VITAMIN C NUTRITION IN CASES OF HAEMATEMESIS AND MELAENA*

BY

SAMUEL LAZARUS, M.D., M.R.C.P.*Extra Dispensary Physician, Western Infirmary, Glasgow*

Haematemesis and melaena, as a complication of peptic ulcer, occur in a considerable number of cases. Hurst and Ryle (1937) record that approximately 30 per cent. of their cases of peptic ulcer were thus complicated. In some instances haemorrhage is the first indication of the disease. More often, however, it takes place in patients who have had gastric symptoms for a considerable time and have received dietetic treatments. Further haemorrhages occur in many cases—for example, in 8.4 per cent. of 130 reviewed by de la Viesca (1935).

Archer and Graham (1936) demonstrated that six out of a series of nine patients suffering from peptic ulcer were in a subscorvy state. It is well known that wounds in patients with actual clinical scorvy heal poorly, and that healed ulcers, fractures, and scars may actually break down in those suffering from this nutritional defect. It was therefore decided to investigate the state of vitamin C nutrition in a group of patients in whom haematemesis and melaena had occurred as a complication of peptic ulcer in order to determine whether these conditions were associated with the presence of the subscorvy state.

Material

The fifteen patients investigated were admitted to the Bispebjerg Hospital, Copenhagen, during the period November, 1936, to February, 1937. Twelve of them were in Department B under the care of Professor Meulengracht. All were given an adequate purée diet and ferrosi tartras from the first day of admission. This method of treatment was introduced by Meulengracht in 1931 and reported on in 1935 and 1936. Six of these cases also received alkali from the first day of admission. Three patients were under the care of Dr. Knud Secher in Department C. These were given half-litres of milk and oatmeal soup from the first day, the quantities being rapidly increased to one and a half to two litres in seven to ten days, when additions of semolina, eggs, and potatoes were made. Ferrosi tartras was given from the first day, but no alkali. The clinical diagnosis of haemorrhage from a peptic ulcer was made in thirteen cases and confirmed radiologically in four of these. One case (Q) was complicated by a history of chronic alcoholism, and one showed a general haemorrhagic tendency; the notes of this last case are given below in full.

Procedure

The amount of ascorbic acid excreted in the urine of these patients during twenty-four hours was estimated by Harris and Ray's (1933) modification of Tillman's 2:6-dichlorophenol indophenol method. The estimations were carried out twice during this period. The urine was stored in dark glass bottles in a cool place after the addition of 10 per cent. by volume of glacial acetic acid. Despite these precautions urine kept under these conditions was found to lose 10 to 15 per cent. of its estimable ascorbic acid content in eighteen hours. In twelve of the cases estimations were carried out at intervals of three days for a preliminary period of fourteen to twenty days after admission. The following procedure was then

adopted during a test period. On the first day of the period the patients were given 700 mg. of synthetic ascorbic acid (Roche Products Ltd.), on the second and third days 1,000 mg., and on the fourth day 700 mg.—all by the mouth. The excretion of ascorbic acid in the urine was estimated each day.

The amount of ascorbic acid excreted in the urine depends on the amount stored in the body tissues and that taken in food. In normal subjects on a uniform dietary the figures are constant from day to day. A diet rich in vitamin C leads to an increased excretion of ascorbic acid, and vice versa. The minimum amount of vitamin C necessary to prevent the first objective signs of scorvy occurring, as determined by Göthlin (1931 and 1934), is that contained in 42 to 60 c.cm. of orange juice or 19 to 27 mg. of ascorbic acid. Abbasy, Harris, Ray, and Marrack (1935) found in a group of healthy adults that if a basal diet containing only moderate amounts of vitamin C was supplemented by the addition of 15 mg. of ascorbic acid (half an orange) the urinary excretion of ascorbic acid in a period of three to four weeks was stabilized at a titre of 15 mg. per day. This represents a state of equilibrium. These workers also noted that when this state of equilibrium had been reached a test dose of 700 mg. ascorbic acid, given by mouth, resulted in an increase in the urinary excretion of ascorbic acid to approximately 50 mg. A daily excretion of 13 mg. (uncorrected titre) and an increased urinary excretion up to 50 mg. after the ingestion of 700 mg. of ascorbic acid were thus established as the minimum figures for healthy individuals receiving adequate amounts of vitamin C in the diet and having adequate tissue stores.

