastric hypertonus, with increased tension in the muscle fibre - in duodenal ulcer pain develops when "only a small proportion of the food is present in the stomach and the hypertonic condition constantly present in cases of duodenal ulcer reaches its greatest development, owing to increase in tone which occurs as the bulk of the gastric contents diminishes". Later(4) he modifies this by bringing in the factor of pyloric achalasia, which he believes to be a result of hyperacidity.

I am more in agreement with Ryle (3) who maintains that acidity plays no part in the causation of pain and that the relief obtained by alkalies is due to

the evolution of gas, which gives bulk to the gastric contents and so causes relaxation of tonus. He quotes a case of a medical man who had a gastrojejunostomy performed thirty years previously, for duodenal ulcer with stenosis, and who since then had developed achlorhydria.

With the recurrence of typical hunger-pains, it was found that alkalies had lost their effect and that small feeds, rest and belladonna were the relieving factors. Ryle states "his case exemplifies three points:-

(a) With a marked stenosis of the pylorus,which is now almost certainly incapable of contraction, or relaxation, he had typical hunger-pain due presumably to general hypertonus of the pars pylorica.

(b) The pain occurred in the absence of free acidity.

(c) In the absence of free acidity, alkalies failed to give the customary relief, not,I believe, because the pylorus was incapable of relaxation, but because with no evolution of gas no adequate relaxation of the pars pylorica was obtained".

I have found that the administration of an effervescent mixture was more acceptable to ulcer cases than was magnesium oxide, which is the most efficient neutralising agent, but which is less effective than sodium bicarbonate, because of the latter's more rapid and plentiful evolution of carbon dioxide. Then again, the pain of duodenal ulcer is not rhythmical, as would be expected if due to peristaltic contraction, but is persistent and of gradually increasing severity.

Spasm of the greater curvature, opposite the site of an ulcer, can be demonstrated radiologically, when pain is absent. When food is ingested, however, whether the contracture be reflex or organic in origin, the adaptation of tonus normally present is no longer possible. Increased tension is the result, with consequent pain. This pain gradually passes when the stomach contents empty through the pylorus, or more effectively, if vomiting takes place. By the administration of sodium bicarbonate, this pain is relieved because belching is facilitated by the evolution of carbon dioxide, with consequent relief in the tension of muscle fibres.

In carcinoma of the body, with non-involvement of surrounding tissues, the growth infiltrating the gastric musculature acts in the same way as spasm of

the muscle, in that it prevents normal adaptation of posture. When food is taken there is increased tension, resulting in an exaggeration of discomfort. When the tumour has progressed to involvement of surrounding tissues, then the pain can no longer be regarded as purely gastric in origin.

Gastric pain, then, naturally can be regarded as analogous to that met with in other hollow viscera, and is not peculiar to the stomach, increased tension of muscle fibres being the sole cause.

Moynihan(5) lays great stress on the punctuality of pain in peptic ulcer, and emphasises the difference of rhythm in gastric and duodenal ulcers, unvarying from day to day in each individual case. In ulcer of the corpus, we have the quadruple rhythm of food, comfort, pain, comfort; in ulcer of the duodenum, the triple rhythm of food, comfort, pain. In duodenal ulceration a peculiarity of the symptoms is their periodicity. For weeks the patient may be leading a normal life, quite free from dyspeptic symptoms. Then he has typical symptoms of his trouble, lasting for varying periods, to be again followed by freedom.

The individual with gastric ulcer, on the other hand, suffers from disability more or less continuous. The pain in carcinoma of the stomach is at first similar to that of gastric ulcer, but gradually becomes continuous in the intervals between meals, being aggravated by food.

The factors relieving pain in the three conditions are distinctive. Vomiting as a relieving factor is common to all three, but occurs rarely in duodenal cases. When it does occur, in benign ulceration the pain is completely relieved for the time being, but in carcinoma only partially so.

Food is a causative factor both in gastric ulcer and in carcinoma, but it is striking how emphatic duodenal cases are in their almost invariably voluntary statements that the taking of food is the best "cure" they have and how effective the "nocturnal" biscuit is.

The effect of alkalies has already been mentioned, with regard to benign ulceration. In carcinoma they are practically of no value in the relief of pain.

In my opinion, investigation into the degree of severity of the pain is not of much account, as it is purely a subjective judgment. Generally speaking, in gastric ulcer the pain is of a more acute nature than

in duodenal ulcer, with which the patient usually complains of a dull,"full" sensation, comparable to the feeling of hunger but in a greater degree. In carcinoma, the pain is not usually acute, but of a "gnawing" character.

S I T E After careful enquiry into three hundred and twenty cases of affections of the stomach, Mackenzie (6) found that 95% referred their pain to the epigastrium. He afterwards confirmed this many times, whatever the nature of the lesion. Very often the pain radiates into the chest, or it may be accompanied by pain between the scapulae. He has amply demonstrated that the pain is not felt in the stomach itself, but in the peripheral distribution of the corresponding cerebro-spinal nerves.

Hyperalgesia. This is by no means a constant sign, but when present yields valuable information as to the site of the lesion. From the sub-costal angle to the lowest part of the epigastrium, in mid-line,hyperalgesia of the skin from above downwards will indicate the position of the lesion along the lesser curvature from the cardia to the pylorus. In duodenal ulcer the site is just below the transpyloric line, and two inches to the right of the mid-line. In carcinoma,hyperalgesia is more diffuse and is not definitely localised to a particular spot, probably on account of the greater

infiltration of gastric musculature.

FLATULENCE. Flatulence is an almost universal complaint of all dyspeptics, but, apart from the complete absence of hydrochloric acid and in the presence of pyloric stricture, I fail to see how gas can be evolved in such abnormal quantities. Patients with carcinoma complain of frequent foul smelling eructations, due undoubtedly to putrefactive processes in the stomach contents, which are prevented from passing out and, in the absence of hydrochloric acid, undergo decomposition. On the other hand, aerophagy, which brings relief to patients with duodenal and gastric ulcers, accounts for the greater part of the flatulence complained of by these cases, unless pyloric obstruction is present. Chyme withdrawn from a normal stomach may show no sign of putrefaction for a period of weeks.

HAEMATEMESIS is rare apart from organic gastric disease. In carcinoma it occurs, but in quantities smaller than in gastric or duodenal ulcers, In hepatic cirrhosis or general haemorrhagic diseases, haematemesis may be a symptom but the case history is entirely different.

Examination of the nose, mouth and the pharynx is sufficient to exclude the possibility of the blood being of extra-gastric origin. Hale White in 1906 could collect from these islands only twenty-six cases,proven by operation or autopsy, where no lesion was found to account for the haematemesis. In haematemesis without symptoms of indigestion, small erosions of the gastric mucous membrane can usually be found, Monod(7) in France, could find only three cases which were operated upon and no lesion found.

APPETITE. Much work has yet to be done in the investigation of the sensation of appetite. Ryle (8) defines it as "in part a memory process, and in part a local manifestation of efficient gastric tonus reflexly induced by the memory stimulus, or by the more direct stimulus of seeing, smelling,tasting or swallowing food; or by some combination of these factors". Beaumont(9) maintained that appetite and hunger belonged to the same class of sensation, differing only in degree. No healthy individual will agree to this. Under the usual conditions of civilised life to-day hunger is a rare experience, but occurs to most of us at some time or other as a decidedly unpleasant sensation. Appetite, on the other hand, is a

sensation of daily occurrence to the healthy individual and is a sensation of distinct pleasure.

To prove that appetite is not entirely a psychic phenomenon, we have radiographic evidence. In debilitating diseases such as pulmonary tuberculosis, hypotonus is a common finding ; in duodenal ulcer, where appetite is usually increased, hypertonus is usual. Barclay(10) in a series of observations, maintains that appetite is related to gastric tonus, and has seen adaptation of tonus in the stomachs of patients to whom palatable viands have been shown. The vagus controls both secretory and motor responses of the stomach and Pavlov(11),in his well known researches, has shown how stimuli to appetite excite secretion. Knowing that secretory and motor responses often show parallel behaviour, it is only to be expected that the same stimuli should call forth an adaptation of tonus as well as increased secretion. Loss of appetite in carcinoma ventriculi is therefore most probably due to loss of the function of tonic adaptation and may be the only symptom present.

ANALYSIS OF CASES FROM CLINICAL INVESTIGATION.

GASTRIC ULCER.

In my series of cases suffering from gastric ulcer, eleven have been proven by laparotomy, the remainder radiologically.

As experience increases and apparatus improves, definite evidence of corpus ulcers becomes more and more frequent. Moynihan(5), Barclay(12) and Faber(13), state that the appearance of a niche in the stomach wall is definite proof of an ulcer. Moynihan goes further, in that he says "the abiding spasm of a zone of the stomach, the "notch" on the greature curvature, seen with or without the crater, indicates just as certainly as the niche, the presence of an ulcer". Two unequivocal methods of diagnosis have therefore been adopted.

In analysing my series of cases it will be seen that all the ulcers are chronic. The definition of this term is that of Moynihan, who holds that chronic ulcer, whether of stomach or duodenum, is a visible and palpable lesion which has existed for months or years. In all twentyfive cases, ulcers had produced symptoms for a considerable period.

The duration of symptoms before admission to hospital will be seen from Table II.

Years	Males	Females.
Under 1.	3	2
1 - 5	9	4
5- 10	4	1
10-20	0	1
Over 20	0	1

TABLE II.

In Table II the sex factor is entirely fallacious as in all the following, the reason being that the proportion of beds for male and female cases was 2:I. It will be seen, however, that the disease is one of very long duration. Extensive statistics have long pointed to a greater frequency in women.

In a series of five thousand one hundred and ninety six autopsies, Harsloef(15) of Copenhagen, found gastric ulcers or cicatrices in 4 per cent, 1.3 per cent of these in males and 3.8 per cent in females; of the cicatrices only .3 per cent were in men and 5 per cent in women.

Reviewing one hundred and sixty-four cases of gastric ulcer, Moynihan (5) found eighty-three in men and eighty-one in women.

The ages of the patients when symptoms commenced are shown in the following table:

Years	Males	Females	Total
10-20	0	1	1
20-30	4	2	6
30-40	8	2	10
40-50	4	2	6
Over 50	1	1	2

TABLE III.

The foregoing table plainly shows that gastric ulceration is a disease of active middle life.

Family History. With regard to family history of peptic ulcer, in only two cases of this series was any definite history given of any relatives suffering from the same complaint. Hurst(14) upholds the "gastric diathesis" and quotes several interesting family histories in proof of the fact that peptic ulcer is a familial disease.

I pass now to the investigation of the various recognised symptoms of ulcer of the corpus. Among these, for the sake of convenience, I include the discovery of blood in the faeces. This latter, not strictly clinical in the true sense of the word, is scarcely to be relegated to the laboratory in every instance.

From Table IV. it will be seen that the pain occurred in every case within one hour of taking food: in nineteen (76 per cent) it occurred within half-an-hour - the notable features being the punctuality of onset and the well marked rhythm of food, comfort, pain, comfort. The pain was almost always described as of a sharp, stabbing character, lasting for about one hour, unless relieved by medicine or vomiting. Six patients stated that the pain was of a dull, gnawing type. Not one individual complained of any nocturnal discomfort. In each patient the site of the pain was in the epigastrium, but in five it was felt between the scapulae. It is noteworthy that in each of these

five cases the ulcer was situated high up upon the lesser curvature.

Symptom		Number of cases -25.
Family history of Dyspepsia		2
Pain	Within one hour after food	6
	Within half-an-hour after food	19
Nocturnal hunger pain		0
Pain confined to epigastrium		20
Pain in epigastrium and between scapulae		5
Hyperalgesia		11
Appetite	Diminished	5
	Normal	16
	Increased	4
Vomiting		20
Pain relieved by vomiting		20
Pain relieved by alkalies		5
Pain relieved by alkalies and vomiting		7
Haematemesis		11
Melaena		7
Loss in weight		3

TABLE IV.

Careful investigation in each patient revealed some degree of hyperalgesia of skin in only eleven cases- always about two inches to left of mid-line, midway between xiphisternum and umbilicus.

Ryle (16) believes that these reflex signs are present only in association with organic disease, thus confirming the investigations of Mackenzie (6). The converse does not hold good, as this part of the physical examination was, as far as possible, undertaken when the patient was suffering from pain.

Vomiting occurred in twenty cases (80 per cent) and in each of these was a decided relieving factor. In seven patients alkalies, as well as vomiting, had a beneficial effect on discomfort. The five remaining cases found relief to some extent from the use of alkalies.

Eleven patients (44 per cent) gave a definite history of haematemesis on one or more occasions. In several of these the alarm caused by this occurrence was the inducement to seek hospital treatment.

On examination of the stools, melaena was discovered in seven cases (28 per cent). In some

the haemorrhage was obvious to the naked eye.

Only three patients stated that their weight had been decreasing, and these three had vomited practically all meals taken.

With regard to appetite, five patients complained of marked loss, while four stated that their desire for food had increased. The remaining sixteen had not remarked on any difference.

It must be admitted that, apart from the objective symptoms of haematemesis and melaena, the history given by a patient with chronic gastric ulcer differs in no respect from that given by any patient with dyspepsia from cause other than peptic ulcer. It is only when the symptoms continue for a considerable time, without signs of abatement, or when one of the two more positive signs already mentioned make their appearance, that the condition is open to suspicion of ulceration.

I would here quote Moynihan (5) who, as a result of his large experience in this branch of our profession, states that "when, from the clinical

history alone------ with a sense of pride in my courage, I make the diagnosis of gastric ulcer, I feel very contented, even a little elated, if I prove right".

