Treatment

Where vomiting occurs during the induction of anaesthesia, the anaesthetist, appreciating the danger of the situation, will encourage the patient, by tilting and suction, to get rid of all vomitus, and the decision to continue with the anaesthetic will be left to his judgment that no aspiration has occurred. If asphyxia develops, solid vomit may have been inhaled. Immediate endoscopy is then indicated for removal of the foreign material. Merrill and Hingson (1951) describe a case in which tracheotomy was required for the removal from the trachea of leaves of spinach, eaten 18 hours before.

When, despite precautions, respiratory spasm develops on recovery from the anaesthetic, treatment should be given along the following lines:

1. If not already performed, bronchoscopy should be undertaken, since the presence of solid debris in the air passages cannot otherwise be excluded. In order to do this it is suggested that the patient should be re-anaesthetized. If it be true that spasm is the main cause of the cyanosis, this measure alone should restore the patient to a satisfactory condition. Through the bronchoscope a suction tube should be passed well down the respiratory tree.

2. The use of oxygen is obviously essential, and it might be found advantageous to combine it with helium in a ratio of helium:oxygen, 70:30.

3. Antispasmodics should be given—intravenous aminophylline or adrenaline will be the first choice, but intravenous A.C.T.H. might be tried in the light of reported success in the treatment of status asthmaticus.

4. If the patient improves on being re-anaesthetized and deteriorates on regaining consciousness, the possibility of maintaining her under anaesthesia for a further period of time should be considered.

Summary

Six cases, four fatal, of the "acid aspiration syndrome" following inhalational anaesthesia in obstetrics are described, together with one case who died from inhalation of solid vomit.

The grave examples of the syndrome generally follow vomiting during the induction of anaesthesia, and a hypothesis is proposed to explain this.

No single method of anaesthesia is adequate for all obstetric cases, but a plea for the wider use of local analgesia is advanced.

In inhalational anaesthesia the importance of the stomach tube, a tilting table, and a mechanical sucker are emphasized in the prevention of disaster. The passage of a bronchoscope is regarded as a first essential in the treatment of the established condition. It is suggested that benefit may come from recommending the anaesthetic in order to do this.

I wish to thank the consultant staff of the Birmingham Maternity Hospital for permission to publish case records of patients in their care and for much helpful advice in the preparation of this report.

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BODY WEIGHT AFTER GASTRECTOMY

BY

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Patients who have undergone subtotal gastric resection often show subsequent loss of weight. Muir (1949) considered weight loss to be second to the "dumping syndrome" as a cause of dissatisfaction with the result of operation, and found that 40% of his patients had lost 7 lb. (3.2 kg.) in weight six months afterwards. Wells and Welbourn (1951) estimated that on the average their patients had lost 17 lb. (7.7 kg.) from their best or pre-illness weight before operation, and that they registered an average gain of 3 lb. (1.4 kg.) after it. Such loss of weight was mainly seen in patients who had previously maintained their weight fairly well: thus in those whose pre-operative weight was within 14 lb. (6.4 kg.) of their best weight there was an average loss after surgery of 7 lb., whilst in those who had lost more than 14 lb. before operation there was an average gain of 18 lb. (8.2 kg.) subsequently.

The use of the best or "pre-illness" weight as a yardstick is open to the objection that it is often wrongly estimated and that it is not possible to distinguish between those patients who were once considerably overweight and those who, while still in normal health, weighed relatively little considering their age and height. This difficulty can be overcome by relating the pre-operative and post-operative weights for each individual to the standard weight for the appropriate sex, height, and age. Though Wells and Welbourn state that the body weight is stabilized by one year after operation, there are no available data showing when loss of weight occurs, and whether it is a sudden or a gradual process.

Wollaeger *et al.* (1946) stated that impaired fat absorption is found in patients who have lost weight after gastrectomy, and Muir (1949) noted the presence of steatorrhoea in five out of seven underweight patients. Wells and Welbourn suggested that the steatorrhoea was due to small-intestinal "hurry," and Brain and Stammers (1951), reporting the condition after total gastrectomy, attributed it to a faulty admixture of food with bile as a result of "dumping" of food into the jejunum. These authors also found that fat absorption is better when the diet has a high fat content than when this is low. These studies have been made on small numbers of selected patients, and no control experiments are reported. Attempts to increase fat absorption by increasing the dietary fat (Brain and Stammers, 1951) and by the use of emulsifying agents (Badenoch *et al.*, 1951) have met with little success in producing a gain in weight.