Archer and Graham (1936) adopt different standards. They estimate the degree of saturation of their subjects. Doses of 1,000 mg. of ascorbic acid are given by mouth on two consecutive days and the percentage excretion of a test dose of 400 mg. is estimated on the third day and compared with control subjects. The test period as adopted in the investigation of the twelve patients here reported permits of a comparison of the results with both the above groups of investigators. A satisfactory correspondence is found when the results are read against both standards.

Results

These are given in Table I. Four control estimations were carried out.

Control 1.—A male patient, aged 29, with bilateral pes cavus and mild pains in the calves. He excreted 13 mg. ascorbic acid in the urine whilst on the ordinary ward diet. After the first test dose the excretion rose to 22 mg., and after the second to 179 mg.; he excreted 73 per cent. of the third. It was not necessary to proceed with the fourth test dose.

Control 2.—This test was carried out on me after a period of ten days during which two small oranges were added daily to a standard diet; 31 mg. ascorbic acid was excreted daily under these conditions, and the ingestion of 700 mg. caused an excretion of 280 mg.

Control 3.—This was also carried out on me, twenty days after the withdrawal of the oranges from the diet; 16.1 and 16.7 mg. ascorbic acid were excreted daily. The first test dose resulted in an excretion of 82.2 mg., and 66 per cent. of the fourth test dose was excreted.

Control 4.—A healthy male clerk aged 20. It was only possible to estimate the response to the first test dose. This was 50 mg.

The daily excretion figures and responses to the first test dose of ascorbic acid in these control subjects corre-

* This work was carried out during the tenure of the Faulds Fellowship in Medicine at the University of Glasgow.

spond with those found by Harris and his co-workers in subjects whose diet was known to contain adequate amounts of foods rich in vitamin C. The daily excretion and the responses to test doses of twelve of the cases of haematemesis are tabulated, together with those of the controls.

It will be observed that in Cases B and E the daily excretion before the test period was more than 13 mg. and that the ingestion of the first test dose of 700 mg. ascorbic acid was followed by a slight rise in the urinary excretion. These two cases, B and E, are not below the minimum standards of excretion. The other ten cases all excreted less than 13 mg. of ascorbic acid daily. None of

ascorbic acid on admission to hospital, and that after one week on an "ulcer diet" the daily excretion had fallen to 9 mg. The significance of the spontaneous daily excretion figures, however, is not clear.

Examining the percentage excretion of the last test dose one notes that in all the cases the responses were below those found in the control subjects. In three of them over 50 per cent. of the 700 mg. ingested was excreted. In the other nine cases values ranging from 4.6 per cent. to 48 per cent. were obtained. Archer and Graham found that after two test doses of 1,000 mg. ascorbic acid six out of their nine cases of peptic ulcer excreted 3.4 per cent. to 44 per cent. of a test dose of 400 mg. The range

TABLE I.—Results of the Examination of Twelve Cases of Haematemesis and Melaena due to Peptic Ulcer