DUODENAL ULCER.

To pass now to the analysis of the thirty duodenal cases. Here laparotomy was performed in eleven instances, and autopsy in one.

Direct radiological evidence, in the form of definite irregularity in the duodenal cap, is as certain as the "notch" in gastric ulcer, according to Moynihan(5). That evidence, along with the result of fractional analysis of the gastric contents, accounts for the verification of the remainder.

As will be shown later, the results of fractional analysis are entirely dependable in this disease.

Duration-in years	Males	Females.
1 - 5	17	0
5 -10	13	0
10 -20	0	0
Over 20	0	0

TABLE V.

Without, in every case, being totally incapacitating, duodenal ulcer must be accountable for a great deal of suffering. From Table V. it will be seen that symptoms are present for many years before the patient is driven to seek institutional treatment.

Age	Number.
10.-20	5
20 -30	11
30 -40	9
40 -50	2
Over 50	3

TABLE VI.

On comparing Tables III and VI. it will be observed that the age incidence is practically the same in ulceration of both corpus and duodenum. The disease appears to have its chief incidence on the age of greatest activity and virility, duodenal ulcer occurring, for the most part, a decade earlier than gastric ulcer. It is rather remarkable that, allowing for fallacy in sex incidence, out of thirty cases of duodenal ulcer, not one should be female.

Symptom		Number of cases.
Family history of dyspepsia		2
Pain Occurring	Less than one hour after food	0
	Between one- and one and a half hours after food	13
	Between one and a half- and two hours after food	13
	Over two hours after food	4
Nocturnal hunger pain		25
Periodicity of pain		25
Pain relieved by food		30
Pain relieved by vomiting		14
Vomiting		14
Pain relieved by alkalies		16
Haematemesis		9
Appetite	Diminished	0
	Normal	15
	Increased	15
Melaena		14
Loss in weight		2
Hyperalgesia		13

TABLE VII.

Passing now to the analysis of the various well recognised symptoms of duodenal ulcer, my findings will be found summarised in Table VII.

As in the series of gastric ulcer cases, so in this instance, the number giving a definite family history of dyspepsia is low, only two (6.6 per cent). Apparently, then, from my findings, family history plays a small part indeed in the investigation into clinical history of peptic ulcer.

From the enquiry into the pain present in duodenal ulcer, much more is to be gained than from all other symptoms. In every case, the pain was described as being "dull and heavy " - not sharp. Even in this, one can see a point of differentiation from gastric ulcer, where the pain is more severe. The discomfort in every case lasted for about two hours, unless means were adopted to relieve it. In no case was pain felt other than in the epigastrium, and in thirteen patients, on careful examination, an area of tenderness was found, about two inches to the right and two inches below the site of tenderness in ulcers of the corpus.

The time relationship of pain to the taking of food is highly characteristic. It is noteworthy that most patients complained of pain coming on "before food, when they felt hungry", in contra-distinction to the complaint of pain after food, in gastric ulcer cases. In thirteen cases (43 per cent) discomfort was felt about one and a half hours after meals: in thirteen cases also it was felt about two hours after a meal. The remaining four patients complained of the pain starting about two and a half hours after food, or shortly before the meal following. The well marked margin in time, between the occurrence of pain in gastric and duodenal ulcers, is, in my opinion, the chief distinction in the symptomatology. In each case the patient was most emphatic about the relief afforded by a meal.

In twenty-five cases (83 per cent) nocturnal hunger pain was strongly marked. It is noteworthy that almost all the twenty-five patients complained voluntarily of this symptom - the fact of its presence had not to be elicited by the examiner. I believe this to be a most important characteristic of the pain, the result of the great impression made

on the patient's mind by being awakened from sleep through a pain which can be alleviated in so simple a fashion. In each case the ingestion of food removed the symptom.

The periodicity of occurrence of the discomfort in duodenal ulcer is a well recognised characteristic. For weeks an individual with this complaint may lead a perfectly normal digestive life - the period of tranquility being broken, without any apparent aggravating factor, by sudden return of discomfort. This occurred in fourteen (46 per cent) of my series. It cannot therefore be recognised as a constant feature.

In fourteen cases also, vomiting was a feature. This percentage (46) is much lower than that in gastric ulceration. In each of these cases it was a factor in relieving pain. No definite relation-ship between time of taking food and time of vomiting could be found - the vomiting being so inconstant. In nine of the fourteen cases haematemesis had occurred on one or more occasions.

Blood was found to be present in the faeces of fourteen cases of the series (46 per cent). This

is a much larger proportion than in gastric ulcer. It is to be noted that melaena is almost invariable in excess of haematemesis in duodenal cases - the reverse of the findings in gastric cases.

Only two patients complained of loss in weight and these two had had copious and frequent vomiting.

With regard to appetite, in no instance was the desire for food diminished. Fifteen patients stated that their appetites were normal, the remaining fifteen stating that they were almost always hungry. Might not this be the first degree of pain, to which they were subject?

As in gastric ulceration, also in duodenal, haematemesis and melaena, the only objective symptoms, bear most weight in diagnosis. Even so, the clinical history of duodenal cases is much more definite, in fact, I would say quite definite. The time relationship of pain to food; the nocturnal hunger pain; the periodicity of occurrence and the relieving factors are so constant that, even without the two objective symptoms, one cannot be in much doubt as to the diagnosis, after careful enquiry into the clinical history.

Again quoting Moynihan (5),I concur, "When, with great confidence, I make the diagnosis of duodenal ulcer from clinical history alone, I feel wounded and amazed if I prove wrong".

CARCINOMA VENTRICULI

Under this heading, we have seven cases to consider. In each of these, of course, laparotomy was the deciding factor in the confirmation of diagnosis.

The sex of the patients was male, except in one case. The youngest patient in this series was thirty-nine; the oldest fifty-seven, while the others were forty-two, forty-nine, forty-nine,fifty, fifty-three. The duration of symptoms previous to examination varied from six to ten months, so that it will be seen that they were relatively early cases, from a hospital point of view.

The age factor, of course, is quite in accordance with that of carcinoma in other organs and with the well known fact that very rarely does this dread disease occur in any part before late in the fourth decade.

No patient in this series had any dyspeptic symptoms previous to those which brings them under review. An individual who leads a normal digestive life until he is well into middle life naturally shows more concern over his condition, if it persists, than had he been inured to previous suffering in that respect. It is well that this is so, because it is essential that every case of dyspepsia, starting for the first time in middle life, should be treated with grave suspicion. One must bear in mind, however, the very difficult cases over which there has been so much discussion, in which malignant changes eventually occur in a previously innocent, or supposedly innocent,gastric ulcer.

A Family history of dyspepsia was negative in all seven cases. Apart from sporadic cases occurring, I do not think that carcinoma in any organ can be held to be familial.

The pain in carcinoma ventriculi is not so pronounced a feature as in non-malignant ulceration. In one of my series, it was absent altogether, while in another it was quite a minor symptom. The remaining five patients stated that pain, although not severe, was constant, and of a dull, aching character, aggravated by the taking of food.

In only three cases was any relieving character mentioned, that one being vomiting. This,however, did not completely abate the pain.

The site of the pain in each case was in the epigastrium, but was not accurately localised. In one case pain was felt also between the scapulae.

Tenderness was elicited in each case over a diffuse area of the epigastrium and in only two cases was anything abnormal found on deep palpation over the upper abdomen. In one of these two cases I could feel a growth only with difficulty, but the

other was easily demonstrable.

Vomiting was a constant feature in each patient, the foul objectionable nature of the vomitus being voluntarily remarked on. The act bore no relationship to pain nor ingestion of food, but was preceded by intense nausea.

Haematemesis occurred on one or more occasions in five cases and was always of the nature of "coffee-grounds".

In six of the seven cases, I discovered blood in the faeces by the usual tests.

Each patient complained of becoming thinner to a lesser or greater extent, this being accompanied by a loss of both strength and feeling of well being. It is to be noted that in cases of peptic ulcer, this latter is of rare occurrence. Along with loss in weight, each patient remarked on the great diminution of appetite experienced. There was lack of relish for any type of viand.

I think it will be conceded that in this series of cases very little difficulty was experienced in diagnosing the condition from clinical history and examination alone. The age of

commencement; the persistence of symptoms; the type of pain, the foul vomiting, the haematemesis; the melaena and loss of weight and strength all go to complete a typical picture.

RADIOLOGICAL INVESTIGATION.

In the diagnosis of peptic ulcer and carcinoma ventriculi, in addition to clinical investigation of the patient, we have two most effective ancillary methods; these are:-

(1) The chemical analysis of the gastric contents withdrawn after a test meal has been given.

(2) The radiographic appearance of the stomach and duodenum after the administration of an opaque meal.

I propose to deal first with the second of these methods.

Within the present century the use of X-rays in diagnosis of various conditions has increased concurrently with the great strides made in radiographic technique. With the introduction of the opaque meal a new field of investigation was opened up and there were revealed obvious paths of usefulness in the diagnosis of disease, the result being that the normal subject received too little attention.

X-Ray examination with a barium meal has now become a valuable procedure.

Some years ago, radiologists were more than pleased when positive evidence of a lesion was found, as they did not expect too much from the method.

It is now only in text-books of anatomy that one finds the adult human stomach described as "retort-shaped, twelve inches long, five inches wide; its walls about one fifth of an inch apart and its capacity forty ounces" a gross distortion of fact, founded on the anatomy of the dead.

In the early days of alimentary radiology, it was found hard to reconcile the pictures obtained with this description. It was obvious that something was at fault and gradually it has been recognised that the functioning stomach does not correspond in appearance with the picture given by descriptive anatomists. Showing the great variability in shape and size of the stomach, occurring in the same patient, Barclay (10), quotes cases in which the changes were brought about during examination by emotion and the exhibition of palatable or obnoxious substances.

In 1907, Hurst and Morton (17) drew attention to the great variations found in healthy students

during radiographic examination of the alimentary tract. At a later date, Moody, Van Nuys and Chamberlain (18), published their results of investigations carried out on six hundred healthy men and women, showing remarkable differences.

The functions of the stomach which may be observed radiologically are its tonus, peristalsis, motor activity and emptying rate.

To some extent the tonus of the stomach may be judged from the position, size, and shape of the shadow thrown by the opaque meal. Hughes Bennett(19) defined tonus as "that slight constant tension which is characteristic of healthy muscle".

In dealing with the greatly misused term, Sherrington(20) says that "the notion of tension is attached as a committant of shortening and supposes that with greater shortening there must be increased tension; but it has become clear that skeletal muscle in postural reflex contraction may alter the lengths of its fibres very considerably with little or no change in the tension the muscle exerts". Tonus in gastric muscle appears to be a counterpart to balance the action of gravity exerted by the weight of the contents and therefore to maintain the

stomach in approximately the same posture.

As a result of their investigations, Moody, Van Nuys and Chamberlain(18) concluded that the use of such terms as gastroptosis was unjustifiable and that the position of the stomach may be so low or so high in healthy individuals, that these variations cannot in themselves be regarded as evidence of disease. In Table VIII we see their findings summarised.

Position of greater curvature re iliac crests.	Percentage of subjects	
	Men	Women.
More than two inches above	2	1
More than one inch above	5	2
Less than one inch above	18	10
Less than one inch below	23	19
More than one inch below	27	21
More than two inches below	16	22
More than three inches below	6	17
More than four inches below	3	8

TABLE VIII

(MOODY, VAN NUYS AND CHAMBERLAIN). Position of Stomach in six hundred men and women Students.

Employing Schlesingers (21) classification, these three investigators found, in their male series, orthotonus

in 79 per cent; hypertonus in 17 per cent; hypotonus in 4 per cent.

It is interesting to compare these figures with those obtained by Bennett and Ryle (22) who found normal secretory curves in 80 per cent: hyperchlorhydria in 15 per cent; hypochlorhydria in 5 per cent.

Campbell and Conybeare(23) examined a group of students both by fractional test meal and radiologically, demonstrating a definite relationship between hypertonus and hyperacidity on the one hand and hypotonus and hypoacidity on the other.

It will be noted from Table VIII that hypertonus is more commonly an attribute of the male sex and hypotonus an attribute of the female sex.

Radiologists have remarked the correspondence between types of stomach and types of individual. Carman(24) goes further and writes " I feel that the chief test by which the stomach is to be adjudged of normal tone is its correspondence to the habitus of the individual, and not its form, size, and position, alone".

The peristaltic activity of the stomach is shown clearly when a patient, having swallowed an opaque meal, is examined under the fluorescent screen. It appears to be confined to the midgastric and pre-pyloric portions and is usually greater when the patient is in the prone position.

Radiographic methods form a useful means to determine the emptying rate of the stomach, but, in my opinion, this is more accurately determined by fractional test meal methods.

In the examination of one hundred healthy individuals, Briggs(25) found the rate of emptying to be as follows:- Two and a half hours - 1 per cent; three hours-6 per cent; three and a half hours- 9 per cent; four hours- 44 per cent; four and a half hours- 32 per cent; five hours- 8 per cent.

The behaviour of the pyloric sphincter is apparently the most important regulating factor in emptying rate, since a hypertonic stomach does not necessarily empty quickly, nor a hypotonic stomach slowly.

Both direct and indirect evidence of pathological processes in the stomach is afforded by X-rays. Direct information comprises the visualisation of a definite niche or crater, and delayed emptying in obstructive

lesions. Indirect evidence is given by observation as to size, shape, position, tonus and peristaltic activity.

