BRITISH MEDICAL JOURNAL

LONDON SATURDAY SEPTEMBER 24 1938

LATE RESULTS OF PARTIAL GASTRECTOMY FOR PEPTIC ULCER

BY

JOHN MORLEY, Ch.M., F.R.C.S.

Professor of Surgery, Manchester University; Honorary Surgeon, Manchester Royal Infirmary

AND

F. H. BENTLEY, B.Sc., M.B., F.R.C.S.

Chief Assistant, Professorial Surgical Unit, Manchester Royal Infirmary

(From the Department of Surgery, University of Manchester, and the Manchester Royal Infirmary)

The operation of partial gastrectomy provides a unique opportunity for considering the relation between gastric function and the general health of the patient as a whole. It is generally recognized that disturbance of this relation after partial gastrectomy does sometimes lead to constitutional changes, although there is conflict between different authorities as to the incidence of such changes.

Ten years ago Morley reviewed the results of his experiences with the Polya and the Billroth I (Schoemaker) forms of gastrectomy, and came to the conclusion that whereas a Polya gastrectomy carried with it a serious liability to anaemia, the liability was diminished after a Schoemaker operation, which was less destructive of gastric activity. It was considered wise to review the results particularly of the Schoemaker operation after a further number of years, and the present investigation was undertaken to determine the health of a series of individuals more than four years after partial gastrectomy, having special regard to gastric activity and blood changes.

Material

Sixty-seven patients who had had partial gastrectomy performed by one of us (J. M.) were examined. The interval since operation was from four to sixteen years, with an average of eight and a half years. These sixty-seven patients were not a consecutive series, but were those who could be traced and who were willing to come for examination out of 130 cases. Fifty-eight of the sixty-seven patients had undergone Schoemaker gastrectomy and nine Polya gastrectomy for the following conditions (Table I):

TABLE I.—Operation Details

	Gastric Ulcer	Gastric Ulcer and Duodenal Ulcer	Gastric Ulcer and Healed Duodenal Ulcer	Duodenal Ulcer	Anastomotic Ulcer	Total
Schoemaker	44	6	4	3	1	58
Polya	8	—	—	1	—	9

Methods

Each patient was investigated by general examination, blood count, and fractional gastric analysis. Fractional gastric analysis was carried out as follows: the patient, fasting from the night before (about twelve hours), swallowed a Ryle's tube. Any resting gastric secretion was withdrawn and 10 oz. of oatmeal gruel given by mouth. At fifteen-minute intervals 10 c.cm. samples were withdrawn. At the end of an hour 0.25 mg. of histamine was injected subcutaneously, and four further samples of gastric contents were withdrawn at fifteen-minute intervals. The gruel test meal was used, because we were anxious to know the response of the stomach to food and to have an indication of the emptying time of the stomach and of regurgitation of intestinal fluids through the stoma. Histamine was later injected so that the stomach might have the maximal acid-secreting stimulus. In each sample the free and total acids were determined, using Töpfer's reagent and phenolphthalein as indicators, the presence of starch was tested for by iodine, and the presence or absence of bile judged by the colour of the specimen.

A blood count was performed by means of the Thoma-Zeiss haemocytometer, and haemoglobin determined colorimetrically after reduction of the blood with carbon monoxide.

Results

Gastric function has been assessed from the test-meal findings, and on this basis the cases can be divided into two broad groups: (1) those whose gastric function is depressed, and (2) those whose function is active. The criteria of the former group are: emptying time below one and a half hours (average one hour), free acid values below 20 c.cm. N/10 acid (the majority in this group have no free acid), bile regurgitation freely occurring. The criteria of the group with active gastric function will be readily inferred: emptying time above one and a half hours, free acid above 20 c.cm. N/10 acid, no bile regurgitation. It is significant, and will be referred to later, that where bile regurgitation was absent free acid values above 20 c.cm. N/10 acid were usual.

In considering the results of the blood counts we have accepted 85 per cent. haemoglobin as being the lowest limit of the normal (Janet Vaughan, 1936), so that we have regarded a haemoglobin percentage of 80 or below as constituting anaemia. In all our cases of anaemia the haemoglobin percentage will be found to be quoted.