Case	Duration of Symptoms	Preliminary Period			Intake of Ascorbic Acid by Mouth Daily (mg.)				General Remarks
		3rd-5th day	5th-14th day	14th-19th day	700	1,000	1,000	700	
		Excretion of Ascorbic Acid in Urine in 24 Hours							
Control 1	..	mg.	mg.	mg. 13.0	mg. 22.0	mg. 179.0	mg. 729.0	+ 73% *	
Control 2	..			31.0	280.0	N.E.	N.E.		
Control 3	..		16.7	16.1	82.2	N.E.	N.E.	66%	
Control 4	..			N.E.	50.0				
B	2-3 years			17.5	21.0	N.E.	N.E.	47%	Fever, alkali
C	3-6 months		11.2	8.4	11.9	N.E.	N.E.	42%	Alkali
D	5 years	13.2	9.0	10.7	15.4	15.0	16.4	4.6%	Alkali, 9th Haematemesis
E	4 "	12.8	9.4	15.9	30.0	68.7	638.0	+ 64%	Alkali, 6th Haematemesis
F	11 "	5.9 ; 6.9	6.0 ; 8.0	9.0	9.8	N.E.			Fever, alkali
G	8 days	9.2 ; 6.0	6.7	11.4	13.4	14.4	20.4	+ 2%	Alkali
J	3 years		11.5	11.0	10.9	94.2	151.0	40%	
K	10 "		8.6	13.0	14.0	42.8	275.3	54%	Fever
L	2 "		7.0	8.9	8.4	28.3	96.0	40%	Fever
M	8 "	8.9	5.7 ; 6.6	8.4	11.1	30.0	340.0	61%	
O	7 "	3.8	4.6 ; 4.6	6.8	8.5	15.6	253.0	38%	Fever
Q	18 "	5.1	7.0	9.7	17.0	19.7	275.0	48%	
Average results		7.3	7.3	11.8					

Cases J, K, and L were treated in Dr. Secher's Department.

N.E.=Not estimated.

* Expressed as a percentage of the amount ingested in the twenty-four-hour period.

these cases responded with a significant urinary excretion to the first test dose of 700 mg. ascorbic acid, and are thus markedly below the standards of adequate vitamin C nutrition. Seven excreted less than 50 mg. after the ingestion of the second test dose—1,000 mg. They were thus in a more severe state of vitamin C subnutrition than the two cases which responded to the second test dose. Cases D and G are remarkable in that no increased excretion of ascorbic acid in the urine resulted after the ingestion of the third test dose—1,000 mg.—that is, after a total of 2,700 mg. had been taken. During the preliminary period the average excretion shortly after admission was 7.3 mg. In some cases the daily excretion fell during the first ten days, whilst in others it rose steadily: the resultant average excretion at this time was also 7.3 mg. Before the test period the average excretion was 11.8 mg. This preliminary period is too short to show decisively whether the purée diet was adequate in vitamin C content, but it would appear that it is not so during the winter months. Kelly (1936) found that eight cases of peptic ulcer had an average excretion of 13 mg. of

of values obtained in the cases here reported is thus seen to be similar to that recorded by Archer and Graham. The two sets of figures are not, however, strictly comparable. In addition to the difference in the first test doses it is known that the percentage excretion in the urine of an ingested dose of ascorbic acid is lower when large doses are taken (Johnson and Zilva, 1934). It can be stated that of the twelve cases investigated in this manner ten were suffering from vitamin C subnutrition or "subclinical scurvy." In seven this was of a severe degree.

Investigation of Three Cases of Haematemesis

The vitamin C nutrition of three cases of haematemesis was investigated by a different method. Four, nine, and twelve days after the haemorrhage two tablets of redoxon (a preparation containing synthetic ascorbic acid), corresponding to 200 mg. of ascorbic acid, were given twice daily by mouth. The urinary excretion of ascorbic acid was estimated every second day. In none of the cases receiving redoxon or the large test doses of ascorbic acid

so soon after the occurrence of the haemorrhage were any disagreeable symptoms produced. These three cases will be described in some detail, since clinical as well as chemical evidence of vitamin C subnutrition was present.