Hour glass contractions are very frequently seen, many of them being pure spasmodic contractions without any underlying local organic lesion to account for them. Naturally, one examines the site of such an appearance very carefully, mere manipulation frequently causing relaxation of the spasm. As will be shown later, many of the contractions are associated with duodenal lesions.

Useful information may be obtained by observation of peristaltic activity. The wave may be interrupted at some point- usually an indurated ulcer. A period of complete rest or of futile waves, followed by a series of powerful waves, indicates definite obstruction to the passage of food. Fixation of any part of the stomach is only demonstrable by visualised palpation.

The presence of a filling defect in a suspected case of gastric ulcer is almost equally confirmatory evidence of its presence as a laparotomy would provide, especially if it be accompanied by an opposing and persistent spasm of the musculature.

In duodenal cases, the evidence is not usually so definite, but as shown in Plate 4 can occasionally be quite as certain. Proof depends on establishing the fact that the duodenal cap is definitely deformed and that the deformity is persistent.

From experiments he has made, Barclay (26) concludes that a spasmodic hour-glass contraction of the stomach is strong evidence of a duodenal lesion. His experiments consisted in electrical stimulation of different points in the stomach wall. On stimulation of the peritoneal surface of a duodenal ulcer, a definite incisura was formed about the junction of the middle and lower thirds of the stomach.

Vilvandre(27) states, from personal observations made, that a valuable aid in X-ray diagnosis of gastric ulceration is the presence of focal tenderness i.e., tenderness on pressure over the spot where an ulcer is suspected because of an opacity seen there. This seems somewhat opposed to present neurological beliefs.

In very early cases of carcinoma ventriculi, a negative radiogram cannot exclude the presence of the disease, yet, with present technique, the smallest niche should be possible of visualisation. Carman (24) maintains that he can make a correct X-ray diagnosis in 96 per cent of cases. He also makes the observation that if the crater of an ulcer is over 2.5 cms in diameter, malignancy is almost certain.

From the foregoing, it will be understood that the only effective method of radiological examination is that under the fluorescent screen. Only in this way can visualised palpation be employed, and most valuable information obtained. Radiographic films and plates hold a place only in so far as they make a permanent record, or if they show detail more clearly than can be obtained under the screen. Serial radiography, as practised in America, is prohibitive in cost and gives no more valuable information.

PLATE I.

CASE G.U. 3

HOUR-GLASS STOMACH
WITH
ULCER CRATER.

PLATE II.

CASE G.U. 7.

PENETRATING ULCER
ON LESSER CURVATURE
NEAR PYLORUS.

ANALYSIS OF CASES

FROM RADIOLOGICAL INVESTIGATION.

The meal used for the examination of my series of cases is the one in common use, i.e.

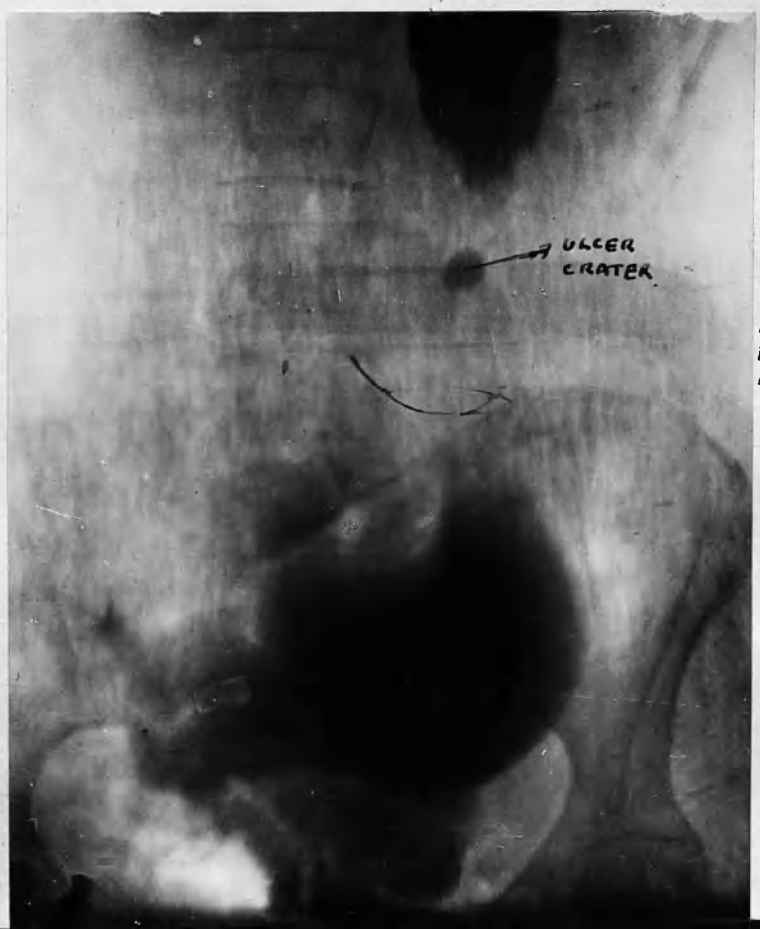
Barium Sulphate	20 ounces.
Gum Tragacanth	2 drachms.
Vanilin	10 grains.
Saccharin	4 grains
Water to	40 ounces.

GASTRIC ULCER.

In my twenty-five cases of gastric ulcer direct radiological evidence was obtained in fourteen cases (56 per cent). Examples of the findings are shewn in Plates 1,2,3,4, and it will be seen that the diagnoses are indubitable, without further investigation being necessary.

Indirect evidence was provided by eight cases (30 per cent). An example of what constitutes this is given in the following report. (Case G.U.12) "Tone of Stomach poor. Hypotonic with feeble peristalsis. Stomach dilated. Definite pyloric spasm. Unable to express meal through to fill duodenal cap. Six hour residue in stomach. Duodenal cap not seen".

This report might apply equally to an ulcer in the duodenum or lower down on the lesser curvature and can



PLATES III AND IV.

CASE G.U. 19.

HOUR-GLASS STOMACH
PENETRATING ULCER ON
LESSER CURVATURE.

only be made use of when correlated with other findings.

A normal passage of the opaque meal with no unusual observations made, was found in three cases (15 per cent). In one of these cases laparotomy was subsequently performed and a small shallow ulcer found on the anterior wall of the stomach, midway between lesser and greater curvature. In the other two, the histories given were those of long standing gastric ulcer. Haematemesis had occurred in each case and melaena was also discovered. A negative finding must therefore be very carefully considered when other findings point to a lesion being present.

With duodenal ulcer, only five cases (17 per cent) gave direct evidence, e.g., Plates 5,6,and 8. This is a much smaller percentage than that found in the cases of gastric ulcer. Considering the greater number of duodenal cases, one can but infer that direct evidence, in these cases, is more difficult to obtain.

In thirteen cases (43 per cent) however, indirect evidence was given - a greater percentage than in gastric cases. This evidence is exemplified by the following report (Case D.U.18). "Marked spasm of pylorus at first and second examinations. Unable to express any

PLATES V. AND VI.

CASE D.U. 16.

STOMACH OF STEER-HORN TYPE.
IRREGULARITY OF DUODENAL CAP.
CRATER SEEN.

of meal into first part of duodenum. Delay in Emptying. Six hour residue. Stomach dilated and atonic".

The chief ground on which this indirect proof was based was the presence of pyloric spasm with delayed emptying. Since this will occur with much greater frequency in cases of duodenal ulceration, the difference in percentage is explained.

In eleven cases (38 per cent) I found complete absence of evidence pointing to a lesion. Of these eleven patients, seven had laparotomy performed, when an ulcer was found. In the four remaining cases, other factors pointed strongly to the presence of a lesion, viz; the result of a fractional test meal; the clinical history; melaena. As with gastric ulceration, even more so with duodenal, a negative radiological report by no means excludes the presence of an ulcer.

With three of the cases of carcinoma, direct evidence was obtained, i.e., where the abnormal shadow, because of its size, could definitely be called a growth. Direct evidence of abnormality was found in the other four cases, but the opacity quite possibly might have been caused by benign ulcer in so far as the radiological examination was concerned.

PLATE VII.

CASE G.C. 7

ADVANCED GROWTH
MASKING
STOMACH OUTLINE.

PLATE VIII.

CASE D.U. 23.

IRREGULARITY OF
PYLORIC OUTLINE.

Plate 7 shows a well marked case where the outline of the stomach wall is greatly altered. In a very early case, where ulceration of mucous membrane has not yet commenced, it is quite understandable that no abnormality can be detected. Being a progressive condition, however, an examination at a later date would be bound to show irregularity of the stomach wall.

INVESTIGATION BY FRACTIONAL TEST MEAL

It is no exaggeration to say that, without access to a pathological laboratory, efficient diagnosis (and therefore treatment) of gastric lesions, is impossible. The physiological chemistry of the stomach has always provided a large field for investigation. Arising out of this we naturally have had much research into its pathological chemistry.

Previous to 1914, the Ewald Test Meal, in which the stomach contents are withdrawn, for measurement and analysis, one hour after a breakfast of tea and bread, was the usual method of investigation employed. In 1914, however, Rehfuss (28) in America, described the method of fractional analysis, and this has now supplanted the Ewald method. Rehfuss' method did not attract attention in this country until 1919, since when it has been largely adopted and made the subject of much research. Like all new methods, it has its detractors, but I believe that anyone having dealings with both methods would be very unwilling to revert to the older one.

The chief criticism appears to be that the specimens obtained are not true samples of the stomach contents, which are not homogeneous. There is a measure of truth in this, but the churning action of the stomach must ensure a thorough mixing. In further comparison of the two methods, it must be recognised that in the fractional method, where the whole of the fasting stomach content is removed before the test meal is given, the resultant analysis must be far more accurate than with the Ewald technique, in which, at the end of one hour, it is a mixture of meal, with old and recent secretions, which is removed for examination.
The observer has therefore no information as to what its fasting contents were.

I here quote Ryle (8) who gives an excellent summary of the various advantages of the fractional test meal.

"(1) It permits of accurate measurement of the fasting juice and a study of the mucous, bile and cell content, together with estimation of the free and total acidity.

(2) It provides in graphic form an indication of the chemical processes at each stage of gastric digestion and detects late rises in acidity and such phenomena as continued secretion. By recording the times at which bile registration occurs, it gives an indication of the occurrence of pyloric

relaxation and duodenal reflux.

(3) It determines with considerable accuracy the emptying rate of the stomach, for a standard meal.

(4) By combining chloride estimation with those of free and total acidity, it furnishes information relating to the factors causing neutralisation and so indirectly again to the functions of the pylorus.

(5) In pathological cases the presence of food residue in the fasting specimen,of pus or blood in this or subsequent specimens,the odour of the samples and other physical characters may also be observed".

In order that results obtained in pathological conditions may be assessed at their true value, it is essential that we should know what variations in secretion and motility occur in the normal individual when subjected to this method of investigation. Bennett and Ryle (22) performed analyses of gastric contents, after fractional test meal, on one hundred healthy students, with no dyspeptic symptoms. Their findings are drawn up in the form of a graph, which forms a convenient method of recording the findings in pathological cases and is taken throughout this communication to represent the limits of normal gastric secretion.

It has been put forward as an objection to the fractional test meal that, in the same individual from day to day, wide variations in emptying rate and acid values will be found. With a view to studying the variations in gastric response to the same test meal repeated under the same conditions on twenty consecutive days, Bell and MacAdam (29) carried out this test on a healthy male subject. Their findings re emptying rate and acid values are remarkably constant, except on the first day, when a low acid curve was obtained. From this they conclude that, if a patient's symptoms point to a hyperchlorhydria, and a low acid curve be obtained, the test should be repeated before the presence of a high degree of acidity can be excluded.

TECHNIQUE. The method which I employed in my series of cases is that in general use. The patient is kept fasting for twelve hours previous to the commencement of the test. The stomach tube (Ryle's modification of Einhorn's) is then passed and the fasting contents withdrawn. Two tablespoonsful of fine oatmeal boiled slowly with one quart of water to one pint volume and strained through muslin forms the meal, which the patient now swallows, the tube remaining in the stomach until the

Name of Patient

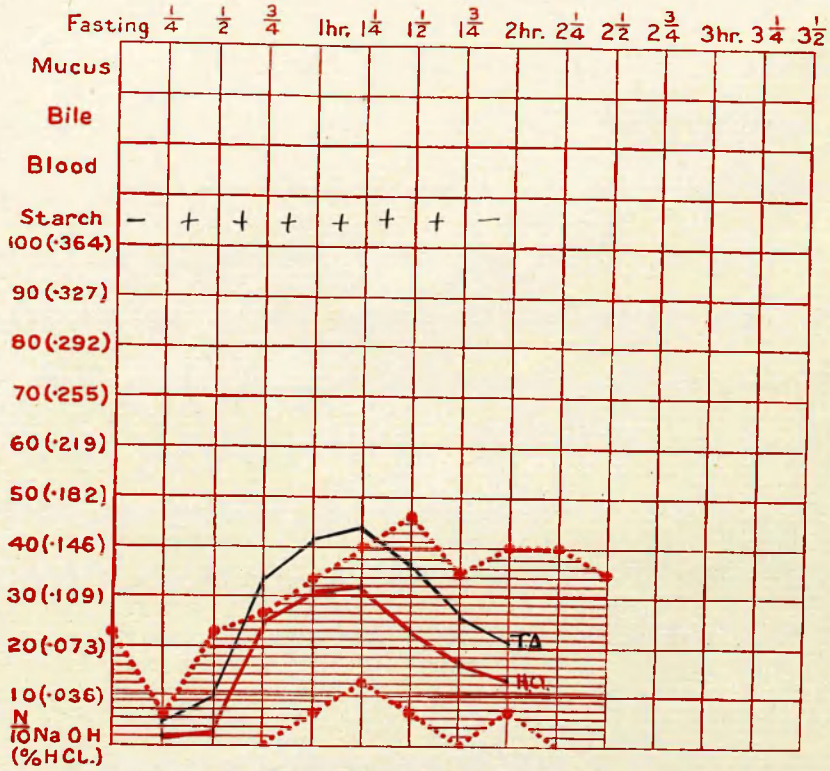
GRAPH 1.