POLYA GASTRECTOMY.—9 cases: 4 male, 5 female. Number of years since operation: maximum 16, minimum 6, average 12

Gastric Function:

Depressed in all cases. Free bile regurgitation occurred in all. No free acid detected in any case. Average emptying time, three-quarters of an hour.

Blood Picture:

Normal count: 3 cases—2 male, 1 female.
Microcytic anaemia: 5 cases—2 male, 3 female. Haemoglobin percentages, 82 (a treated anaemia, was previously 40), 80, 63, 54, 38.
Macrocytic anaemia: 1 case—a female. Operation, 1925, 1928, microcytic anaemia (Hb 48%; colour index 0.48). 1935, macrocytic anaemia (Hb 38%; colour index 1.32).

General Health:

Good: 6 cases (Criteria of "good health": no illnesses, no complaints, working).
Good until pernicious anaemia developed, now good again under treatment: 1 case.
Fair: 2 cases. Both have microcytic anaemia with complaints of the anaemia.

Ulcer Symptoms Since Operation.—No case.

SCHOEMAKER GASTRECTOMY.—58 cases: 43 male, 15 female. Number of years since operation: maximum 14, minimum 4, average 8. In 45 cases gastric function was depressed (Group 1). In 13 cases gastric function was active (Group 2)

GROUP 1 CASES: 45 cases—31 male, 14 female

Gastric Function:

Depressed in all cases. Bile regurgitation present. Free acid: in 34 cases no free acid detected; in 11 cases free acid was between 1 and 20 c.cm. N/10 acid. Average emptying time, 1 hour. In 27 of these cases gastric function was greatly depressed (comparable with the Polya cases).

Blood Picture:

Normal count: 33 cases—25 male, 8 female.
Microcytic anaemia: 12 cases—6 male, 6 female. Haemoglobin percentages, 80, 80, 80, 80, 80, 80, 80, 80, 78, 72, 70, 60, 55.

General Health:

Good: 38 cases.
Good for 6 years, then developed gastric carcinoma: 1 case.
Fair: 6 cases; 4 have microcytic anaemia with complaints of the anaemia.

Ulcer Symptoms Since Operation: 1 case.

GROUP 2 CASES: 13 cases—12 male, 1 female

Gastric Function:

Active. No bile regurgitation. Free acid, above 20 c.cm. N/10 acid; average, 52 c.cm. Stomach not empty in 1½ hours.

Blood Picture:

Normal count: 12 cases—11 male, 1 female.
Microcytic anaemia: 1 case—a male. Haemoglobin, 80%. Patient recently in sanatorium; ? phthisis.

General Health:

Good: 10 cases.
Good for 7 years, then developed gastric carcinoma: 1 case.
Fair: 2 cases (one has thyrotoxicosis).

Ulcer Symptoms Since Operation:

1 case has uneasy feeling in epigastrium unless eating often. Free acid, 80 c.cm. N/10 acid.
2 cases have pain after food. Free acid, 47 and 58 c.cm. N/10 acid respectively.

Gastric Activity after Partial Gastrectomy (Polya and Schoemaker)

The chief functions of the normal stomach appear to be the early breakdown of food constituents by ferments, the intimate mixing of the food and its slow rhythmic delivery in semi-fluid form to the duodenum, and the solution of mineral constituents of the food by hydrochloric acid; but in the present state of our knowledge there is no uniformly satisfactory test for these functions. We have therefore used the information of the gruel-histamine test meal to assess gastric activity in the present series. The information consists of emptying time, amount of free acid in the stomach contents, and an estimation of any regurgitation of intestinal fluids through

the stoma as judged by the presence of bile in the samples.

Using these criteria, it is seen that gastric activity was depressed in forty-five out of fifty-eight Schoemaker cases, and in all the nine Polya cases. There were differing degrees of depression. In the Polya cases gastric activity was abolished rather than depressed, for the stomach emptied very rapidly, no free acid was detectable, and bile regurgitation was so free that the samples resembled pure bile. A similar drastic reduction was found in twenty-seven of the forty-five Group 1 Schoemaker cases (depressed gastric activity). In the remaining eighteen Group 1 cases gastric activity was less completely abolished, and in thirteen (Group 2) cases gastric activity was normal. That is, in the Schoemaker cases gastric activity was greatly depressed (abolished) in nearly a half, depressed in almost one-third, and normal in about a quarter.