Methods and Material

The observations reported here have been made upon 285 patients submitted to subtotal gastrectomy for peptic ulcer at St. George's Hospital, all of whom have been personally followed from the time of operation for at least one year. A gastro-jejunal anastomosis was carried out in 225 patients, and a Billroth I operation of comparable extent in 60. The problem of body weight after operation has been studied in the following way.

1. The weight of each patient has been related to the standard figure for sex, height, and age, and expressed as a percentage of this figure. Weight has been studied immediately before operation, on discharge from hospital, and at two, six, and twelve months after operation. The

standard weight is the mean weight of individuals of given sex, age, and height based on observations of 28,697 persons in the practice of seven British life assurance companies. The figures were obtained before the war, and it is appreciated that dietary and other changes since then may have affected their absolute accuracy. As a working standard of comparison their usefulness is unimpaired, and the only modern figures obtainable are all from American sources.

2. Five-day fat-balance studies have been carried out as follows: (a) upon nine patients immediately before the performance of gastrectomy, and again one month after operation; (b) upon five patients immediately before and one month after surgical operations other than gastrectomy (prostatectomy, hernioplasty, splenectomy, appendicectomy); and (c) upon 11 patients one year after gastrectomy, five of whom had lost 20% or more of standard weight while six had maintained or gained weight. The daily fat intake during the balance period was 50 g. The faecal fat was estimated after ether extraction of the dried stool by the Soxhlet method.

3. The gastric emptying rate and small-intestine transit time have been studied after administration of a barium meal in 128 patients who had undergone gastrectomy. Eighteen of these patients had lost 15% or more of standard weight following operation. The small-intestine transit time was judged by the position of the head of the meal two hours after ingestion.

4. Intensive early post-operative feeding has been employed in 12 patients weighing between 80 and 90% of standard before operation, and they have been followed for six months afterwards. The method used has been drip feeding by a tube placed in the jejunum at the time of operation (Stengel and Ravdin, 1939) or by gastric tube. Feeding was started on the third morning after operation, provided that good bowel sounds were present, and the following mixture was used: "casilan," 200 g.; sucrose, 200 g.; arachis oil, 100 ml.; whole milk, 1,500 ml.; sodium chloride, 5 g.; ascorbic acid, 1,500 mg.; water to 3,000 ml. This gives a daily intake of 36.7 g. of nitrogen and 3,420 calories. Further fluid up to 1,000 ml. daily was taken by mouth as desired. Mouth feeding began on the sixth day, and was supplemented by the drip to keep the daily calories and nitrogen intake constant. The tube was removed on the morning of the tenth day, and frequent feeds were given to ensure a daily intake of at least 2,800 calories.

Results

1. Body Weight Before and After Operation

The body weight of each patient has been expressed as a percentage of his standard weight, and the series has been divided into groups according to the deviation from standard weight present before operation. For convenience of presentation the groups are made up in terms of 10% variations from the standard, and Fig. 1 shows the numerical distribution in these groups, before operation, of the patients in the series. It is apparent that more than 75% of patients are under standard weight at this time.

FIG. 1.—Weight distribution of patients before operation.

Table I compares the distribution of patients before operation with that one year afterwards. To avoid a misleading impression being pro-

TABLE I.—Showing by Groups the Change in Weight Distribution One Year After Operation

Weight as % Standard	No. of Cases	
	Before Operation	1 Year After Operation
140-130	3	1
130-120	3	2
120-110	16	8
110-100	43	49
90-100	83	77
80-90	84	79
70-80	37	60
60-70	16	9

duced as a result of small changes in weight, a change in group is only shown if the change in weight is greater than 5% of standard. Over the whole series this gives a reliable picture of what is happening, and three examples illustrate the changes in different groups. In the group of 43 patients weighing 100-110% standard before operation, 25 were in the same group, 12 in the group 90-100%, and 6 in the group 80-90% one year afterwards. Of 84 patients originally 80-90% standard, 11 were in a higher group at one year, 50 remained in the same group, and 23 were in a lower one. Sixteen patients were grossly underweight at the time of operation (60-70% standard), and, of these, 11 attained a higher group and 5 remained in the same one. Thus after operation there is a definite downward shift in the weight of 25-30% of patients in all the pre-operative groups

FIG. 2.—Weight-loss patterns after gastrectomy. (a) Average curve for 23 patients originally weighing 80-90% standard. (b) Curve for one originally overweight patient.

except the lowest. It is also apparent that the greatest loss of weight occurs in the patients in the higher groups, though the result from an individual point of view is the same for the patient who has failed to gain on a pre-operative weight of, say, 70% of standard as it is for another who reaches the same level only after a frank post-operative loss of many pounds.