1. FRACTIONAL TEST-MEAL. Date.

Fasting Juice.

Volume.

Cells.



One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

Summary.

ISOSECRETORY GRAPH.
CROHH AND REISS.

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completion of the test. Every half-hour thereafter, for three or more hours, until the stomach is empty, 12.c.cms of the contents are withdrawn by means of a 20 c.cms syringe, and are placed in numbered test tubes.

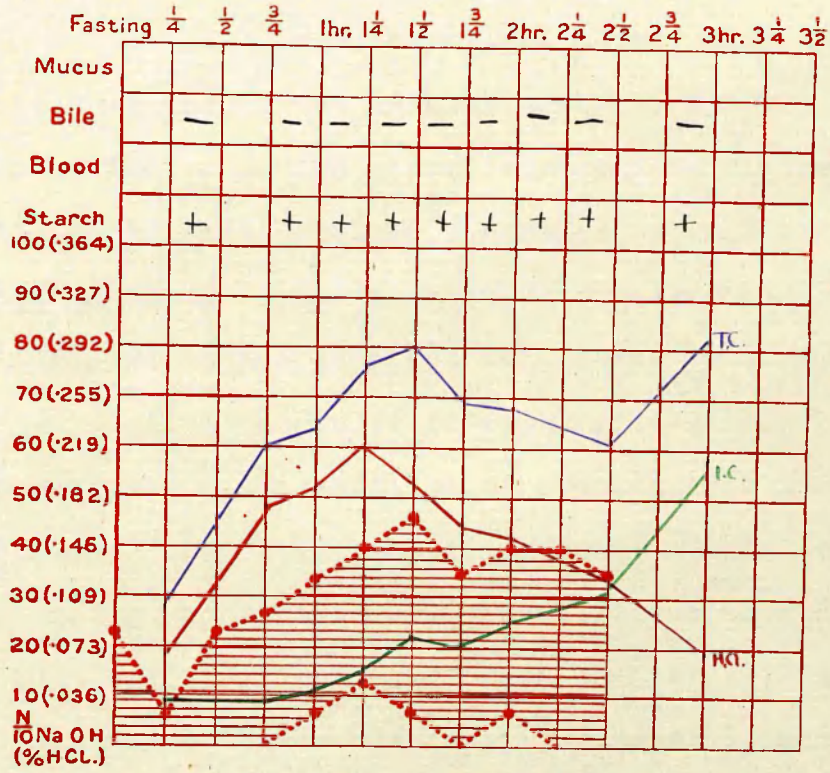
INTERPRETATION. The average normal curve of free hydrochloric acid and total acidity rises gradually to a maximum and thereafter falls, forming a single peak as the stomach empties. Different cases show the apex at different periods of digestion. The apex is found usually between 40 and 50 and these curves are known as isosecretory(Graph 1). Marked variations of these curves, either higher or lower in value, are respectively hypersecretory and hyposecretory. Another variant is the type of curve which never descends, but the highest point of which occurs when the stomach has just emptied, and is called the "climbing" curve by Bennett and Ryle(22).

A large amount of research has been done in the study of these curves in different physiological and pathological conditions. For scientific investigation of pathological processes, however, it is far from being accurate, in that it neglects protein hydrochloric acid, and the hydrochloric acid which has been neutralised and combined in forming inorganic chlorides.

Name of Patient

GRAPH 2

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume.

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

———— represents free HCl.

– – – – represents total acidity.

———— represents total chlorides

———— represents inorganic chlorides.

Summary.

NORMAL CURVE OF TOTAL CHLORIDE, INORGANIC CHLORIDE AND ACTIVE HCl (= PROTEIN HCl + FREE HCl)

(BOLTON)

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The total chloride and free hydrochloric acid curves cannot truly be regarded as secretory curves. They merely represent the excess of unneutralised acid. The chief factor in modifying the curve of acidity, viz, the self-regulation of gastric acidity, must be taken into account.

Bolton (30) in an excellent paper, discloses the disadvantages of the earlier method. He has definitely proved that when the percentage acidity of the digesting stomach contents reaches a certain average height, regurgitation of the alkaline duodenal contents takes place, and brings down the acid curve by neutralisation.

A rise in the curve of free hydrochloric acid undoubtedly means addition of hydrochloric acid to the digesting contents, and brings about a parallel rise in the total chloride curve. The converse does not hold good. A fall in the acid curve indicates that the percentage of Hydrochloric acid is decreasing by neutralisation - as is shown by the rise in the curve of inorganic chlorides, which crosses the curve of hydrochloric acid (Graph 2). The in-organic chloride curve therefore represents the curve of neutralisation, depending upon relaxation of the pyloric sphincter and being a measure of the pyloric tonus. The actual height of the hydrochloric acid curve is not a point of great significance.

Apart from a close study of the graphs plotted from the chemical analysis of the gastric contents, much more is to be learnt. The resting secretion provides not a little valuable information in many cases. As to the quantity which should be considered a normal average, there is yet no consensus of opinion, but the majority of investigators favours 30.c.cms as the maximum. I hope to show that figures in excess of this may not indicate hypersecretion, since the contents withdrawn may be composed partly of swallowed saliva and duodenal secretions. The character of the resting juice is of much more value. The presence of blood, food debris, mucous or pus, may go a long way to clinch a diagnosis without further investigation.

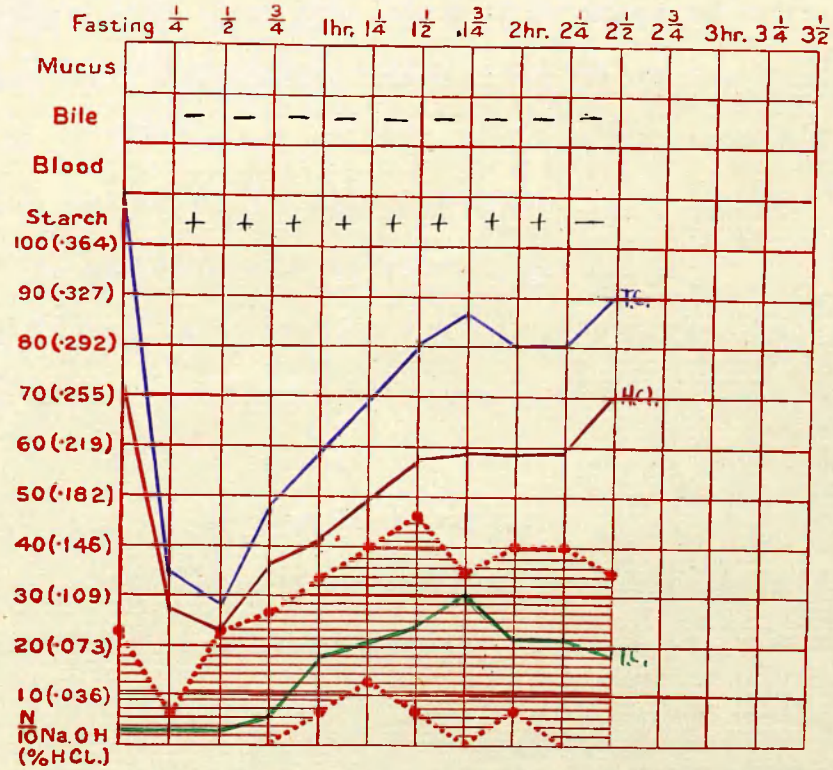
Then again, the rate of emptying may be very accurately ascertained by the fractional method, and is very closely comparable with the rate of emptying as determined radiologically.

It has long been taught that .2 is the normal percentage of hydrochloric acid in the human gastric secretion. This figure represents really the percentage of hydrochloric acid in a mixture of food and gastric juice. The true figure approaches closely to .4 or .5 as in animals.

Name of Patient

GRAPH 3

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume.

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

———— represents free HCl.

– – – – – represents ~~total acidity~~.

———— represents total chlorides.

———— represents inorganic chlorides.

Summary.

HYPERCHLORHYDRIA.

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In hypersecretion, hyperacidity may be found; it may be found also in cases where there is excessively rapid emptying. In neither of these conditions, however, is hyperacidity maintained except in the presence of pyloric hypertonus, which is the essential cause of hyperacidity, in that it prevents the regurgitation of the neutralising medium. The result is that the hydrochloric acid curve follows one of three courses:-

(1) It may continue to climb.

(2) It may carry on a horizontal course.

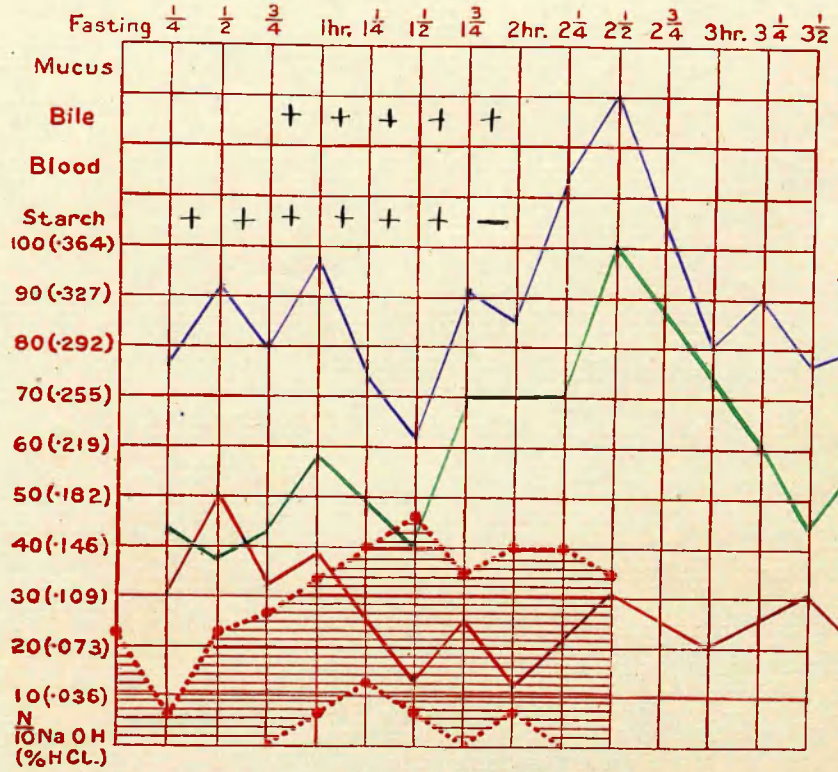
(3) It may show several dips, corresponding with rises in the inorganic chloride curve, indicating incomplete attempts at neutralisation.

I have previously stated that an excessive quantity of resting juice may not indicate hypersecretion. There is a corollary to this viz: hypersecretion may only take place during digestion and for a short time thereafter. It will therefore be missed unless the tube is left in situ with a view to drawing off any secretion formed once the stomach has emptied itself of food content.

There is only one indication by which hypersecretion may be said to exist, and that is a rapid rise in the total chloride curve when the stomach is full. Later, the shape

Name of Patient GRAPH 4.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume.

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

———— represents free HCl.

– – – – – ~~represents total acidity.~~

———— represents total chlorides.

———— represents inorganic chlorides.

Summary.

HYPERSECRETION. RAPID EMPTYING
NO HYPERACIDITY (BOLTON)

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of the curve is of no value and there cannot be a "hypersecretory" curve once the pylorus is functioning.

Some investigators hold that hypersecretion is a reflex phenomenon - the result of peptic ulcer. If this were so, hypersecretion would occur whether spasm is excited or not. The relationship is not so simple. The chief effect of an ulcer is on the motor functions, as has been shown. A local spasm in the vicinity is the result.

A duodenal ulcer will produce spasm in the pylorus, as will also a pyloric ulcer; a gastric ulcer will produce a ring spasm in the body, with obstruction supervening at either point. The ultimate result is therefore hyperacidity, following deficient neutralisation, whether it be in the stomach contents, following pyloric obstruction, or in the contents of the proximal sac, following the formation of an hour-glass stomach.

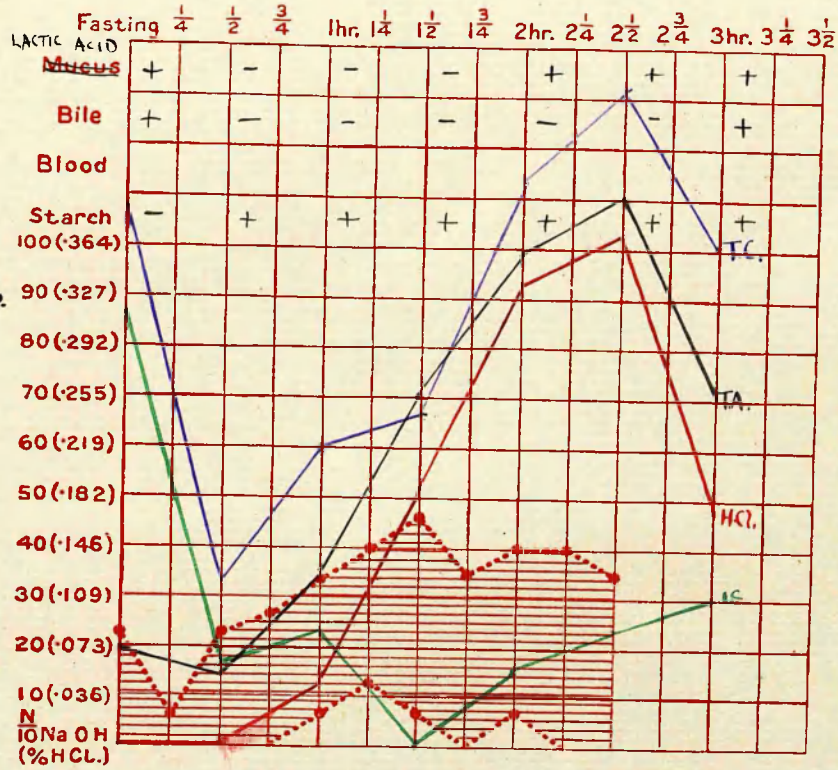
Name of Patient CASE GU.19. GRAPH 5.