The three factors available from the gruel-histamine test meal are together of much more value in assessing gastric activity than a consideration of the level of acid secretion alone. There are, however, one or two points of interest as regards acid secretion in these cases, especially as various opinions are held concerning the capacity of the stomach to secrete free acid after partial gastrectomy. Originally it was considered by many that secretion of free acid was almost entirely abolished, but this is clearly not so, and series of cases have more recently been published (Klein *et al.*, 1933) showing that achlorhydria or relative achlorhydria is achieved only in about 50 per cent. of cases of partial gastrectomy. Snell (1937) points out the large number of variables which enter into the problem and which make a constant result unlikely.

In our series of nine Polya gastrectomies no free acid was demonstrated in any case, and in fifty-eight Schoemaker gastrectomies there was no free acid in thirty-four cases, relative achlorhydria in eleven, normal acid values in ten, and high values in three. That is, about 60 per cent. showed achlorhydria and 20 per cent. relative achlorhydria. The higher incidence of achlorhydria in our series may be accounted for by the large number of gastrectomies done for gastric rather than duodenal ulcers. It is recognized that reduction of free acid following gastrectomy for duodenal ulcer is less likely to occur than when gastrectomy is done for gastric ulcer, and in this connexion it is interesting to note that two of our three cases with high acid values were gastrectomies for duodenal ulcer.

The mechanism as well as the degree of reduction of free acid after partial gastrectomy is the subject of dispute. Certainly not enough of the fundic mucosa is removed to cut off the source of hydrochloric acid, unless it is believed that the capacity of this remaining portion of the stomach to secrete acid is diminished as a result of removal of the pyloric end of the stomach. A hormonal connexion between these two parts of the stomach has often been suggested but never conclusively demonstrated, and the experimental results of Priestley and Mann (1932) appear to rule out such connexion. Recently, however, Hill, O'Brien, and Wilhelmj (1937) have shown in dogs that the reduction in acidity following partial gastrectomy is greater than can be accounted for by dilution and neutralization alone, and, further, that when a pouch is made of the fundic part of the stomach and its secretion collected, much more acid secretion occurs where the pylorus is intact than where the pylorus has been removed. They conclude that there is a pathway between the pyloric and fundic parts of the stomach, possibly hormonal, possibly

nervous. The significance of this factor in man cannot yet be assessed, for it is to be noted that these results were obtained in short-term experiments in dogs, and, as Snell has observed, the human stomach has a strong tendency to return, so far as the surgical procedure allows, to its original state of both secretory and motor activity. The occurrence of acid values of 80 to 90 c.cm. N/10 acid (as occurred in three of our cases eight years after partial gastrectomy) does not suggest a lowering of acid secretion in those cases.

The factor of simple dilution and neutralization is stressed by Walters (1936) as the factor chiefly responsible for diminished acid values after partial gastrectomy, and the significance of this factor is further emphasized in our results. It was a notable feature of our case groups that achlorhydria was usually accompanied by free bile regurgitation, and that when free acid was demonstrable there was very little or no regurgitation of bile. This occurrence of free acid without bile and achlorhydria with bile was so marked that it is not reasonable to consider it to be a coincidence, but rather that the presence of bile indicates dilution and neutralization, and that free acid is probably secreted in many of the achlorhydric cases only to be rendered incapable of detection by free regurgitation of duodenal contents and by rapid emptying of the stomach. This observation is further supported by the nine Polya cases, in none of which was free acid detected and in all of which regurgitation of bile was a pronounced feature. It should be observed, however, that it is unlikely that free acid secretion is of significance in such cases because of its prompt dilution and neutralization.

