LATE PROGNOSIS IN COELIAC DISEASE

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It seems to be the common belief that coeliac disease generally clears up at about the age of 12 years, although the popular textbooks on disease in childhood are cautious in their opinions on this point. Sheldon (1955) states that "by 7 or 8 years of age most cases . . . have recovered, a few drag on to puberty, and there have been instances recorded in adult life." May (1953) remarks that "if the diet is not managed properly, or frequent infections interrupt the progress, the symptoms may persist for years even in adult life."

It is well known that many instances of idiopathic steatorrhoea have been reported in adults in whom there has been a history of coeliac disease in infancy, which has sometimes apparently cleared up for many years and then relapsed, or which has never entirely disappeared. Thaysen (1932) found, in five out of eight cases of idiopathic steatorrhoea, a history of chronic intestinal disorder in childhood. Bennett *et al.* (1932) found symptoms beginning in childhood in 12 out of 15 cases of idiopathic steatorrhoea; six of these had had some form of diarrhoea or dysentery in infancy. Moore *et al.* (1936) thought the history probably dated from childhood in 6 out of 10 cases of adult steatorrhoea. Bennett and Hardwick (1940) thought that many cases of "non-tropical sprue" were examples of coeliac disease which had escaped recognition in childhood. Davidson and Fountain (1950), as the result of a questionnaire sent to the doctors of 100 patients suffering from idiopathic steatorrhoea, found that five had a definite history of coeliac disease in infancy, and 25 had had in childhood some alimentary disorder, or disorder of growth, suggestive of the malabsorption syndrome. They regarded their figure of 34% as probably an underestimate of the proportion of adults with idiopathic steatorrhoea who had symptoms dating from childhood. Cooke *et al.* (1953) thoroughly investigated 110 cases of idiopathic steatorrhoea, of which 43 had a history of anaemia or of some intestinal upset in childhood such as severe diarrhoea, "tuberculous peritonitis," or "consumption of the bowels."

It is well known that a retrospective survey may be misleading, and it is obvious that a history of "consumption of the bowels," rickets, or anaemia in infancy can hardly be interpreted as good evidence of coeliac disease. Consequently the high figures given in these surveys for a history dating back to infancy must be treated with some reserve. On the other hand, Hardwick (1939) has pointed out that the absence of a history of diarrhoea, or of any disorder of the bowel, does not necessarily exclude steatorrhoea in childhood. There is good reason to believe that infantile steatorrhoea often persists into adult life, or relapses some twenty to thirty years later, but the direct approach to the problem by following cases from infancy into adult life has never met with much success.

Hardwick (1939) reviewed the progress of 73 children with coeliac disease who had been admitted to the Hospital for Sick Children between 1923 and 1938. Fifteen years had elapsed since the first of these patients was in hospital, and the oldest living subject was then aged 16½. Twenty-two had died in hospital and four more in the intervening period. Of 37 living patients traced and investigated, 17 appeared to have recovered. These ate a normal diet and passed normal motions, and had been doing so for more than three years; 10 were in similar health, but three years had not elapsed since recovery; in six the disease was still active; and four had relapsed after improvement.

Hostomská and Horák (1949) found that of 16 cases of coeliac disease treated between 1934 and 1944, seven were free of symptoms in three to five years, and in three they persisted after eight years.

Zellweger and Läuchli (1950) followed up 22 patients who had been treated at the Kinderspital, Zurich. Their ages ranged from 17 to 30 at the time of review. Fourteen had made a complete recovery and seven a partial recovery, but one had developed typical symptoms of sprue and another had severe "bowel dysfunction." Of the 12 female patients in the series, four had had a delayed menarche. Most of the group were thought to be of subnormal intelligence, and showed signs of "instability of the nervous system," hypotension, and muscular hypotonia; osteoporosis of the bones, according to x-ray appearances, was usual; urinary ketosteroids were diminished. Even those who were thought to have made a good recovery were still liable to minor disturbances of bowel function and were intolerant of fats.

di Sant'Agnese (1953) reviewed 23 patients (17 girls, 6 boys) three to eleven years after their original admission with coeliac disease to the Babies' Hospital, New York City. At the time of the study they were aged 5 to 13 years. All were leading normal lives; 10 were clinically normal in every respect and 13 still had abnormal stools with occasional episodes of diarrhoea and pain. The glucose-tolerance test was normal in all but four, but the vitamin A (and carotene) absorption was abnormal in every case. Balance studies were not done. Gerrard *et al.* (1955) studied 32 patients, aged 4 to 19 years, in whom a diagnosis of coeliac disease had been made in early childhood. They concluded that none had completely recovered, "a mild, intermittent diarrhoea" being the commonest symptom. They found the majority to be below the average height and weight for their ages. Steatorrhoea, flat oral glucose-tolerance curves, anaemia, and dilated small intestinal patterns were found in all cases.