The weights of 23 patients in the pre-operative group 80-90% who subsequently were in a lower group have been recorded at two, six, and twelve months after operation. Almost all the weight loss occurred in the first two months, and after that time only minor fluctuations in weight took place, often in the form of slight gains (Fig. 2). These patients therefore subsequently fail to gain upon a low weight which has been established at the end of convalescence. In the lowest groups a corresponding deviation from standard weight is already present before operation, though, even so, some further loss may occur soon afterwards. The progressive loss of weight reported after total gastrectomy is rare after less extensive resections, except in patients who are considerably over standard weight before operation. The pattern of weight loss in these patients is different from that just described, and weight may gradually be lost over a period of twelve or even eighteen months. Though many pounds may be lost, the weight nearly always stabilizes ultimately within 10% of the standard figure.

2. Fat Absorption After Gastrectomy

Table II shows the fat-absorption figures in the nine patients before and after gastrectomy, and in five before and after other operations. Diminished absorption does occur in every case after gastrectomy, but the drop as a

TABLE II.—*Fat Absorption (5-Day Balance) Before and One Month After Gastrectomy in Nine Patients and in Five Patients Undergoing Different Operations*

Operation	Fat Absorption	
	Pre-operative	Post-operative
Gastrectomy	90%	83%
"	93%	89%
"	93%	90%
"	89%	86%
"	95%	91%
"	93%	90%
"	88%	86%
"	93%	91%
"	84%	75%
Prostatectomy ..	91%	92%
Appendectomy ..	93%	90%
Prostatectomy ..	88%	89%
Hernioplasty ..	89%	88%
Splenectomy ..	92%	89%

rule is small (average 4%), and is close to the experimental error of the method. After other operations a 3% drop was found in two cases, and there was scarcely any change in the other three. Absorption of 80% or less was found in one of the controlled gastrectomy cases and in three of the eleven uncontrolled cases studied one year after operation. In Fig. 3 the weight one year after operation is shown plotted against the fat-absorption figures for all the 20 patients studied. They have been divided into two groups on the basis of their daily calorie intake—those with a daily

FIG. 3.—Relation between weight (as % of standard) one year after operation and fat absorption. O=Patients with daily calorie intake less than 2,500 calories. X=Patients with daily calorie intake greater than 2,700 calories.

intake of more than 2,700 calories and those with an intake of less than 2,500. It is apparent that weight is related to calorie intake and to fat absorption. Both the high-calorie and the low-calorie group had the same relation between weight and fat absorption.

3. Radiological Studies

Table III shows the relation between the gastric emptying rate and the small-intestine transit time in 110 cases after

TABLE III.—*Gastric Emptying and Small-intestine Transit Times in 110 Patients Following Gastrectomy*

Gastric Emptying Time	Intestinal Transit: Position of Barium Meal at 2 Hours		
	All Small Gut	$\frac{1}{2}$ Small Gut $\frac{1}{2}$ Large Gut	All Large Gut
X-ray dumping	12	3	0
10–20 minutes	18	0	0
Over 20 minutes	70	5	2

gastrectomy. The transit time is clearly independent of the rate of emptying time of the remnant, and hurry is not initiated by a "dumping" of the gastric contents into the small intestine. The gastric emptying rate and small-intestine transit times for 18 patients who had lost 15% or more from standard weight after operation are shown in Table IV.

TABLE IV.—*Gastric Emptying Rate and Small-intestinal Transit Time in 18 Patients who had Lost 15% or More of Standard Weight Following Operation*

Loss after operation as % Standard Weight	Gastric Emptying Time	Intestinal Transit
15	Slow-normal	Normal
17	Normal	"
20	"	"
23	"	"
15	Rapid	"
18	Normal	"
18	"	"
20	"	"
15	"	"
20	"	Very fast
20	"	Normal
15	Dumping	"
15	Normal	"
17	Dumping	"
21	Normal	"
20	"	"
15	Dumping	"
19	Normal	"

Gastric emptying time: normal=20–30 minutes; slow-normal=40 minutes; rapid=10 minutes.