Although the Polya series is a small one, it would appear that Polya gastrectomy leaves a very rapidly emptying stomach with free regurgitation of intestinal fluids and consequently no detectable free acid; and that Schoemaker gastrectomy gives a similar result in some cases, but that in many regurgitation is not so free, emptying of the stomach is not so rapid, and reduction of free acid not so great. It does not seem reasonable to conclude that there is much difference between the amount of acid secreted after the two operations, or that true achlorhydria is produced in more than a few cases. Whether the differences between the two types of gastrectomy are of significance either locally as regards further ulcer formation, or constitutionally, will be discussed below.

Blood Picture after Partial Gastrectomy

The occurrence of anaemia after partial gastrectomy has frequently been noted, and although expectations of a macrocytic anaemia have only occasionally been realized, microcytic anaemias of varying degrees of severity have often been observed. Now that it is understood that a macrocytic anaemia follows absence of intrinsic factor (haemopoietin) from the alimentary secretions, and that the first part of the duodenum probably shares with the pyloric part of the stomach in the secretion of intrinsic factor, development of a macrocytic anaemia after partial gastrectomy is not to be expected to occur frequently. Such expectations are borne out in our results. In sixty-seven patients there were nineteen with anaemia—eighteen of them microcytic in type and one who was originally microcytic and subsequently became macrocytic.

Of the nine patients with Polya gastrectomy six were anaemic, with haemoglobin ranging from 80 to 38 per cent.; all these cases were microcytic in type originally, but one subsequently developed true macrocytic (pernicious) anaemia. Of fifty-eight patients undergoing

Schoemaker gastrectomy thirteen were anaemic, all microcytic in character, with haemoglobin ranging from 80 to 55 per cent.

Investigation of the relation between gastric function and anaemia in the fifty-eight Schoemaker cases revealed a very interesting condition. Thirteen patients had anaemia, and twelve of them belonged to the group in which gastric function was depressed (forty-five cases). Only one occurred in the group in which gastric function was active (thirteen cases), and there was reason to doubt the gastric origin of this anaemia because of a history of sanatorium treatment for lung disease (? pulmonary tuberculosis). It was stated above that in the forty-five Group 1 cases (gastric function depressed) there were varying degrees of depression, and that gastric function was largely abolished in twenty-seven of the cases and was less severely depressed in eighteen. It is therefore interesting to note that ten of the patients with anaemia belonged to this subgroup of twenty-seven cases whose gastric function was largely abolished. That is:

Ten patients were anaemic out of twenty-seven whose gastric function was largely abolished.

Two patients were anaemic out of eighteen whose gastric function was depressed.

One patient was anaemic out of thirteen whose gastric function was active. (The anaemia was probably not gastric in origin.)

This suggests that the cause of the anaemia may be associated with the gastric conditions peculiar to the Group 1 cases. The question of the intrinsic factor does not, we consider, enter into the problem here, for none of the anaemias are macrocytic in type. The three significant features of gastric activity of Group 1 cases are rapid emptying, free regurgitation of intestinal fluids, and absence of free acid in the gastric contents. Free regurgitation of intestinal fluids dilutes and neutralizes any acid secreted by the stomach. Absence of free acid does not in itself lead to anaemia (Bloomfield and Pollard, 1933; Wilkinson, 1937), but it may predispose to anaemia by interfering with normal solution of iron in the stomach and possibly with its absorption in the upper jejunum (Witts, 1936). The role of hydrochloric acid in this connexion has, however, not been entirely proved, and the other factor, that of rapid emptying of the stomach, may be of greater significance by causing incompletely mixed under-digested food constituents to be hurried through the duodenum and upper part of the jejunum, and so interfering with iron absorption. The cause of these microcytic anaemias thus may be diminished iron absorption resulting from severe depression of gastric activity. It is well known that considerable improvement is obtained in such post-gastrectomy anaemias by the administration of massive doses of iron.

This conclusion, which emerges from a study of the Schoemaker gastrectomy results, is further supported by those of the Polya operations. Depression of gastric function was particularly severe in the nine patients with Polya gastrectomy, and among them there were six patients with microcytic anaemia (one subsequently becoming macrocytic). Table II contrasts the test-meal findings in the anaemic patients with those in patients showing a normal blood picture.