CASE I

A female aged 59 with a history of rheumatic fever at 16. She had never had any dyspeptic symptoms until two weeks before admission, when she started to have nausea and vomiting in the morning. On the day of admission this was preceded by faintness, dizziness, and cold sweat. She vomited about two tumblerfuls of coffee-ground material, and this was followed shortly afterwards by the passing of tar-coloured stools. On admission she complained of a little pressure in the epigastrium; there was no nausea, and no further vomiting occurred. The day after admission the patient appeared pale, but was warm and comfortable and did not sweat. Pupils were round and equal, and reacted to light and accommodation. Ophthalmoscopic examination did not reveal any haemorrhages in the optic fundi. There was no abnormality of the mouth and fauces beyond the pallor of the mucosa, and no peripheral glandular or thyroid enlargement. Examination of the heart and respiratory system revealed nothing abnormal. The abdomen was soft and the liver and spleen not enlarged; no abdominal tenderness was present. There was no oedema in the extremities. Spread over the trunk and the lower extremities were numerous skin haemorrhages 1 to 2 cm. in diameter. The patient stated that she had bruised very easily during the past ten years, and that in the last two years she had often had bleeding from the nose. There was no history of vaginal bleeding or of bleeding from the gums. Pinching the skin produced considerable bruising. Occult blood was found in the faeces, using Gregerson's benzidine test. The bleeding time (Duke) was longer than fifteen minutes; the icteric index (Meulengracht), < 5 ; haemoglobin (Hb 100 per cent. = 18.5 c.cm. O_2), 54 per cent. The red blood cells numbered 3,205,000 per c.mm.; the leucocytes 5,500 per c.mm.; and the blood platelets (Thomsen-Gram), 200,000 per c.mm. The blood urea was 42 mg. per 100 c.cm.; and the sedimentation rate 1 hour 30 minutes.

Graph showing the Daily Urinary Excretion of Ascorbic Acid during the Period in which Redoxon Tablets containing 200 mg. of Ascorbic Acid were given.

On the seventh day the bleeding time (Duke) was 5½ minutes. There was slight nose-bleeding. On the twelfth day the bleeding time (Duke) was 4½ minutes. No further bleedings occurred. The capillary resistance (Göthlin)* was 50. Treatment with two redoxon tablets twice daily was started. On the eighteenth day the icteric index (Meulengracht) was < 5 ; the haemoglobin 71 per cent., the red cells

* Göthlin considers the occurrence of five to eight petechial haemorrhages, when the pressure in the cuff constricting the arm is maintained at 50 mm. Hg for fifteen minutes, as suggestive of diminished capillary resistance.

3,495,000, the leucocytes 5,500, and the blood platelets 183,000 per c.mm.

There was no history of any "bleeders" in the family. The patient lived alone, and stated that her diet had included very little meat and vegetables of any sort. She very rarely ate any fresh fruit. She also said that her diet had been quantitatively restricted during the past two months. The daily excretion of ascorbic acid in the urine before and during the period in which she received 200 mg. ascorbic acid daily by mouth is shown on the graph. Only after eleven days of this regime, in which 2,200 mg. of ascorbic acid was added to the diet, did any considerable increase in the urinary excretion occur.

Radiological examination of the stomach and duodenum revealed no abnormality.

Although the clinical picture presented by this patient was not typical of scurvy, the absence of any family tendency to bleeding, the normal blood platelet counts, and the dietetic history with the complete retention of 2,200 mg. of ascorbic acid lead me to suggest that the presence of this nutritional defect contributed in some measure to the haemorrhagic tendency and the bleeding into the gastro-intestinal tract.

CASE II

A male aged 37 with a history of slight pressure in the epigastrium of twelve years' duration. This occurred one hour after meals, and was relieved by food. There had been remissions lasting two to three years, but no previous vomiting or history of black stools. On the evening of admission he vomited approximately one litre of fluid which was strongly blood-stained and contained blood clots. Examination revealed a thin, pale, poorly nourished man. The teeth were discoloured and carious, the gum margins retracted and congested. He stated that he often had bleeding from the gums on brushing his teeth, and this occurred once during his stay in hospital. No other relevant findings were noted.

Radiological examination of the stomach and duodenum revealed the following: the stomach was elongated and there was pronounced peristalsis. No niche, spasm, or filling defect was found. The duodenal bulb was unusually large, and some spasm at the apex of the bulb was noted.

Routine treatment with purée diet and ferrosi tartras was instituted. Redoxon was given on the ninth day after the haemorrhage. The excretion figures are plotted in the accompanying graph. It will be noted that 1,600 mg. of ascorbic acid (200 mg. for eight days) was given before any increase in the urinary excretion occurred.