Katsampes *et al.* (1955) investigated 20 patients in whom a diagnosis of coeliac disease had been made six to twenty-five years previously. Their ages ranged from 7 to 35. Twelve still had symptoms and 17 had poor absorption of vitamin A ester from the gastro-intestinal tract.

Present Survey

This survey is based on the 37 patients investigated by Hardwick in 1939. The diagnosis of coeliac disease in these cases was accepted by him on the grounds of a history of "diarrhoea, anorexia, and loss of weight, accompanied by the classical clinical features and with the finding of an excess of split fat in the stools on more than one occasion." He included only patients who had been under observation long enough for a transient digestive upset to be ruled out. Re-examination of the records suggests that his criteria were

fairly adequate, and there is little risk that any of the 37 cases were not suffering from coeliac disease, although the evidence on which the diagnosis was originally based is often very sketchy by present-day standards.

We have obtained data on 26 of Hardwick's 37 patients. One of these had died from tuberculosis at the age of 17: according to her mother, she "was a tall and well-built girl." Eleven could not be traced, but there is no record of the death of any of them in the files of the Registrar-General. The 25 living patients about whom some information was obtained are discussed in two groups, according to the amount of information obtained. None of these patients had received any treatment with a gluten-free diet.

Group I: No Investigation by Us

Written or verbal information only was received in respect of seven patients (Table I), of whom four were reported to be in good health. Three were under the care

TABLE I.—Details of Seven Patients Obtained by Correspondence and Hospital Records Only (Group I)

Case	Sex	Marital Status	1938		1953-4	
			Age	Condition	Age	Condition
G. D.	F	?	10	Good	25	Good
E. B.	F	?	17	?	32	?
A. M.	F	S.	9	Good	24	"
V. M.	F	S.	10	Disease active	25	"
O. P.	F	M.	14	Good	29	Relapsed
B. T.	F	M.	12	"	27	"
J. H.	M	S.	10	"	24	"

of other hospitals, and the following information was kindly sent by the physicians in charge of them. It was evident that none of the three had made a permanent recovery, and that they had continued to suffer from slight symptoms or more severe relapses which had necessitated admission to hospital from time to time.

Mr. J. H., aged 24, had been liable to attacks of diarrhoea with distension of the abdomen lasting several days until he was 17; during these attacks he had passed frequent bulky, unformed, and offensive stools. He was then small and pale, his abdomen was distended, and he had developed no secondary sexual characteristics. At the time of the inquiry he had just been admitted to hospital on account of severe hypochromic anaemia; investigation showed that the fat content of 24-hour stool specimens was 27.5%. His anaemia responded to iron given intravenously. His only complaint at that time was of "indigestion."

Mrs. O. P., now aged 29, had improved by the age of 13 or 14 but continued to suffer from occasional looseness of the bowels. At the age of 27 she had a severe relapse necessitating admission to hospital, where she was found to have a hypochromic anaemia. Her faeces contained 43% of fat by weight. The serum calcium was normal, but x-ray examination of the long

bones suggested decalcification. She responded well to dietary treatment, and has had no further relapses since being discharged from hospital. She gave birth to a normal child in October, 1953.

Mrs. B. T., aged 28, had been well from the age of about 5 to 25, when she started to suffer from cramps which were found on investigation to be hypocalcaemic tetany. Investigation at this time showed that she had steatorrhoea. She responded to large doses of oral vitamin D, but was clearly a patient who had had a severe relapse after an apparent recovery.

Group II: Seen as Out-patients or Investigated in Hospital

We have seen 18 of the patients ourselves and 11 of them agreed to enter hospital for further study. The principal features of the histories, physical findings, and biochemistry are shown in Tables II, III, and IV.