It will be noted that of the sixty-seven patients in this investigation forty-seven were males and twenty females. Of the nineteen cases of anaemia nine were males and ten females—that is, a greater tendency to anaemia is found in females than in males. This would be expected from the normal tendency for women to have a lower haemoglobin percentage than men, and from their peculiar

liability to achlorhydric anaemia. The gastric origin of anaemia in these cases is, however, stressed by the fact that a definite proportion of the cases of anaemia occurred in men. Idiopathic microcytic anaemia in men is described by Witts (1930) as a haematological curiosity.

TABLE II

	Microcytic Anaemia (19 cases ; Hb 80% or less)	With Normal Blood (48 cases ; Hb more than 80%)
Form of gastrectomy ..	Polya, 6 Schoemaker, 13	Polya, 3 Schoemaker, 45
Sex	Male, 9 Female, 10	Male, 38 Female, 10
Emptying time (average) ..	42 minutes	80 minutes
Bile :		
Present ++	18	20
" traces	1	16
None	0	12
Acidity :		
No free acid	17	27
Below 20 c.cm.	1	9
Above 20 c.cm.	1 (sanatorium case)	12

The case of microcytic anaemia subsequently becoming macrocytic is of interest. Wilkinson (1933), Janet Vaughan (1932), and Heck and Walters (1936) have described cases showing that an anaemia may change from typical microcytic to macrocytic type within a few weeks, particularly under the influence of iron therapy. In the present instance it is known that iron was given for some months before the patient was sent in 1935 for blood examination, and it may be that this is a comparable occurrence. We feel, however, that the problem may be a more complicated one and that there is not enough evidence to form a conclusion.

If depression of gastric function leads to anaemia it would be expected that the operation that produced more severe depression would have the higher incidence. The following figures are therefore of significance. The same standard of anaemia is adopted as in this paper.

Gordon-Taylor, 1929 :

Fifty-two Polya gastrectomies, two to seven years after operation.
Anaemia in twenty-eight cases.

Morley, 1928 :

Twenty Polya gastrectomies ; average period since operation, seven years. Anaemia in sixteen cases.

Total of Morley's figures (that is, 1928 and 1938) :

Twenty-five Polya gastrectomies ; average period since operation, nine years. Anaemia in nineteen cases.

It is thus clear that in the hands of one surgeon a gastrectomy that produces severe depression of gastric activity has a much higher incidence of post-operative anaemia (Polya, nineteen out of twenty-five) than a gastrectomy that is less destructive of gastric function (Schoemaker, thirteen out of fifty-eight). And it follows that where gastrectomy is performed for gastric ulcer one aim should be to construct the stoma so that the emptying time of the stomach is prolonged and regurgitation of intestinal fluids lessened, if the risk of post-operative anaemia is to be reduced as much as possible. It is our opinion that this is more readily to be obtained with the Schoemaker modification of the Billroth I operation than with the Polya gastrectomy. These remarks apply to the treatment of gastric ulcer. In duodenal ulcer, where the risk of recurrence is much greater, the more destructive Polya operation has definite advantages.

General Health after Partial Gastrectomy

In our sixty-seven cases the general health was good in fifty-five—that is to say, there had been no serious illness,

and the patients made no complaints and were able to do full work.

In two cases gastric carcinoma developed after six to seven years of perfectly good health following Schoemaker gastrectomy. It so happened that each patient was examined within a few weeks of the onset of symptoms of carcinoma. In one case gastric function was depressed and in the other it was active. The occurrence of carcinoma must have been unconnected with the original ulcers, for in neither case was there any digestive upset or premonitory symptom until a sudden onset of digestive trouble six to seven years after operation, while histological examination of the original ulcers proved their benign character.

In ten cases the general health was fair, and efficiency could be described as about 50 per cent. Six of these cases had microcytic anaemia and the complaints were those of the anaemia. As there were nineteen cases of anaemia in the whole series it is seen that in thirteen—that is, in about two-thirds of the anaemic cases—the anaemia was not producing any symptoms. Apart from the tendency to anaemia in the cases where gastric function was depressed, there was no appreciable difference between the general health of those cases and of those in which gastric function was active. It is of value to note that severe depression of gastric activity appears to affect adversely only the blood-forming mechanism and has no other ill effects on the general bodily processes.