I. FRACTIONAL TEST-MEAL. Date.

Fasting Juice.

Volume.
15 ccms.

Cells.
Epithelial cells.



One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

——— represents total chlorides.

——— represents inorganic chlorides.

Summary.

SECRETION HYPERACTIVE. NEUTRALISATION DELAYED.
HYPERACIDITY. EVIDENCE OF PYLORIC DELAY

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Case No. 1.	Character of resting juice 2.	Emptying rates in hours and minutes. 3	Tubes containing. Blood 4a.	Tubes containing. Bile 4b.	Relation of inorganic Chloride to Hydrochloric Acid Curve 5.	REMARKS. 6.
1	20 c.cms No blood Leucocytes Streptococci	2:45	0	4	Crosses at 3-45. Then rises	Marked hyperacidity until 2-45. At 2.A.H. reaches 100. I.C.Nil.Resting juice suggestive
2	10 c.cms Clear	2:15	0	1	Crosses at 1-15.then rises	Neutralisation effective
3	15 c.cms Few pus cells and Streptococci		0	5	Crosses at 3-15.then rises	Neutralisation delayed until 2-45.Emptying markedly delayed Climbing curve.
4	7 c.cms. Bacilli No.pus.	2:45	0	0	Crosses 1-30	Secretion subnormal. Neutralisation effective
5	15 c.cms Pus and Blood cells		1	1	Crosses 2-45	Delayed Neutralisation.Blood cells.Hypersecretion.Delayed emptying.
6	20 c.cms Bile Stained Debris	2:15	0	7	Crosses 1-30	Debris in resting secretion. Neutralisation Incomplete.
7	15 c.cms Nil important	2:15	8	1	Crosses 1.	Rapid neutralisation.Blood in every specimen
8	10 c.cms Pus and Streptococci	3+30	0	1	Crosses 2	Neutralisation somewhat delayed no hyperacidity.

(1)	(2)	(3)	(4a)	(4b)	(5)	(6)
9.	10.c.cms. Food debris.	3:15	0	0	Does not cross	Hypersecretion prolonged into third hour Neutralisation delayed.
10.	10.c cms. pus.Strep-tococci	1:45	6	0	Always above	Very active neutralisation Pus and blood in samples.
11.	15 c.cms Few pus cells	3:15	0	7	Crosses at 3.	Secretion pro-longed. Neutral-isation delayed.
12.	20.c.cms Clear	2:15	0	3	Crosses 1-15	Neutralisation rap-id and effective Normal curves.
13.	20 c.cms Clear	3:15	0	0	Crosses 1-45	Resting juice A.H.30.
14.	20 c.cms Clear	2:15	0	0	Crosses 1-30	Normal curves
15.	7. c.cms Pus	3:	0	2	Crosses 2-15.	Prolonged hyper-secretion (3-30) Hyperacidity (70 at 1-30).
16.	25 c.cms Clear	2:45	0	2	Crosses 2.	Nprmal curves
17.	20.c.cms Clear	2:15	0	6	Always above	Hypersecretion Neutralisation checked at 3 hours.
18.	10 c.cms Pus.Epith-elium.	3:15	0	8	Always above	Neutralisation not complete until after three hours.
19.	15 c.cms Epithe-lium.	3:15	0	2	Does not cross	Hyperactive secretion.Delayed neutralisation. Hyperacidity. (100 at 2-30).Duodenal type.

(1)	(2)	(3)	(4a)	(4b)	(5)	(6)
20	10 c.cms. Clear	1:15	0	7		Achlorhydria
21	15 c.cms. Clear	2:15	0	4	Crosses at 2:15	Normal curves
22	15 c.cms. Clear	2:30	0	0	Does not cross	Hyperacidity.No neutralisation.
23.	20 c.cms. Clear	2:15	0	1	Crosses 1-45.	Hypersecretion Rapid neutralisation until 2 hours. Hyperacidity.
24.	10.c.cms. Pus. Mucus.	3:15	0	2	Always above	Normal curves Pus and Mucus in resting juice
25.	15.c.cms. Pus.Red Blood cells.	3:15	0	2	Crosses at 1-45.	Normal curves Pus and blood cells.

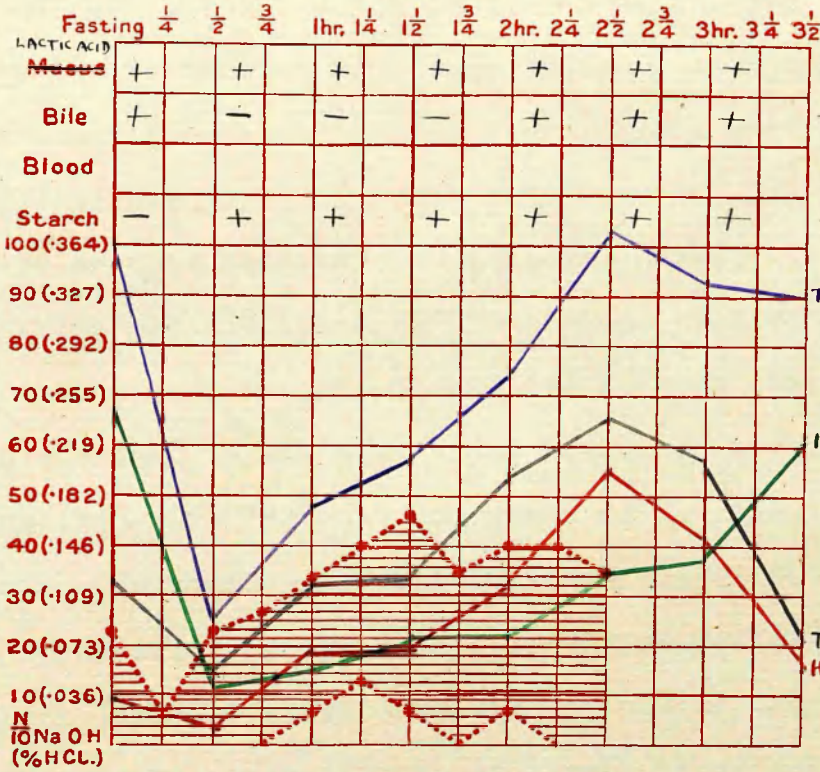
TABLE IX.

SUMMARY OF FINDINGS FROM ANALYSIS OF GASTRIC CONTENTS IN GASTRIC ULCER SERIES.

(A. H. - Hydrochloric Acid).

Name of Patient CASE G.U.3. GRAPH 7.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 15 cems.

Cells. Pus cells and Streptococci.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

——— represents total chlorides

——— represents inorganic chlorides.

Summary.

ACTIVE SECRETION. NEUTRALISATION DELAYED.

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Table IX is a summary of findings from test meals given to the twentyfive cases with gastric ulceration. The findings are not at all constant and the type of curve varies greatly.

Eleven cases (44 per cent) showed delayed and ineffective neutralisation with some evidence of pylorospasm. In these graphs the curves conform to a more definite type as exemplified by Graph 7.(Case G.U.3). (The particulars of this case were as follows:- Male, aged 37. Two sisters had "indigestion". Two years history of severe shooting pain behind sternum and between scapulae coming on one half to one hour after meals. No nocturnal pain. Vomiting very frequent and eased pain. Alkalies eased pain. No haematemesis. No melaena, Hyperaesthesia in epigastrium. No periodicity. Barium meal - penetrating ulcer lesser curvature (plate 1). Laparotomy -stomach adherent to under surface of liver, along lesser curvature. Much thickening of stomach wall high up on lesser curvature. Ulcer found).

In these eleven cases the curves were above the limits of normal.

The greatest quantity of resting juice obtained was 25 c.cms; and food debris was present in two specimens.

In eleven cases, pus cells and streptococci were found

and blood also in two of these. In only one case was the value of hydrochloric acid high, viz, 30.

Along with the digesting meal, blood was present in three cases, in one, six, and eight tubes respectively.

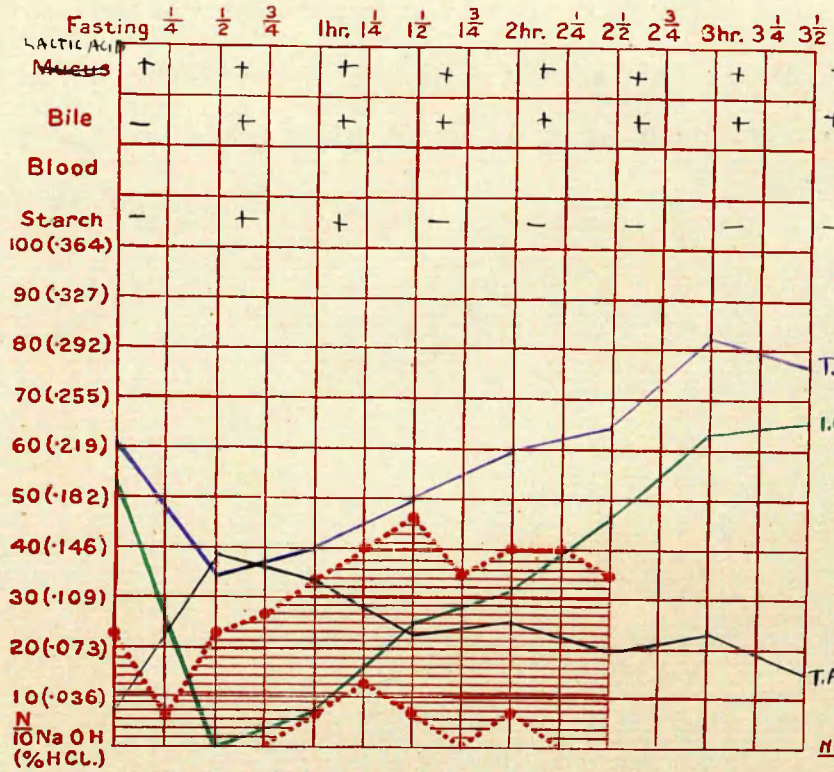
Analyses of eight meals provided curves essentially within normal limits.

One case gave a curve typical of that found in duodenal ulcer. It is worthy of note that this patient had a well-marked hour-glass stomach.At operation the lumen was found to be so small that only with difficulty could a tube be passed through it. The surmise is that the contracture acted in like manner as spasm of the pyloric sphincter and that the tube entered only the proximal sac, from which the contents for analysis were therefore drawn. The history of this particular case is as follows (Case G.U.19). WOMAN. Age 47. For four years had burning pain in epigastrium, occurring one hour after meals. Vomiting frequent and profuse. Haematemesis on three occasions. No Melaena. No loss in weight. Appetite normal.

Barium Meal. Hour glass stomach with penetrating ulcer at lesser curvature, in cardiac portion. At operation hour glass stomach with penetrating ulcer on lesser curvature. Lumen very small. Partial gastrectomy performed. Ulcer benign. Plates 3 and 4 and Graph 5 refer to this case.

Name of Patient CASE G.U. 20. GRAPH 8.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 10 cems

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

——— represents total chlorides.

——— represents inorganic chlorides.

Summary.

NEUTRALISATION EFFECTIVE. ACHLORHYDRIA.

DOWN BROS., LTD., LONDON.

Achlorhydria was found in the analysis of one case. It is to be noted that this was a case with a rapid emptying rate (one and a half hours) and with bile present in every specimen. In only one other case was secretion subnormal. Concerning the rate of emptying, starch was present on completion of the meal in two cases, the average rate being two and a quarter hours.

Case No.	Character of resting juice.	Emptying rate.	Tubes containing		Relation of Inorganic Chloride to Hydrochloric Acid Curve	REMARKS
			Blood	Bile		
1.	2.	3.	4a.	4b.	5.	6.
1	15 c.cms Pus		0	2	Does not Cross.A.H. Climbing.	Active secretion and prolonged.Neutralisation very imperfect
2.	10 c.cms Epithelium		0	4	Crosses AH Climbing	Active secretion. Neutralisation delayed
3	15 c.cms Clear	2:15	0	4	Crosses and recrosses AH Climbing	Neutralisation spasmodic.Hyperacidity Intermittent pylorospasm
4	25 c.cms Pus	2:15	0	1	Crosses and recrosses	Active secretion Delayed and spasmodic neutralisation Intermittent pylorospasm
5	20 c.cms. Clear	1:15	0	5	Achlorhydria	Secretion active but delayed.Neutralisation immediate.Rapid emptying.
6.	16 c.cms Clear	2:	0	5	Hypochlorhydria	Neutralisation early and complete
7	20 c.cms Clear		8	0	Crosses and recrosses Climbing AH	Hyperacidity. sustained pylorospasm.Blood present.
8	20 c.cms Clear	2:	0	0	Crosses above at 1-15	Normal
9	20 c.cms Clear	3:15	0	4	Crosses and recrosses Climbing AH	Hypersecretion. Imperfect and spasmodic neutralisation.Resting AH 50
10	4.c.cms Clear	2:45	0	2	Crosses at 1:30	Normal
11	15 c.cms Clear	2:15	0	8	Crosses at 1-45	Hypersecretion Excessive Neutralisation.