CASE III

A male aged 63 years with a previous history of gastro-enterostomy in 1923 and cerebral thrombosis in 1935. He was admitted to hospital on two occasions in 1935 suffering from severe melaena. Since last discharged the patient had been free from dyspeptic symptoms. He ate a full diet and his weight had increased. On the afternoon of the day of admission he had a small haematemesis, and some hours later vomited about one litre of bright red blood. After admission to hospital the patient vomited blood amounting to about half a litre on three occasions. Morphine was given. During the night he vomited coffee-ground material six times—quantity not known: the patient was very collapsed and anaemic, and there was marked tenderness over the abdominal scar. The day after admission he was given a blood transfusion of 500 c.cm., and the purée diet with ferrosi tartras was begun. He vomited on the second and the third day; no blood was present.

On the second day the blood urea was 88 mg. per 100 c.cm. On the third day the capillary resistance (Göthlin) was 50, and he started taking redoxon tablets on the fourth day. On the tenth day the haemoglobin (Hb 100 per cent. = 18.5 c.cm. O_2) was 71 per cent., and the red cells 3,625,000 per c.mm. Pyorrhoea alveolaris was present, but there was no history of bleeding from the gums. The urinary excretion of ascorbic acid is given in the graph. Only after the administration of

2,200 mg. of ascorbic acid did any marked increase in the urinary excretion occur.

Radiological examination of the stomach and duodenum was performed with the patient supine. A small hernia hiatus oesophagus was seen. The gastro-enterostomy was revealed; the anastomosis was patent. No niche, spasm, or filling defect was visible.

Discussion

The results obtained in this investigation demonstrate that in a large proportion of the cases tested a severe haemorrhage from a peptic ulcer was associated with a marked degree of vitamin C subnutrition. That this state was responsible for or favoured the occurrence of the haemorrhage cannot be ascertained from the present evidence. However, the four control estimations carried out on three subjects receiving uncontrolled diets yielded results which indicated that these diets were adequate as to their vitamin C content.

Archer and Graham have shown that the subscurvy state occurs in patients suffering from uncomplicated peptic ulcer. Davidson (1928), Platt (1936), and Wood (1935) recorded the existence of actual clinical scurvy in dyspepsia and peptic ulcer patients who had been taking the usual ulcer diet. Haematemesis and melaena did not occur in these cases. In order to obtain material strictly comparable, the state of vitamin C nutrition of three cases of peptic ulcer was studied at the same time and by the same method as was used with the cases of haematemesis here investigated. The results are tabulated in Table II.

TABLE II.—Results of the Examination of Three Cases of Peptic Ulcer

Case	Duration of Symptoms	Pre-liminary Period	Intake of Ascorbic Acid Daily			
			700 mg.	1,000 mg.	1,000 mg.	700 mg.
			Excretion of Ascorbic Acid in Urine in 24 Hours			
1	2 years	8.1 mg.	N.E.	9.0 mg.	288.0 mg.	41%*
2	10 "	2.2 "	3.1 mg.	10.3 "	53.8 "	24%
3	8 "	7.2 "	8.5 "	10.0 "	38.0 "	13%

* Expressed as a percentage of the amount ingested. N.E.=Not estimated.

It is seen that in this series a marked degree of vitamin C subnutrition was present. The question arose whether the haemorrhage itself was responsible for the nutritional state noted in the cases of haematemesis. This possibility cannot be excluded altogether, but the frequent occurrence of a subscurvy state in cases of peptic ulcer not complicated by haemorrhage renders it improbable. Other factors which may have been responsible for the low excretion and storage of ascorbic acid in the cases of haematemesis will be briefly considered.

Schroeder (1935) and Harde and his co-workers (1935) showed that the occurrence of fever has a marked effect in reducing the urinary excretion of ascorbic acid, and also its storage in the body tissues. Five of the cases here reported had low fever up to 38° C. shortly before or during the preliminary period of the investigation and are indicated in Table I. It will be seen that the excretory responses of these cases are not significantly inferior.