TABLE II.—Data Relating to Group II

Case	Sex	Age (1953-4)	Marital Status	Menarche (Years)	Height (ft. in. cm.)	Weight (st. lb. kg.)	B.P.
J. R.	F	29	S.	16½	5 6½ 169	8 8 54.4	130/80
E. R.	F	33	M.	13	5 3 160	10 0 63.5	—
H. V.	F	23	S.	13	5 4½ 164	10 9 67.6	120 80
J. S.	F	19	S.	15	5 3 160	9 11 62.1	125 80
R. C.	M	33	M.	—	5 9 175	10 5 65.8	—
K. H.	M	17	S.	—	5 4½ 164	8 13 56.7	—
J. C.	F	21	M.	—	—	—	—
D. A.*	M	29	S.	—	5 4 163	8 2 51.7	110/70
J. A.*	F	29	M.	17	5 0 152	7 5 46.7	120 80
A. B.*	M	20	S.	—	5 8 173	9 7 60.3	120 80
D. B.	M	29	M.	—	5 6 168	10 6 66.2	160 95
C. C.	M	22	M.	—	5 7 170	9 6 59.9	150/100
J. D.*	F	19	S.	15	5 3 160	7 11 49.4	125 80
M. E.	F	23	S.	15	5 0 152	6 11 43.1	—
B. G.	F	20	S.	14	5 0 152	6 13 44.0	120/70
P. M.	F	19	S.	16	5 2 157	7 8½ 48.3	120 80
J. T.	M	24	S.	—	5 9 175	9 9 61.2	145 75
D. M.	M	21	S.	—	5 7 170	8 12 56.2	100 70

* In these cases the history suggested that they were still liable to relapses.

Thirteen of these patients claimed to be in good health, and, although questioning brought to light minor degrees of bowel disorder or digestive disturbance in four of them, these did not appear to be significant. A further four (D. A., J. A., A. B., and J. D.) did not appear to have made a complete recovery. They were still liable to attacks of diarrhoea and vomiting, abdominal pain, or distension, and had to be careful about their diet. Another (J. T.) regularly passed two bulky motions daily.

In the women, the menarche had tended to occur late (Table II). In none did it occur before the 13th year, and in six out of nine it was later than the 14th year. The average age of the menarche in the South of England is 13.49 years (Wilson and Sutherland, 1950) and the standard deviation 1.19. In three of our cases the menarche was more than two standard deviations later than the normal mean.

TABLE III.—Group II

Case	Vit. A (i.u./100 ml.) 0-5 Hrs.	Fat	Faecal N. (G./24 Hrs.)	G.T.T.	17 K.S. (mg./24 Hrs.)	Alb./Glob. (G./100 ml.)	Hb	P.C.V.	M.C.V. (Cubic microns)	M.C.H. (μg./100 ml.)	M.C.H.C.
<i>In-Patients</i>											
D. A. . .	42-134	69%	1.4	" Flat "	4.8	—	73%	38%	76	22	29%
J. A. . .	100-100	95.9%	2.1	—	3.9	3.9/2.7	100%*	45%	92	31	33%
A. B. . .	92-210	96%	1.3	" Flat "	7.6	4.1/3.7	84%	42%	77	23	30%
D. B. . .	155-680	94.3%	1.3	N	—	4.4/2.8	114%	49%	—	—	35%
C. C. . .	84-428	94%	2.3	N	8.0	5.0/2.4	97%	43%	—	—	34%
J. D. . .	160-160	98%	0.8	N	15.0	3.9/3.4	100%	43%	88	31	34%
M. E. . .	150-150	92%	—	—	5.7	—	100%	42%	—	—	34%
B. G. . .	75-540	98%	1.0	—	10.6	5.1/3.2	91%	41%	97	32	33%
P. M. . .	70-150	98%	1.4	" Flat "	5.2	7.1 (total)	61%	33%	72	20	27%
J. T. . .	—	90.5%	1.8	"	9.0	4.0/3.8	90%	44%	—	—	31%
D. M. . .	-720	94%	1.6	—	12.2	4.2/3.8	112%	49%	87	30	34%
<i>Out-Patients</i>											
J. R. . .	—	—	—	N	—	—	84%	39%	92	31	32%
E. R. . .	190-620	—	—	—	—	—	83%	36%	—	—	34%
H. V. . .	140-370	—	—	—	—	—	90%	40%	—	—	33%
J. S. . .	—	—	—	—	—	—	85%	—	—	—	—
R. C. . .	100-	—	—	—	—	—	97%	47%	98	30	30%
K. H. . .	84-218	—	—	—	—	5.3/3.1	94%	44%	—	—	32%
J. C. . .	84-286	—	—	" Flat "	—	5.1/2.7	84%	—	—	—	29%

* This patient had already received oral iron therapy for iron-deficiency anaemia.