(1)	(2)	(3)	(4a)	(4b)	(5)	(6)
12.	10 c.cms Pus	2:15	0	1	Crosses and recrosses Climbing AH	Hypersecretion Intermittent spasm Hyperacidity.
13.	10.c.cms Clear	1:15	0	8	Crosses and recrosses Climbing AH	Normal course for 2½ hours then pylorospasm.
14.	10 c,cms clear	2:45	0	8	Always above	Hyperactive secretion.Some hyperacidity.
15.	8 c.cms Clear		0	4	Crosses and recrosses Climbing AH	High resting A.H.(50) Neutralisation irregular. Intermittent spasm. Hyperacidity,
16	20 c.cms Blood		0	0	Always below	No neutralisation Resting A.H.80 Persistent pylorospasm.
17.	26 c.cms Leucocytes		0	3	Always below	Hyperacidity Deficient and delayed neutralisation.Climbing curves
18.	4 c.cms Clear		0	0	Crosses and recrosses	Hyperacidity. Deficient neutralisation.Pylorospasm.
19.	10 c.cms Clear		0	8	Always below. Climbing AH	Resting A.H.65 Hyperacidity. Neutralisation imperfect.Persistent spasm.
20.	20.c.cms Clear	3:15	0	5	Always below Climbing AH	Hypersecretion Hyperacidity. Delayed and imperfect neutralisation. Persistent spasm.
21.	25 c.cms Pus		0	5	Crosses and recrosses Climbing AH	Hyperacidity.Delayed and imperfect neutralisation. Pylorospasm.

(1)	(2)	(3)	(4a)	(4b)	(5)	(6)
22	15 c.cms Clear		0	0	Always below Climbing AH	Delayed and imperfect neutralisation.Hyper-acidity.Resting AH 60 Persistent spasm
23	15 c.cms Clear		0	8	Always below Climbing AH	Hypersecretion.Hyper-acidity.Imperfect and delayed neutralisation Resting AH 35. Persistent spasm.
24.	10 c.cms Clear		0	2	Crosses and recrosses	Hyposecretion Intermittent spasm
25	20 c.cms Clear	3:45	0	7	Crosses and recrosses	Late hyperacidity Late spasm
26	10 c.cms Clear	2:45	0	8	Crosses at 1:15	Secretion delayed Normal curves
27	5.c.cms Epithe-lium	3:15	0	7	Below until 3-15	Hyperacidity Prolonged spasm
28	20 c.cms Clear	3:15	0	1	Always below Climbing AH	Prolonged hyperacidity Neutralisation much delayed.Persistent spasm.
29.	20 c.cms Pus.Strep -tococci		0	0	Always below	Excessive secretion Hyperacidity.Deficient neutralisation. Persistent spasm.
30.	20 c.cms Clear	3:30	0	2	Crosses 3-30	Hyperacidity.Marked delay in neutralisa-tion.Resting Juice A.H.70.

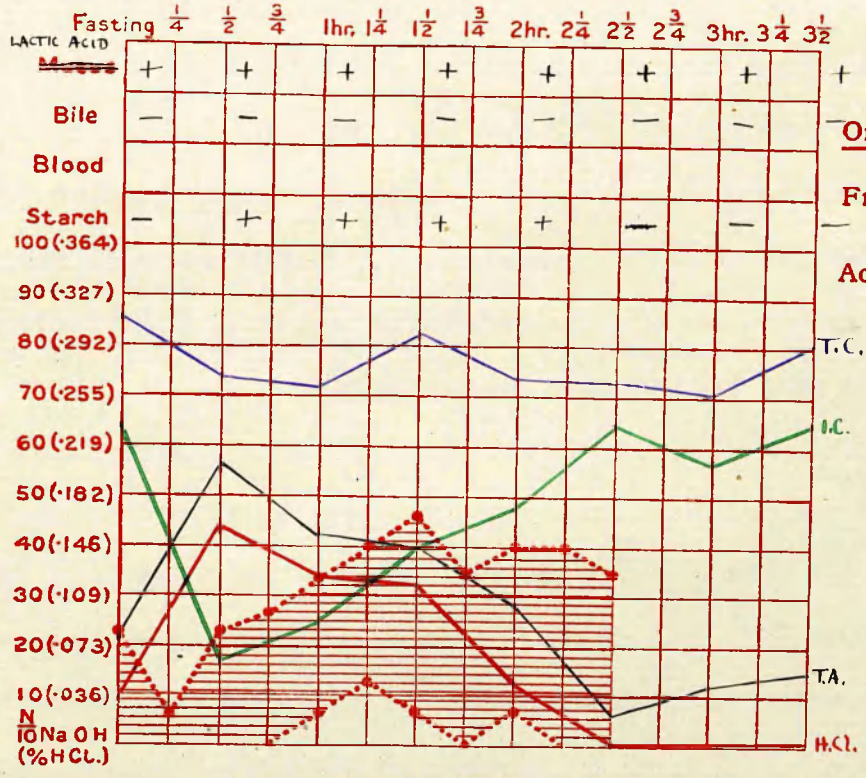
TABLE X.

SUMMARY OF FINDINGS FROM ANALYSIS OF GASTRIC CONTENTS IN DUODENAL ULCER SERIES.

(A.H. -Hydrochloric Acid. Emptying rate in hours and minutes. In cases where there is no entry under (3) starch was still present on completion of test).

Name of Patient CASE D.U.8 GRAPH 9

I. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 20 cms

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides.

represents inorganic chlorides.

Summary.

ESSENTIALLY NORMAL FINDINGS.

DOWN BROS., LTD., LONDON.

In Table X we have a summary of test meal results in the thirty cases of duodenal ulceration. In this series the findings are much more consistent than in the gastric ulcer group, and can be divided into four distinct types.

TYPE 1. Four cases, viz, Numbers 8,10,14, and 26, fall into this type, in which the curves show no deviation from normal. The emptying rate is within average limits; the resting juice is clear; and the inorganic chloride curve crosses the A.H.curve early and continues to climb, neutralisation being effective (Graph 9).

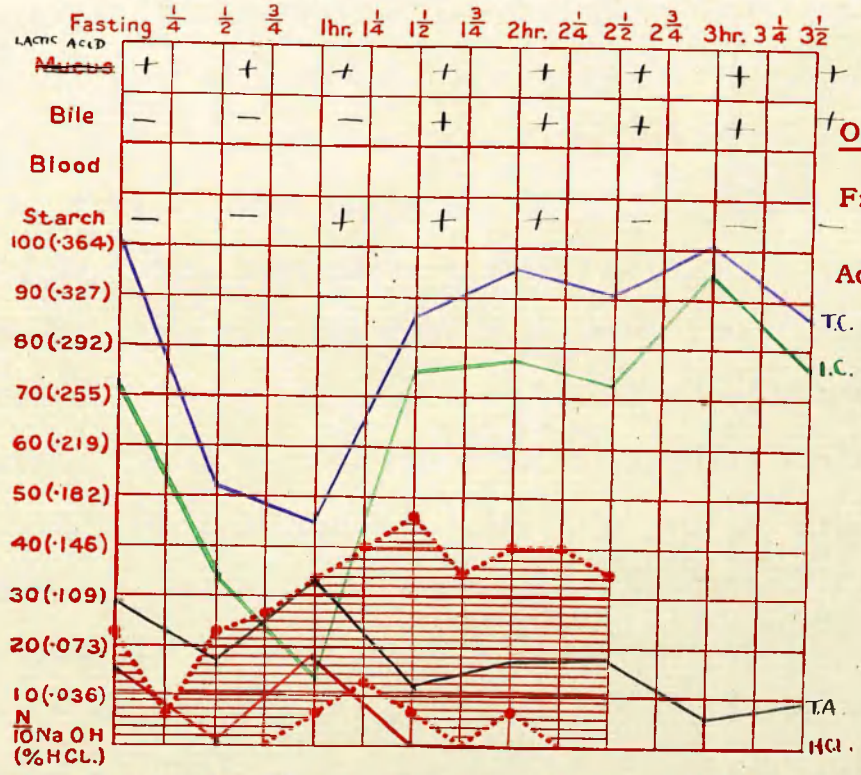
TYPE 2. embraces two cases, numbers 5 and 6, where hypochlorhydria is present. It will be noted that in these cases the rate of emptying is fairly rapid, exemplifying the "hurry" type already spoken of. The rate of secretion is active but neutralisation takes place immediately, and is complete. ~~Plate 4 shows the radiological findings in the same patient as represented in~~ (Graph 10.)

The remaining two types, comprising 80 per cent, are those usually associated with duodenal ulcer.

TYPE 3. Cases numbers 1,16,17,19,20,22,23,27,28,and 29. Here we have a graph in which at no time does the curve of inorganic chlorides rise above the curve of hydrochloric acid, neutralisation being very defective.

Name of Patient CASE D.U.6 GRAPH 10.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 10ccms.

Cells.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides.

represents inorganic chlorides.

Summary. NEUTRALISATION COMPLETE. HYPOCHLORHYDRIA.

DOWN BROS., LTD., LONDON.

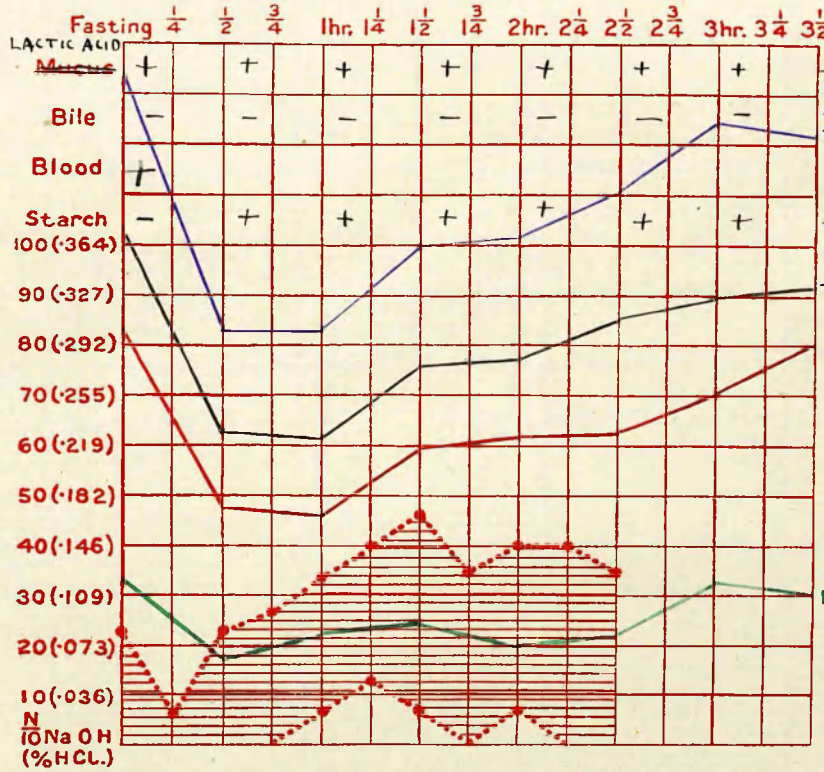
The A.H.curve is of the climbing type. In this type the shortest time of emptying is three hours,forty five minutes.(in three cases only; the remainder were not emptied at the completion of test. Both the delayed emptying and defective neutralisation give practically conclusive evidence of pyloric spasm. The resting juice in only one case is helpful,blood being present.(Graph 11).

TYPE 4. Cases numbers 2,3,4,7,9,11,12,13,15,18,21,24, 25,30. This type shows evidence of intermittent pylorospasm. The inorganic chloride curve rises above the A.H. curve, only to fall again at one or more points in the graph. Here the one curve is the inverse of the other. Neutralisation proceeds,therefore, but is checked at various points, and, consequently, delayed. Seven cases in this type showed considerable delay in the emptying rate of the gastric contents.(Graph 12). 25 c.cms was the maximum amount of resting secretion from any of the thirty cases, and in only seven was the free hydrochloric acid value higher than normal. In six tubes of resting juice, pus was found. The presence of blood was demonstrated in only two cases.

It will be observed that the rate of emptying varies greatly, ranging from the cases with "hurry" to those in which there is prolonged and sustained pylorospasm, with starch still present on completion of the test.

Name of Patient CASE D.U. 29. GRAPH II.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 20 cems.

Cells. Altered Blood.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides.

represents inorganic chlorides.

Summary.

EXCESSIVE SECRETION. NO SIGNS OF NEUTRALISATION. HYPERACIDITY. SUSTAINED PYLOROSPASM.

DOWN BROS., LTD., LONDON.

Case No.	Character of resting juice	Emptying rate	Tubes containing		Relation of inorganic Chloride and Hydrochloric Acid curves	REMARKS
			BLOOD	BILE		
1	10 c.cms Pus		0	7	Achlorhydria	No indication of obstruction
2.	Pus.Starch. Boas-Oppler Bacilli. Muscle-fibres		6	0	Achlorhydria	High total acidity due to organic acids
3	Pus.Streptococci	3:30	0	0	Achlorhydria	Rapid Neutralisation
4.	Pus.Blood Bacilli Debris	2:	0	8	Achlorhydria	Neutralisation Rapid
5.	Pus.Blood. Bacilli Debris		8	0	Achlorhydria	Acidity due to organic acids
6.	Pus.Boas-Oppler. Bacilli. Debris		7	0	Achlorhydria	Practically no secretion
7.	Blood.Boas-Oppler Bacilli Debris		8	0	Achlorhydria	Secretion Active

TABLE XI.