Lund and Lieck (1936) have shown that the oxygen tension and pH of the urine in the urinary tract influence the oxidation of the ascorbic acid present in the urine. Hawley and his co-workers (1936) observed that the administration of large doses of alkali, by increasing the pH of the urine, reduces the amount of ascorbic acid

estimable in the urine when voided. Six of the fifteen cases here reported received considerable doses of alkali. It was not possible to estimate the pH of the urine in these cases, but certain losses in estimable ascorbic acid content must undoubtedly have occurred in this manner. The cases which received alkali are indicated in the table: comparison with those not receiving alkali leads me to conclude that this factor does not obscure the general significance of the results.

Three cases did not receive alkali and had a normal temperature during the course of their illness. It would thus appear that the subscurvy state found in these cases of peptic ulcer complicated by haemorrhage was in the main due to the insufficiency of vitamin C in their diet before and immediately following the haemorrhage.

With regard to the significance of the findings there is some evidence that certain experimental animals (guinea-pigs, monkeys, and pigeons) kept in the subscurvy state tend to develop haemorrhagic infiltration of the bowel wall, and in some cases actual ulcers have been noted in the stomach and duodenum. McCarrison recorded these facts in 1921, and Smith and McConkey in 1933 also found that guinea-pigs kept in the subscurvy state tended to develop peptic ulcers. It must be emphasized that the lesions noted by these workers were present in the majority of cases before clinical evidences of scurvy were apparent. There is no direct evidence, experimental or clinical, that the existence of the subscurvy state in human subjects produces or favours the onset of peptic ulcer. However, the fact that in human subjects suffering from actual clinical scurvy the healing of wounds is very poor, and that in general the fibrous tissue responses of the organism are also very poor, may be of significance.

Examination of patients admitted to hospitals shows that a considerable proportion of them are in a subscurvy state. Harris, Abbasy, Yudkin, and Kelly (1936) found that 84 per cent. of seventy-four patients admitted to the Cambridge Hospital excreted less than the 13 mg. of ascorbic acid which they regarded as the minimum. Using the capillary resistance as an indication of the state of vitamin C nutrition, Schultzer (1934) found that twenty-five out of 145 patients admitted to the Kommunehospital, Copenhagen, during winter months showed evidence of subnutrition in this respect. In both these groups of patients the proportion of cases with gastric symptoms among those regarded as unsatisfactory was large. The high general incidence of subscurvy in these hospital patients was such that no special significance can be attached to this association when considering the aetiology of the gastric symptoms.

The evidence as yet available is, however, sufficient to suggest that the presence of a state of subscurvy in patients with peptic ulcer may influence the course of the disease unfavourably. Further, clinical observation has demonstrated the importance of maintaining the general condition and nutrition in cases of peptic ulcer.

The fact that a very high proportion of patients suffering from peptic ulcer, with or without the complication of haemorrhage, are much below what has been found to be the minimum standard of vitamin C nutrition is thus a clear indication that attention should be paid to this aspect of their nutrition. The importance, and the possibility, of rapidly restoring the general nutrition in patients with haematemesis were shown by Meulengracht (1935 and 1936). In a series of 273 patients with haemorrhage from a peptic ulcer who were given an adequate purée diet from the first day of admission the mortality was only 1 per cent. Schiödt (1936 and 1937) showed that the

restoration of blood loss is more rapid in cases of haematemesis treated by the Meulengracht method. The effect of the more rapid restoration of the vitamin C nutrition in the present series of cases cannot as yet be estimated. Whether peptic ulcers heal more soundly, whether haemorrhages recur less frequently, and whether the blood regeneration is still more rapid in patients whose vitamin C nutrition as well as their general nutrition is maintained at what is regarded as physiological level are questions that have still to be answered.