Four patients complained of abdominal pain in relation to food—one whose gastric function was depressed and three whose function was active. Since there were fifty-four cases (Polya and Schoemaker) in the former group and only thirteen in the latter it is evident that, while depression of gastric activity carries with it a risk of anaemia, it carries a greater certainty of freedom from ulcer symptoms. It is generally considered that such freedom is associated with marked reduction or abolition of free acid, and this conclusion is in accord with our findings. It is a most interesting point ; for whereas acidity *per se* does not appear a sufficient explanation of the aetiology of peptic ulcer, yet marked reduction in free acid, and not merely removal of the ulcer-bearing area, is necessary if risk of further ulcer symptoms is to be avoided so far as possible.

Summary

1. Nine cases of Polya gastrectomy and fifty-eight cases of Schoemaker gastrectomy were investigated more than four years after operation.

2. Different degrees of depression of gastric activity were found, and the mechanism of this depression is discussed.

3. Where gastric activity was severely depressed there was a high incidence of microcytic anaemia. It is suggested that absence of free acid plus rapid emptying of the stomach may interfere with the absorption of iron and so cause anaemia.

4. Depression of gastric activity was less severe after Schoemaker gastrectomy than after the Polya operation, and the incidence of anaemia was therefore correspondingly less after the former operation.

5. Where gastric activity was not depressed there was a risk of further ulcer symptoms.

6. The bearing of these results on the technique of gastrectomy is discussed.

We wish to acknowledge our indebtedness to Dr. J. F. Wilkinson, director of the medical research laboratory at the

Manchester Royal Infirmary, for allowing us to utilize the resources of his laboratory for this investigation.

REFERENCES

- Bloomfield, A. L., and Polland, W. S. (1933). *Gastric Anacidity*, The Macmillan Company, New York.
 Gordon-Taylor, G. (1929). *Brit. J. Surg.*, **16**, 641.
 Heck, F. J., and Walters, W. (1936). *Proc. Mayo Clin.*, **11**, 118.
 Hill, F. C., O'Brien, F. T., and Wilhelmj, C. M. (1937). *Arch. Surg.*, **34**, 909.
 Klein, E., et al. (1933). *Trans. Amer. gastro-enterol. Ass.*, **36**, 197.
 Morley, J. (1928). *Brit. J. Surg.*, **16**, 239.
 Priestley, J. T., and Mann, F. C. (1932). *Arch. Surg.*, Chicago, **25**, 395.
 Snell, A. M. (1937). *Amer. J. Surg.*, **35**, 45.
 Vaughan, Janet M. (1932). *Lancet*, **2**, 1264.
 — (1936). *The Anaemias*, Oxford Medical Publications, London.
 Walters, Waltman (1936). *Ann. Surg.*, **104**, 585.
 Wilkinson, J. F. (1933). *Quart. J. Med.*, n.s., **2**, 300.
 — (1937). Personal communication.
 Witts, L. J. (1930). *Guy's Hosp. Rep.*, **80**, 417.
 — (1936). *St. Bart's Hosp. J.*, **43**, 167.

THE PROGNOSIS OF ANXIETY STATES

BY

ARTHUR HARRIS, B.A., M.D., D.P.M.

Assistant Medical Officer, St. Bernard's Hospital, Southall;
 Honorary Medical Psychologist, West End Hospital
 Child Guidance Clinic

Anxiety is regarded by McDougall (1936) as the emotion produced when, in the course of striving towards some goal, we doubt whether we shall achieve the desired end. It is a derived emotion, and sharply to be distinguished from fear, which is a primary emotion. Henderson and Gillespie (1936) define anxiety in the psychiatric sense as "a fear of danger usually from within—that is, impending physical illness." Fear and anxiety seem clinically to be different degrees of the same emotion, and may be regarded as pathological when they are aroused without reasonable cause.