SUMMARY OF FINDINGS FROM ANALYSIS OF GASTRIC CONTENTS

IN CARCINOMA VENTRICULI SERIES.

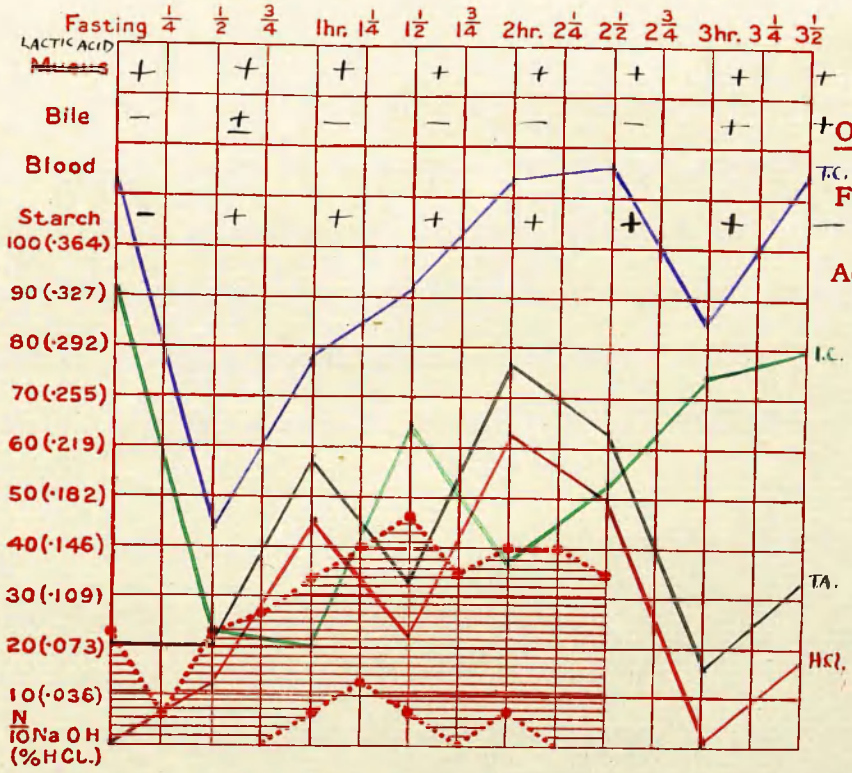
Name of Patient CASE D.U.3. GRAPH 12.

1. FRACTIONAL TEST-MEAL. Date.

Fasting Juice.

Volume.
15 ccms.

Cells.



One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides

represents inorganic chlorides

Summary.

ACTIVE SECRETION. NEUTRALISATION SPASMODIC HYPERCHLORHYDRIA. INTERMITTENT PYLOROSPASM.

DOWN BROS., LTD., LONDON.

A summary of the findings in the analysis of test meals from the seven cases of carcinoma ventriculi appears in Table XI. A mere glance at this table is sufficient to show the value of the fractional test meal in the diagnosis of this disease.

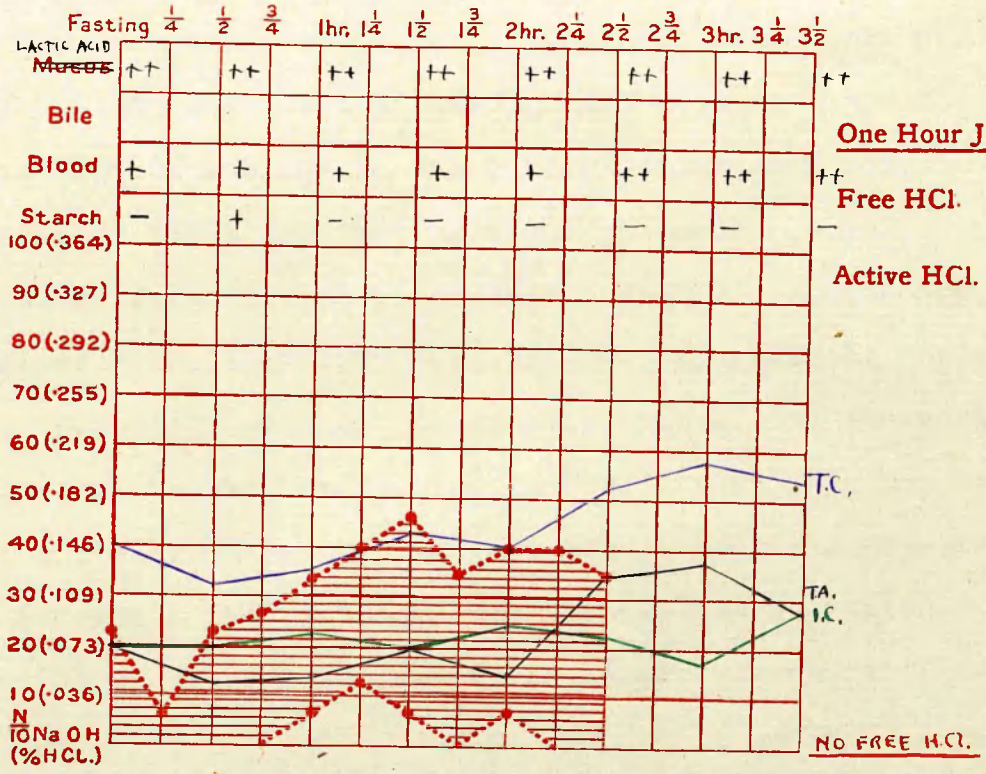
Achlorhydria occurs in every case and in no other condition is it so constant, with the exception of Addisonian Anaemia. It will be seen that food debris, blood, bacteria and pus are found in each test, Boas-Oppler Bacilli being present in three cases. In four cases, the presence of blood was demonstrated in every test tube.

The total acidity in six cases was within normal limits, but this was due, not to free hydrochloric acid, but to the presence of organic acids.

In only one case was the emptying rate within two hours, the remainder being over three and a half hours. (Graph 13).

Name of Patient CASE G.C. 5. GRAPH 13.

I. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume. 2 ccms.

Cells. Epithelium Pus. Debris. many bacteria, including Oppler Boas Bacilli

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides.

represents inorganic chlorides.

Summary.

LESSENED SECRETION. ACID LEVEL LOW AND DUE TO ORGANIC ACIDS. NEUTRALISATION IRREGULAR. ACHLORHYDRIA.

DOWN BROS., LTD., LONDON.

SPECIMEN CASES.

CASE G.U.3. Male, age 37. Had suffered from abdominal pain for two years. Jaundice two years previously. Two sisters had "indigestion". Heavy smoker.

Pain commenced two years previous to admission. Was felt behind lower part of sternum and between scapulae. Severe and "stabbing" in character, coming on a half to one hour after meals and lasting about one hour. Periodicity present. No nocturnal pain. Pain eased by vomiting and by alkalies. Vomiting very frequent. No haematemesis. Appetite good. Heartburn marked. Bowels constipated. No melaena. No loss in weight. Tenderness in epigastrium. Van den Bergh test showed nothing abnormal. Wasserman test was negative.

Radiogram showed "Stomach of hour-glass type with penetrating ulcer about midway on lesser curvature" (Plate V and 6).

Fractional test meal. Active secretion. Neutralisation delayed with consequent rise in acid curve. Probably pylorospasm. Analysis suggestive of ulcer in pylorus. (Graph 7).

Laparotomy. Stomach adherent to under surface of liver along lesser curvature. Large indurated ulcer high up on lesser curvature.

CASE G.U.16. Male, age 45. Complained of pain in epigastrium of fourteen month's duration. Previous history -nil pertinent. Family history - nil pertinent.

Pain came on fourteen months previous to admission. Was felt in epigastrium only and was of acute and "stabbing" character. Definitely no food relationship. Came on gradually and disappeared suddenly. No periodicity.

Nocturnal pain present. Pain was eased by alkalies and vomiting. Vomiting frequent. Haematemesis on several occasions. Appetite good. Heartburn troublesome. Bowels constipated. No melaena. No loss in weight. Slight tenderness localised midway between ensiform cartilage and umbilicus.

Van Den Bergh test - nil abnormal.

Radiogram- Penetrating ulcer on lesser curvature. No delay in emptying time.

Fractional test meal. Secretion active and prompt. Neutralisation efficient. The analysis shows normal gastric function.

Laparotomy. Penetrating ulcer on lesser curvature. Partial gastrectomy performed.

CASE G.U.17. Male, age 36. Complained of abdominal pain of two years duration.

Previous history- enteric fever in 1902. Family history- nil pertinent.Was heavy drinker of spirits.Pain started two years previous to admission. Was sharp in character. Felt in epigastrium and between scapulae. Came on one hour before meals. Periodicity present. Nocturnal pain absent. Eased by food but not by vomiting. Vomiting frequent. No haematemesis. Bowels constipated. No melaena.

Radiogram. Nothing abnormal noted.

Fractional test meal. Hypersecretion,prolonged for three hours. Neutralisation rapid and effective but possibly some pyloric spasm after three hours.

Course. Had three weeks on Hurst's Diet and was discharged free from pain. Was re-admitted two months later with profuse haematemesis. After course of appropriate medical treatment, laparotomy was performed and an indurated shallow ulcer found low down on lesser curvature.

CASE D.U.4. Male,age 28. Complained of five year's pain in abdomen.

Previous history. Gas poisoning in 1917 and 1918. Pneumonia three years before admission. Family history- Mother and brother had Phthisis Pulmonalis.

Pain commenced five years previous to admission. Was localised to epigastrium and was dull and heavy in character. Came on always from one and a half to two hours after meals and was relieved by vomiting or taking of food. Periodicity present. Nocturnal hunger pain present. Vomiting occasional. No haematemesis. Appetite good. Bowels constipated, Melaena present.

Tenderness and some rigidity present over right rectus. No abnormal physical signs detected in chest.

Radiogram. Stomach dilated and ptosis present. Some deformity of duodenal cap. Peristalsis brisk; meal passed out slowly. At one and a half hours, greater portion of meal in stomach. Stomach empty in four hours and head of meal in first part of transverse colon.

Fractional test meal. Secretion active. Neutralisation delayed, resulting in some hyperacidity. Degree of intermittent pylorospasm.

Laparotomy. Ulcer found on first part of duodenum. Patient developed phthisis pulmonalis and died. At post-mortem examination small punched out ulcer, about size of sixpence, found in posterior wall of first part duodenum,

about half-inch from pylorus. Base formed by pancreas. Many adhesions.

CASE D.U.16. Male,age 54. Complained of pain in abdomen, of about seven year's duration. Previous and family histories - nil pertinent.

Pain commenced seven years previous to admission. Was "gnawing" in character. Came on regularly two hours after meals and lasted until next meal was taken. Periodicity marked.Nocturnal hunger pain present. Pain was eased by food or vomiting. Vomiting and haematemesis were frequent. Appetite good. Heartburn marked. Bowels constipated. Melaena present.

Tenderness over upper part of rectus.

Barium meal. Pyloric obstruction. Half of meal retained at six hours examination.

Fractional Test Meal. Excessive secretion, with no signs of neutralisation, and consequent hyperacidity. Probable pyloric spasm. Analysis is very suggestive of duodenal ulcer. (Graph14).

Course. Patient developed acute broncho-pneumonia while in hospital and died. At post-mortem examination, we found a perforating ulcer on first part of duodenum, near pylorus, surrounded by greatly thickened mucosa. Almost perforated. Duodenal diverticulum below the ulcer. Two healed ulcers on posterior wall of stomach. One acute ulcer, about half-inch in diameter, and showing haemorrhage, on greater curvature.

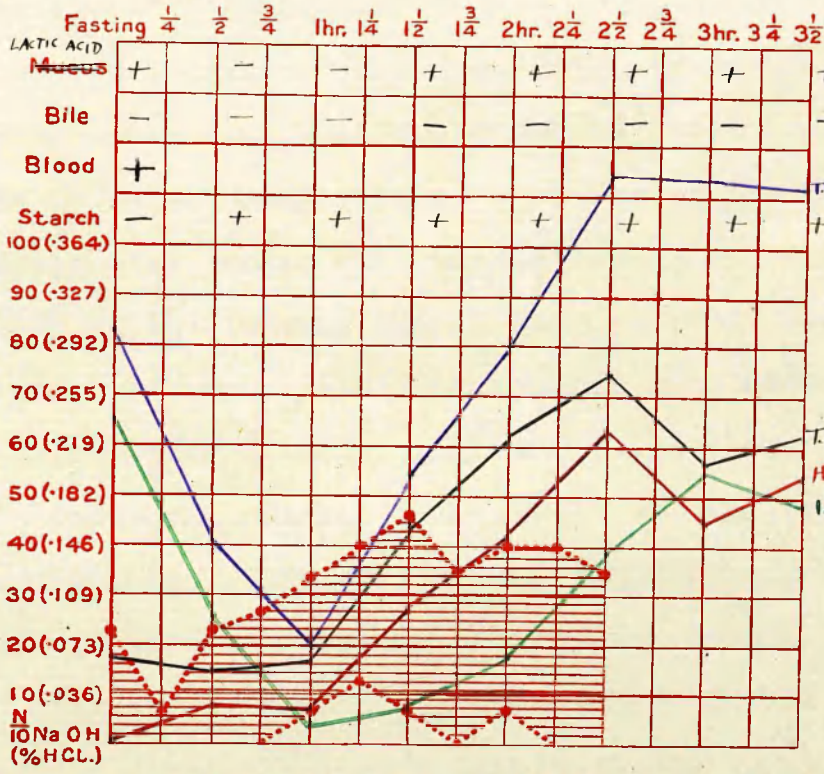
Name of Patient CASE D.U.16. GRAPH 14.