It appears from the results of this investigation that the purée diet given to these cases of haematemesis during the winter months did not contain enough vitamin-C-rich foods to restore rapidly their vitamin C deficiency. The addition of preparations or foods rich in vitamin C is thus necessary. Harris (1928) recommended such additions to the diet of patients with peptic ulcer, and Witts (1937) has recently added adequate amounts of orange juice, marmite, and cod-liver oil to the purée diet given in cases of haematemesis and melaena. As regards the amount of ascorbic acid usually required by patients with haematemesis to replenish the vitamin C stores of their tissues, 200 mg. daily by mouth will as a rule accomplish this in ten to fifteen days. After this a maintenance dose equivalent to 30 to 60 mg. is advisable. This could be achieved very satisfactorily by giving 60 to 100 c.cm. of orange juice, or smaller amounts of tomato juice, together with additions of fresh milk, vegetables, and potatoes.

Summary

1. The state of vitamin C nutrition of fifteen cases of haematemesis and melaena was investigated by the estimation of the excretion of ascorbic acid in the urine.
2. Thirteen of the fifteen cases were found to be in a condition of vitamin C subnutrition or "subclinical scurvy." This was of a severe degree in seven of the cases.
3. Three cases of peptic ulcer uncomplicated by haemorrhage were similarly found to be in a state of vitamin C subnutrition.
4. Estimations carried out on three healthy control subjects did not reveal any vitamin C subnutrition.
5. The addition of 200 mg. of synthetic ascorbic acid to the purée diet given to the cases of haematemesis led to the correction of the nutritional defect in ten to fifteen days, and produced no untoward symptoms even when started four days after the actual bleeding.
6. Ascorbic acid, 200 mg. daily by mouth for ten to fifteen days, is recommended to be followed by the liberal addition of orange juice (60 to 100 c.cm.) to the diet of these patients.
7. The general indications for correcting this nutritional defect are discussed.

It is a pleasure to record my indebtedness and gratitude to Professor E. Meulengracht for hospitality and direction. My thanks are also due to Dr. Knud Secher for permission to investigate cases under his care, and to Roche Products Ltd. for a generous supply of redoxon and ascorbic acid.

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SQUINT AND HETEROPHORIA

WITH SPECIAL REFERENCE TO ORTHOPTIC TREATMENT*

BY

W. H. McMULLEN, F.R.C.S.

Consulting Ophthalmic Surgeon, Charing Cross Hospital

The rational treatment of any disorder must be based upon the study of its aetiology, of its pathology, and of its clinical features and course. The aetiology of concomitant strabismus is a problem as yet unsolved. We have hypotheses in plenty, but none that gives a completely satisfactory explanation of the development of squint. Pathological changes are absent, except perhaps occasional hypertrophy and shortening of one muscle with thinning and lengthening of its opponent. It is only in the study of the clinical features and course of the disorder that we obtain indications for treatment based on exact observation. The treatment of squint has, however, been largely influenced by the theories held as to its aetiology, so it seems well to begin with a short critical review of these theories.

In ancient times very fantastic ideas prevailed as to the cause of squint, and it is a curious fact that one of the first writers to propound anything like modern views on the subject was the notorious charlatan, the Chevalier Taylor, who flourished in the eighteenth century (1702-72). He said that squint was nothing but a misdirection of the eyes on looking at objects; that if such misdirection were produced artificially by pressing on the eye diplopia resulted, because the image fell on an abnormal area of the retina; that diplopia did not occur in squint because many squinters saw better with one eye than with the other, or if they saw equally well with both they used one eye more than the other, and therefore directed its axis on the object. He explained that an image was indeed formed in the squinting eye, but it was so weak that it did not hinder clear vision with the other, and that with practice one learned to disregard a second image. Elsewhere he made more questionable statements, as that a child squinted owing to association with squinting persons, or from too many objects being brought to his notice at the same time, which caused him to look simultaneously in different directions.

The theories most generally held in recent times are: (1) The muscular theory; (2) the accommodation theory; and (3) the theory of defective fusion faculty. In addition to these one has to consider the influence of anisometropia, of heredity, of nervous factors, and of social conditions.

* Read in opening a discussion in the Section of Ophthalmology at the Annual Meeting of the British Medical Association, Belfast, 1937.