Intestinal transit: normal=head of meal in terminal ileum or at ileo-caecal valve at 2 hours.

The incidence of different rates is the same as in the large series above, and there is no evidence that the small-intestine transit time bears any relation to post-operative loss of weight.

4. Intensive Early Feeding

The weights in relation to standard of the 12 patients intensively fed after operation are shown in Table V, before and at two weeks and two and six months after operation. All the patients gained weight while in hospital,

TABLE V.—*Body Weight Before Operation and at 14 Days, Two Months, and Six Months After Operation in 12 Patients Receiving Intensive Early Feeding*

Sex	Age	Ht. (in.)	St. Wt. (lb.)	Pre-op. Wt. (lb.)	%	After Operation			%	Shift
						14 days (lb.)	2/12 (lb.)	6/12 (lb.)		
M.	33	67	146	121	82.8	124	128	135	92.5	+9.7%
M.	42	69	160	138	86.2	143	145	150	93.7	+7.5%
M.	49	72	178	150	84.2	151	150	150	84.2	No change
M.	43	68	157	128	81.5	135	132	125	79.6	–1.9
M.	37	65	142	125	88.0	139	135	145	102.1	+14.1
M.	32	65	139	120	86.3	121	122	124	89.2	+2.9
M.	45	63	138	115	83.3	117	122	128	92.0	+8.7
M.	53	68	161	139	86.3	142	143	145	90.0	+3.7
F.	60	63	130	110	83.9	112	115	118	90.7	+6.8
F.	56	66	141	119	84.3	124	126	134	95.0	+11.3
M.	59	69	167	138	82.6	140	142	150	89.8	+7.2
M.	38	70	161	135	83.8	137	138	138	85.7	+1.9

and 10 of them maintained this weight or showed a further gain at six months. Two patients could not be induced to eat an adequate diet after they went out, and both lost ground, the weight of one falling below the pre-operative level.

Discussion

Many, if not the majority, of the patients who complain of being underweight after gastrectomy have no troublesome symptoms, are working, and, apart from some quantitative restriction of their diet, are leading normal lives. Though the significance of weight loss may thus easily be unduly magnified in the majority, there are some cases in which it is more often underestimated. Four different groups of patients complaining of weight loss are: (1) Those who have failed to reach some arbitrary weight which they consider proper, but in whom no loss of weight has really occurred. (2) Those few who were well above standard weight before operation and who afterwards lost a considerable amount of weight but ended up within 10% of the standard figure. (3) Those who were under standard weight

before operation and lost some more after it, but stabilized their weight at a figure 80% or better of standard and in other respects had a good or fair clinical result. (4) A group persistently remaining between 60% and 80% of standard weight after operation. There were 69 such patients in this series. Thirty of them were in higher groups before operation. The remainder were in the 60-80% groups before operation, and either failed to gain or actually lost a little more weight after it.

This last post-operative group contains a very high portion of the unsatisfactory clinical results in the series. Two years after operation eight patients in the series were regarded as being as disabled as they were before it, by reason of severe postprandial distress and fatigue. Seven of these patients are in this post-operative group. Muir (1949) and Brain and Stammers (1951) drew attention to the correlation between low body weight and restriction of the diet as a result of continued gastric symptoms after operation, and these patients illustrate this. What is remarkable, however, is that six of these seven patients were in the same low-weight category before they were operated upon—a category which includes only 53 out of the 285 patients in the series. They all suffered from the type of postprandial distress variously termed the "general syndrome" (Butler and Capper, 1951) or vasomotor "dumping syndrome" (Custer *et al.*, 1946). In all, 15 patients were at one time afflicted with this disturbance, and no fewer than 10 of them were in this small group of patients 60-80% of standard weight before operation.

The great majority of patients remaining underweight after gastrectomy lose weight either before operation or in the first few weeks after it, sometimes during both periods, and subsequently fail to gain weight from their new baseline. This study reveals that impaired fat absorption is a frequent sequel of gastrectomy, but the importance of this in determining failure to gain weight remains doubtful. Both dietary calorie intake and fat absorption are related to body weight, and failure to gain is most pronounced when both are impaired. The impression—it cannot be put more strongly—is that of the two factors calorie intake is the more important.