Pathological anxiety is a common feature of every form of psychosis, and may be the most prominent one in the prodromal stages. When it occurs as the sole abnormality, apart from depression, the condition is known as anxiety neurosis or anxiety state. Lewis (1934) and Curran (1937b) have recently pointed out that anxiety is a common concomitant of depression and, conversely, that depression is a common concomitant of anxiety, so that it is impossible to draw a sharp dividing-line between depressive states on the one hand and anxiety states on the other. No frankly psychotic syndrome, however, will be diagnosed as an anxiety state.

Little has been written about the course of an anxiety state, but many observers have noticed a strong tendency for hypochondriasis to accompany anxiety and with the passage of time partly to replace it, one of the most comprehensive papers on the subject being by Brown (1936). Ross (1923) and Yaskin (1936), among many others, consider that the development of a psychosis is exceedingly rare.

Difficulty of Measuring Anxiety

In scientific work quantitative measurement is a necessity, and consequently many efforts have been made to devise a measure of anxiety, so far with little success. Since mental processes cannot be measured the problem is usually attacked through the autonomic nervous system, the close connexion between which and anxiety has been demonstrated by Cannon and his co-workers (1915). Jones (1936) finds that anxiety and sympathetic activity are apparently synonymous, both being evoked by adrenaline

and abolished by acetylcholine. One method which has been regarded as very promising is that of the psychogalvanic reflex, but Landis (1932) in a comprehensive summary of the literature states that quantitatively the method is useless, although it is produced by sympathetic action, and in a later paper (1933) he envisages the possibility of a satisfactory technique being worked out. Ødegaard (1932) believes that an index of the vegetative emotional reaction in general can be obtained from it. Solomon and Fentress (1936), however, in a careful investigation found no correlation between the galvanic skin reflex and autonomic activity, following on a previous paper (1934) in which they put forward the possibility of measuring "bound" and "unbound" energy. Psychological methods have also been tried, such as the measurement of the reaction time to word stimuli (Ebaugh, 1936), but quantitative exactitude has not been claimed for them. Culpin and Smith (1930) have found some correlation between a clinical estimate of anxiety and performance on the Schuster dotting machine.

The above-mentioned difficulty of measurement is most noticeable in the publication of results of the various modes of treatment, such as baths, massage, and other physiotherapeutic measures (Engelhorn, 1910), injection of polyglandular extracts (Léopold-Lévi, 1933), continuous narcosis (Ström-Olsen and McCowan, 1934), psychotherapy (Wenger, 1934; Luff and Garrod, 1935; Yaskin, 1936; Neustatter, 1935; Huddleson, 1927), and institutional treatment combined with psychotherapy (Ross, 1936). Such terms as "improved," "moderately improved," and "slightly improved" are in general use, although they are obviously unsatisfactory, elastic, and liable to variation according to the degree of optimism of the therapist concerned. Ross (1936), Luff and Garrod (1935), Curran (1937a), and Neustatter (1935) have given definitions of these terms, but none of them include details of the condition of the patients when first interviewed, and the degree of improvement is not measured by objective standards.

The prognostic studies of anxiety states published up to the present time fall into two groups, the first of which is the above-mentioned results of treatment. Systematic follow-ups were not always undertaken, but Luff and Garrod have traced their cases for three years and Ross some of his cases for five years and the rest for three years. Both have used the method of follow-up by letter. Luff and Garrod have 220 anxiety states in their series, and 30 per cent. of the cases treated were untraceable. Ross makes no distinction between hysteria and anxiety neurosis. Nearly 50 per cent. of his cases were untraceable.

It is extremely difficult to compare these results on account of the differences in diagnostic grouping of cases, criteria and classification of end-results, and methods, but the percentage of cases whose progress was satisfactory varied between 40 and 80 and that of cases developing psychoses and committing suicide was always very small.

The second group consists of clinical impressions, and gives no figures. For example, Wechsler (1929) stresses the skill of the psychotherapist, the age of the patient, and the degree of introversion, expressing the opinion that the illness in the case of female patients may stop at the menopause; Karpman (1931) holds the view that the provision of psychotherapy of an analytical type is all-important; and Ross emphasizes the purposive character of the illness, attaching considerable prognostic importance to the question of whether it is providing a satisfactory solution to the patient's difficulties or merely transferring