TABLE IV.—*Bone Studies (Group II)*

Case	X-ray Report	Serum Ca (mg./100 ml.)	Serum P (mg./100 ml.)	Serum Alk. Phosp. (K.A. Units)	Cp/Ccr*	Ca Infusion (0-12 Hours Gross Excretion)†
J. R.	—	—	—	—	—	—
E. R.	—	—	—	—	—	—
H. V.	Normal	12.2	2.4	7.0	—	—
J. S.	No bone pathology	10.1	3.1	7.0	—	—
R. C.	No sign osteoporosis	11.4	4.1	10.2	—	—
K. H.	No osteoporosis	11.2	8.5	7.0	—	—
J. C.	Normal	10.4	2.7	7.7	—	—
D. A.	Slight osteoporosis at wrist	10.3	2.6	8.0	0.06	65.0%
J. A.	Bones of hand slender: no osteoporosis	10.1	2.0	8.3	0.14	62.1%
A. B.	No bone pathology	9.0	3.0	8.7	0.05	35.1%
D. B.	No osteoporosis	11.5	2.7	—	0.06	29.5%
C. C.	Normal	9.5	3.4	10.7	0.06	58.0%
J. D.	No osteoporosis	9.5	2.5	5.5	0.09	50.4%
M. E.	No abnormality	10.5	5.2	6.0	—	—
B. G.	osteoporosis	9.3	2.5	9.8	0.05	61.9%
P. M.	Slight osteoporosis	10.4	3.6	10.6	0.03	—
J. T.	No osteoporosis	9.5	2.9	—	0.15	38.0%
D. M.	" "	11.4	3.3	5.5	0.03	62.0%

* Phosphate clearance
Creatinine clearance

† Normal range about 38–62%.

Temperament and Intelligence.—The temperaments and personalities of these patients varied, as would be expected in any group of people, but the observer was struck by their lack of maturity. Only 5 out of 18 were married, and only one of the remaining 13 had left home, and she had had a nervous breakdown. The unmarried ones were still strikingly dependent on their parents, and it was usually the latter who decided whether their grown-up sons and daughters should come to the hospital. They tended, as a group, to be shy and nervous, but alert and of normal intelligence. It is probable that irregular schooling, because of their illness, was responsible for their remarkably poor handwriting and badly phrased letters.

Physical Findings.—On the whole these patients were underweight and somewhat undersized (Table II), and it could almost be said that a characteristic type emerged, of a small, thin, delicate-featured, and pale individual with immature secondary sexual characteristics. Statistical analysis of their departure from the mean normal weight of persons of their age in the population at large (Kemsley, 1952) showed that they were significantly underweight ($P < 0.05$), but their departure from normal height was just not significant. The blood pressure was normal in every case in which it was measured. Clubbing of the fingers was not seen. There were no deformities to suggest previous rickets. Dental development appeared normal and the incidence of caries was no greater than usual, but in one case (D. B.) the teeth were worn down to stumps apparently as a result of enamel hypoplasia.

Investigations

Methods.—The object of the investigation was to determine whether any degree of malabsorption was still present, and whether it was causing any secondary manifestations. Fat and nitrogen balances were estimated in all in-patients. After three days on a constant intake of fat and nitrogen (50 g. of fat daily and 50–60 g. of protein) all stools were collected for a four- or six-day period (except in one case when the patient could remain for only three days). Vitamin A absorption tests were performed after the manner described by Paterson and Wiggins (1954). Glucose-tolerance tests were performed by giving 50 g. of glucose in the fasting state and taking samples of capillary blood for three hours. Serum and urine calcium, phosphate, and creatinine were measured by the methods described by Nordin and Fraser (1954), and calcium infusions were carried out with the technique reported by Nordin and Fraser (1955b). Serum albumin and globulin, plasma alkaline phosphatase, and

urinary 17-ketosteroids were estimated by the Biochemical Laboratories of the Postgraduate Medical School as routine procedures.

Results.—The results of the biochemical investigations are shown in Tables III and IV.

Absorption.—Fat absorption exceeded 90% of the intake in 10 out of 11 cases: in five of these it exceeded 95%. In only one case (D. A.) was it definitely abnormal (69%), and this was the patient in whom clinical assessment suggested that steatorrhoea was still present. In two cases the fat content of single stool samples was measured and found to be normal (K. H. and J. C.—16% and 10.4% of dry weight). By contrast the majority of the vitamin-A absorption tests yielded abnormal results. In 10 out of 13 cases the five-hour vitamin-A level was less than the 500 units per 100 ml. which is regarded by Paterson and Wiggins (1954) as being the lower limit of normal. The fasting levels were below 100 units per 100 ml. in seven of the patients, and D. A. had the lowest fasting level of all.