The problem of putting on flesh after severe weight loss has been studied from many points of view in recent years. Keys (1946) made a study of the conditions obtaining after experimental starvation in man, and Murray (1947) and Widdowson and McCance (1951) have given detailed reports upon the recovery of body weight in undernourished Germans at the end of the war. The latter authors report 19 cases in which the weights varied between 100% and 71% of standard, with an average of 82.7%; when allowed access to unlimited food the subjects consumed a diet containing 200 g. of protein and 210 g. of fat, and comprising 6,000 calories daily, and required six weeks on this intake to reach an average of 98% of standard. It is clear from these and other observations (Widdowson and Thrussel, 1951; Murray, 1947) that to register a gain in weight up to normal when starting from 80% of this or less requires a very high daily calorie, nitrogen, and fat intake. In this series of gastrectomy patients the average daily intake of 30 patients who had lost 10% of standard after operation was 2,800 calories at one year and considerably less in the first two months.

The critical period as regards body weight is the post-operative convalescent period, for it is during this period of restricted diet that the new weight "baseline" is established. The early post-operative days are further distinguished by the occurrence of negative nitrogen balance. Wilkinson *et al.* (1950) found that after gastrectomy this catabolic phase started usually on the second day and ended between the eighth and tenth days. The intravenous administration of protein hydrolysates merely resulted in an increase in urinary nitrogen excretion. Nasal tube feeding with a mixture containing 10 g. of nitrogen and 1,800 calories daily was tried in six cases, and, though a negative nitrogen balance still followed, it was shorter in duration and much less severe. The daily nitrogen intake and the calorie value

of the diet for these patients are, however, small when compared with the needs reported in other conditions involving nitrogen loss.

Levenson *et al.* (1945) found that even in mild burns 125 g. of protein and 2,800 calories daily were needed to prevent progressive weight loss, and that severe cases required up to 400 g. of protein and 4,000 calories daily to reverse the negative nitrogen balance and prevent loss of weight. Similar findings are reported by Taylor (1944). Riegel *et al.* (1947) were able to keep two-thirds of a series of patients in positive nitrogen balance after operation (including gastrectomy) by giving feeds containing 0.3 g. of nitrogen and 30 calories per kg. body weight daily by intragastric or intrajejunal drip. Their findings were in agreement with those of Co Tui *et al.* (1944a, 1944b). Werner (1947) also drew attention to the necessity for a high calorie intake to spare nitrogen, and Werner *et al.* (1949) found that after surgical operation there was no loss of nitrogen beyond that observed on the same calorie intake before operation. He concluded that the post-operative nitrogen loss could be explained in terms of simple lack of calories, and that there was no evidence of abnormal mechanisms handling nitrogen metabolism after operation.

Metabolic studies were not carried out on the 12 patients reported here who were intensively fed by nasal tube during the first ten post-operative days, but their progress supports the view that weight loss can be largely prevented by high nitrogen and high calorie intake during this period. All of them gained weight while in hospital, and 10 maintained this improvement or gained further afterwards. Two lost ground after they went out, because they could not manage an adequate dietary intake. Thus by intensive early feeding a patient may be returned to his normal environment without any additional weight deficit, acquired in hospital, to wipe off. Once he has returned, economic factors and the clinical result in terms of continued gastric symptoms determine his further progress. Fortunately most patients achieve a diet upon which they can maintain weight, though they might not be able to gain on it.

The use of the intrajejunal tube was demonstrated to me by J. A. McDougal (1951, personal communication), who, like Stengel and Ravdin (1939), started the drip on return from the operating theatre. In the small series reported here there was some trouble in two cases with diarrhoea and distension, and subsequently the drip was started on the third morning and use made of the "polythene" tube already in place for gastric aspiration. Though the method is clearly effective for its purpose, it has disadvantages which restrict its use in clinical practice. The presence of a nasal tube, which in most post-operative routines is usual for the first two days, is probably not to blame for causing chest complications, but it certainly does help to perpetuate them and increase the difficulty of treatment. At least until post-operative chest complications are a less frequent occurrence, there will be many cases in which it seems undesirable to leave a nasal tube longer than is necessary for surgical safety. Nevertheless, in selected cases, particularly those patients who weigh 80% or less of standard before operation, the method deserves clinical consideration and further trial. It can be abandoned at any time if this seems desirable, and, while nothing is lost by trying the method, much may sometimes be gained by persisting with it.

Summary

Body weight before and after gastrectomy has been studied in 285 patients. Weight has been related to the standard weight for each individual.

At the time of operation 75% of patients were under standard weight. Those severely underweight (60-70% of standard) tended to do badly after operation, not only in terms of weight but by reason of continued gastrointestinal complaints.