1. FRACTIONAL TEST-MEAL. Date.

Fasting Juice.

Volume.
20 ccms.

Cells.
Altered Blood Present.



One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

represents free HCl.

represents total acidity.

represents total chlorides.

represents inorganic chlorides

Summary.

EXCESSIVE SECRETION. HYPERACIDITY
DEFECTIVE NEUTRALISATION.

DOWN BROS., LTD., LONDON.

CASE D.U.18. Male,age 38. Complained of abdominal pain of about ten year's duration. Nil pertinent in past or family histories.

Pain commenced about ten years previous to admission. Was felt in epigastrium and was like"a sense of fulness". It came on regularly about two hours after meals and lasted until next meal was taken. Periodicity was present, also nocturnal hunger pain. Vomiting or taking of food relieved the pain. Vomiting occurred very occasionally and haematemesis only once. Appetite good. Heartburn marked. Bowels regular. Melaena present. Some tenderness on palpation over right upper rectus. No loss in weight.

Radiogram. Marked spasm of pylorus at first and second examinations. Unable to express any of the meal into first part of duodenum. Stomach dilated and atonic.

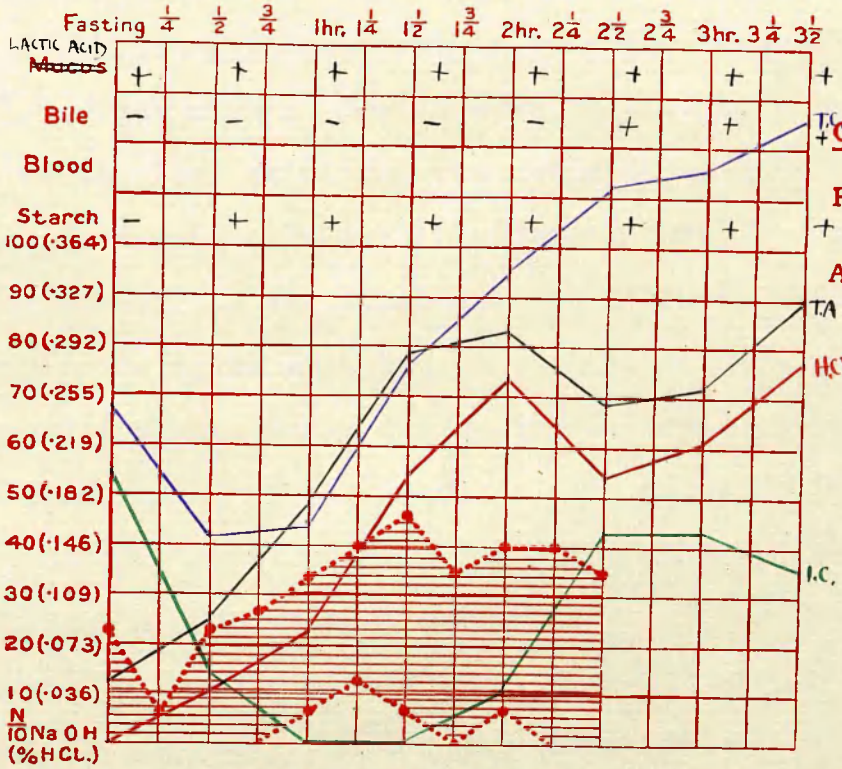
Fractional Test Meal. Hypersecretion and delay in neutralisation, leading to marked hyperacidity. Evidence of pyloric spasm. The analysis is characteristic of duodenal ulcer (Graph 15).

Course. Patient was transferred to a surgical ward, where perforation took place and emergency laparotomy was performed. A small leak was discovered in duodenum more than one inch from pylorus.

Name of Patient

CASE D.U.17. GRAPH 15.

1. FRACTIONAL TEST-MEAL. Date.



Fasting Juice.

Volume.
20 ccms.

Cells.
Leucocytes and Epithelium.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

——— represents total chlorides.

——— represents inorganic chlorides.

Summary.

HYPERSECRETION. DEFICIENT NEUTRALISATION. HYPERACIDITY.

DOWN BROS., LTD., LONDON.

CASE G.C.2. Female Age 53. Complained of pain in abdomen of about six month's duration. Pain was felt in epigastrium. Was constantly present but worse at night time and when food was taken.Pain was dull and "heavy" in character. Was eased somewhat by vomiting and belching. Vomiting was copious, foul, and frequent. Haematemesis occurred. Appetite was poor. Flatulence was marked. Bowels were very constipated. Melaena was present. Loss in weight was noticeable. On palpation, slight, diffuse tenderness in upper abdomen. No growth felt.

Barium meal. A very much dilated stomach, with ptosis and marked delay in emptying.

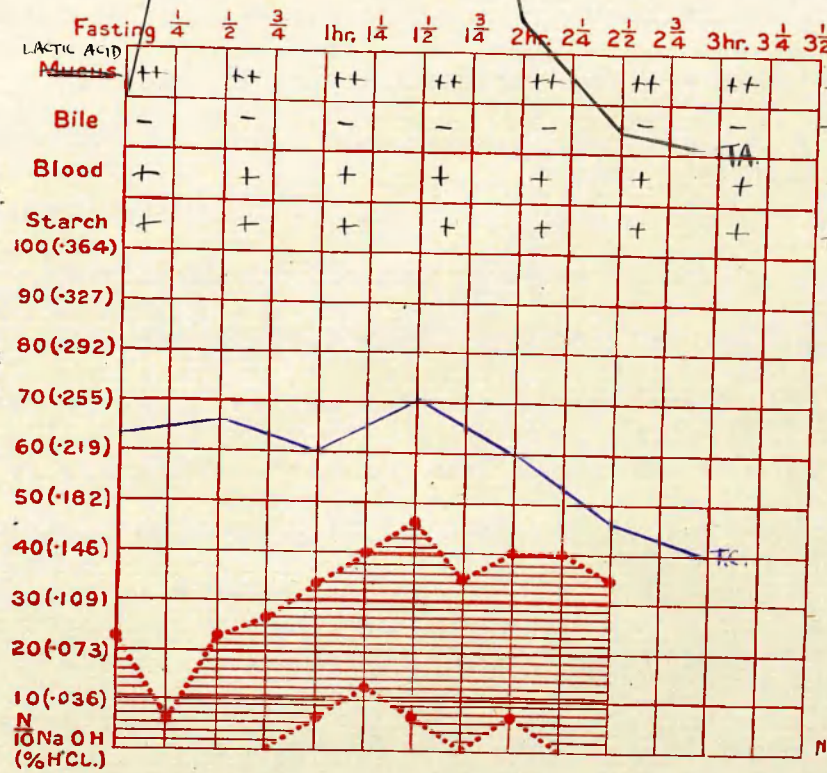
Fractional testmeal. "In spite of very high total acid, there is evidence of achlorhydria, the actual acidity being due to organic acids. Lactic acid present throughout and in large quantity. There is clear evidence of gastric stasis and probably pyloric obstruction. The analysis is strongly indicative of gastric carcinoma" (Graph 16).

Course. Laparotomy performed. Carcinoma of pyloric end of stomach (verified microscopically). Pyloric obstruction. Partial gastrectomy performed. Anastomosis of jejunum with upper half of stomach. Months later was doing well.

Name of Patient

CASE G.C.2. GRAPH 16.

1. **FRACTIONAL TEST-MEAL.** Date.



Fasting Juice.

Volume. 3ccms.

Cells.

Boas Oppler Bacilli +++
Starch grains.
Muscle fibres
Pus cells.
Blood.

One Hour Juice.

Free HCl.

Active HCl.

The shaded area represents the limits for free H.Cl. (dimethyl indicator), of 80% of normal people.

——— represents free HCl.

——— represents total acidity.

——— represents total chloride

Summary.

EVIDENCE OF ACHLORHYDRIA. VERY HIGH TOTAL ACIDITY DUE TO ORGANIC ACIDS. PYLORIC OBSTRUCTION. FINDINGS IN RESTING JUICE SUGGESTIVE.

DOWN BROS., LTD., LONDON.

CASE G.C.3. Male, Age 50. Complained of pain in abdomen of about nine month's duration. Pain commenced nine months previous to admission; was felt in epigastrium only and was constantly present, being worse after meals. Was "burning" in character. Nothing found to relieve pain. No vomiting . No haematemesis. Appetite very poor. Foul eructation. Bowels constipated, Melaena present. Loss in weight noticeable.

Barium Meal. Partial pyloric obstruction.

Fractional Test Meal. Analysis showed delay in secretion but ultimate secretion effective. Neutralisation provided immediately so that there was achlorhydria. This does not suggest pyloric obstruction but would be compatible with carcinoma.

Course. Laparotomy. Carcinoma of body commencing near pylorus.

CASE G.C.7. Male, age 49. Ten month's vomiting with very slight abdominal discomfort. Ten months previous to admission patient began to have frequent attacks of nausea and vomiting. Pain was very slight and felt only after meals. Vomiting was very frequent and haematemesis occurred. Appetite was poor. Foul eructations present. Bowels regular. No melaena. Loss in weight marked. Occult blood demonstrated in faeces. Patient thin. Small mass felt in left subcostal area, Nodular and hard. Moveable.

Barium Meal. Advanced growth masking most of stomach. (Plate 7).

Fractional Test Meal. Secretion about normal. Some excess of neutralisation, resulting in low acid values. The constant presence of blood shows there is ulceration and the analysis would not exclude benign nor malignant ulcer, though the latter more probable.

Course. Laparotomy. Patient desired laparotomy which was performed and an inoperable carcinoma was found in stomach wall.

SUMMARY

In all, sixty-two cases of organic gastric disease were investigated by:-

(a) Careful inquiry into clinical history.

(b) Radiological methods.

(c) Fractional test meal.

Of these sixty-two cases, twenty-five had gastric ulcer; thirty had duodenal ulcer; seven had carcinoma.

A. CLINICAL INVESTIGATION.

(1) In the presence of gastric ulceration, clinical investigation proved of little help. The clinical picture was not well defined. Even in the most favourable cases (20 per cent) one felt diffident about giving a definite diagnosis.

(2) When we take cases of duodenal ulceration, however, the clinical investigation assumes a much higher value. The histories given were remarkably constant, and, by avoidance of leading questions, were almost always spontaneously given. In only three cases (10 per cent) was any doubt entertained as to the diagnosis.

(3) With regard to the seven cases of gastric carcinoma, in only two would one have been justified in operating without further investigations being made, and with reasonable

certainty of finding a neoplasm. The old maxim,however, of regarding with suspicion any primary and incipient dyspeptic symptoms in a patient over forty years, still holds good. It is therefore highly culpable, given such a patient, if no further steps are taken to arrive at a definite diagnosis. It is only in the advanced and usually inoperable cases that a definite picture is provided by clinical investigation alone.

B. RADIOLOGY.

(1) Direct evidence of gastric ulceration was given by fourteen cases(56 per cent): indirect evidence by eight cases(32 per cent): in only three cases (12 per cent) was a normal passage of the meal noted.

(2) In duodenal ulceration, direct evidence was obtained in only five cases (18 per cent): indirect evidence, however,was given in thirteen cases (43 per cent) while in twelve cases (40 per cent) no evidence was found.

(3) In three cases of carcinoma the findings definitely suggested malignancy: in the remaining four there was direct evidence of abnormality, but no definite opinion could be expressed as to whether malignancy were present or not.

C. FRACTIONAL TEST MEAL

(1)Eleven cases (44 per cent) of gastric ulceration afforded graphs conforming to a more or less uniformly abnormal type, Curves essentially within normal limits were provided by eight cases (32 per cent).

The evidence obtained by this mode of investigation is not nearly so conclusive as that obtained in cases of duodenal ulceration.

(2) Taking the thirty cases of duodenal ulceration it was found that only four cases (13 per cent) had curves showing no deviation from normal: the remainder,(87 per cent) fell into three definite and uniform types.

Type 1. comprises two cases where there was evidence of excessively rapid emptying and excessive neutralisation.

Type 2. Ten cases in which very little neutralisation was effected and where persistent pylorospasm was present.

Type 3. Fourteen cases which showed proof of intermittent pylorospasm.

In 80 per cent therefore, it can be said that spasm of the pyloric sphincter, either persistent or intermittent, was present with consequent defective neutralisation,and this percentage represents the duodenal type of graph.

(3) In each of the seven cases of carcinoma, the findings of the fractional test meal afforded definite proof of the presence of that disease.

From the foregoing results I now assess the respective values of the three different methods of investigation.

In gastric ulceration I find that radiological methods afford the most conclusive evidence for diagnosis. Where indirect evidence is obtained by this method, further help may be obtained by correlating the findings with those obtained from the other two methods.

Pride of place in the diagnosis of duodenal ulcer must be given to clinical investigation, but very considerable help is obtained from fractional analysis, By comparing the findings from these two methods,one can reasonably hope for a definite diagnosis in the majority of cases.

With regard to the diagnosis of carcinoma ventriculi, in my opinion practically 100 per cent of cases are capable of being proven by fractional test meal alone.

Apart from the percentage number of cases proven by any of these methods of investigation,it must be borne in mind that positive radiological evidence is palpable, and, when present, outweighs all other findings.

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