Loss of weight after operation occurred in 28% of patients. It is most pronounced in those patients who

previously were much over standard weight. Different patterns of post-operative weight loss are discussed.

Defective fat absorption follows gastrectomy, but the significance of this alone in relation to body weight is doubtful. Both dietary calorie intake and fat absorption are related to body weight, and failure to gain is greatest when both are impaired.

When loss of weight follows operation it occurs in the first few post-operative weeks, and thereafter the patient cannot regain it. The literature upon dietary requirements after severe weight loss and that dealing with the catabolic phase after injury or operation are reviewed.

Early post-operative drip feeding of a high-calorie high-protein mixture can prevent the loss of weight in the early post-operative period.

I wish to thank Mr. R. Marnham, who sponsored the work; the surgeons of St. George's Hospital for allowing me to investigate their patients; Professor Nicholas Martin for his advice and for affording me facilities in the Department of Biochemistry at St. George's; Professor T. Crawford and Dr. Hugh Gainsborough for much encouragement and help; and Dr. W. J. Martin for statistical advice. The weight tables were kindly lent by Dr. Malcolm Purvis.

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One of the subjects discussed at a recent meeting of the Fever Group of the Society of Medical Officers of Health at Fazakerley Hospital, Liverpool, was acute gastro-enteritis. Dr. E. BAILY (Park Hospital, London) summarized the bacteriological aspects, and drew attention to the importance of unmasking latent roughness in physically smooth colonies: the addition of a 1 in 500 solution of acriflavine to a saline suspension would at once cause auto-agglutination of serologically rough colonies and so prevent mistakes of interpretation. He showed slides illustrating finger contamination: a half-minute wash in antiseptic followed by a half-minute wash in running water was required for satisfactory cleansing. Dr. STANLEY BANKS (Park Hospital, London) dealt with the practical applications of bacteriological findings. Cubicles were no safeguard against cross-infection unless they were scrupulously clean: all unnecessary fittings must be removed, vacuum cleaning used, and small hand-towels, for use once only, provided. Nail brushes were often infected and were not necessary. Dr. R. B. MACKAY (Royal Children's Hospital, Manchester) and Dr. S. KEIDAN (University of Liverpool) gave brief reports on the use of polymixin and neomycin respectively in gastro-enteritis. Both antibiotics seemed to have an effect as least as good as other antibiotics on the disease: they appeared to have no toxic effects when given by mouth.

GAS TRANSPORT FUNCTION OF THE BLOOD IN CONGENITAL FAMILIAL METHAEMOGLOBINAEMIA

BY

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In normal blood only 1 to 2% of haemoglobin is present in the form of methaemoglobin, for, although methaemoglobin is constantly being formed by the oxidation of haemoglobin, there exists a very efficient mechanism within the red cell for the reduction of methaemoglobin to haemoglobin (Gibson, 1943). Methaemoglobin occurs clinically when drugs such as phenacetin or nitrites oxidize haemoglobin more rapidly than the normal reducing mechanism can function, or when there is an inherent defect in the reducing mechanism, as in congenital methaemoglobinaemia. Iron occurs in methaemoglobin in the oxidized or ferric form and the pigment is inert as an oxygen carrier.

It was first observed by Douglas *et al.* (1912) and by Barcroft *et al.* (1926) that the presence of abnormal derivatives of haemoglobin not only diminishes the oxygen capacity of the blood but also alters the readiness with which the blood releases oxygen to the tissues. The latter change is reflected in a shift of the oxygen dissociation curve. A shift of the curve to the left indicates an impaired release of oxygen to the tissues due to a greater affinity of haemoglobin for oxygen. Hitzenger (1932) and Gibson and Harrison (1947) each found in one case of congenital methaemoglobinaemia a shift to the left of the oxygen dissociation curve. On the other hand, Litarczek *et al.* (1930), Eder *et al.* (1949), and Waisman *et al.* (1952) reported no alteration of the oxygen dissociation curve in single cases of methaemoglobinaemia.

In view of the conflicting nature of these reports the opportunity was taken to study gas transport in two cases of familial methaemoglobinaemia.

Case 1

A married woman aged 44 was admitted to hospital in March, 1953, for an operation for hallux valgus and vari-

FIG. 1.—Family tree, with cyanosed subjects indicated by solid symbols, Case 1 and 2 having proved methaemoglobinaemia.