The faecal nitrogen ranged from 0.8 to 2.3 g. per 24 hours, and exceeded 2 g. in only two subjects. These are almost certainly normal figures (Wollaeger *et al.*, 1947).

Glucose-tolerance tests (see Chart) were performed in 9 subjects, and in four of these the blood sugar never rose as high as 50% above the fasting level. These have been described as "flat" in Table III. Four of the tests were

Glucose-tolerance curves. Four out of eight curves fail to reach the normal rise of 50% over the fasting level.

normal; one case has had to be excluded because the fasting level of 112 mg. per 100 ml. suggested an error. According to the data of Evensen (1942) the blood sugar rises more than 50% above the fasting level in normal people.

Haematology.—Seven out of 18 cases had less than 90% haemoglobin on the Haldane standard. In five there was iron deficiency (M.C.H.C. below 31%), and in three of them the M.C.V. was less than 80 cubic microns. These three, who included D. A. with frank steatorrhoea, all had low fasting vitamin-A levels. One other (J. A.) had a normal blood picture when seen by us but was known to have been recently treated elsewhere for iron-deficiency anaemia.

Bone Studies.—The hands and spine were radiographed in 16 subjects and nothing significant was noted, although the radiologist reported slight osteoporosis in two (D. A. and P. M.). Serum calcium levels were within the normal range in 15 out of 16 cases; the one reading of 12.2 mg. per 100 ml. was probably a laboratory error. The alkaline phosphatase was normal in 14 out of 14 cases. Several of the serum phosphate levels were rather low—8 out of 16 were less than 3 mg. per 100 ml. and 4 were 2.5 or less. However, these low serum phosphate levels were associated with a low rather than a high phosphate:creatinine clearance ratio, suggesting a low phosphate intake rather than the secondary hyperparathyroidism of osteomalacia (Nordin and Fraser, 1955a). Calcium infusions were given to nine

patients. The 0-12 hours gross excretion lay within or just below the normal range (38-62%) in all but one patient (D. A.), in whom it was 65%. We observed that in most of these cases the fall in phosphate output normally seen after a calcium infusion did not occur (Nordin and Fraser, 1954). We are unable at present to assess the significance of this, but have observed it occasionally in osteoporosis and associate it with impaired calcium retention by the skeleton.

Conclusions

Biochemical and haematological investigation did not bring to light many serious disorders in the cases studied. Fat balances revealed only one case of steatorrhoea, but several flat vitamin-A absorption and flat glucose-tolerance curves suggested that some degree of malabsorption might be present. Three cases seemed to have definite iron-deficiency anaemia, and one more was known to have been treated for it. Sensitive tests of calcium and phosphate metabolism yielded nothing to suggest osteomalacia, and only the merest hint of osteoporosis.

Weighing up the biochemical evidence obtained in each case, we conclude that one patient is still suffering from steatorrhoea, and that in a further four (P. M., A. B., J. A., and J. T.) there is enough indirect evidence of malabsorption for us to say that they have not fully recovered from their disease. In four out of these five cases the history had suggested that recovery was not complete (Table II), but one (P. M.) claimed to be perfectly well. One further case (J. D.) gave a history suggesting relapses, but the only biochemical abnormality discovered was a flat vitamin-A absorption curve.

Dr. Christopher Hardwick has very kindly allowed us to examine the notes he made on the cases which he saw and assessed in 1938, and this has enabled us to compare our individual assessments with his. The result is shown in

TABLE V.—18 Cases of Coeliac Disease Assessed in 1938 and in 1953-4 (Group II)

Case	1938		1953-4	
	Age	Condition	Age	Condition
J. R.	14	?	29	Good
E. R.	18	Good	33	"
H. V.	8	"	23	"
J. S.	4	"	19	"
R. C.	18	?	33	"
K. H.	2	Disease active	17	"
J. C.	6	"	21	"
D. A.	14	"	29	Disease active
J. A.	14	Good	29	Not fully recovered
A. B.	5	Disease active	20	"
D. B.	14	?	29	Good
C. C.	7	Good	22	"
J. D.	4	"	19	"
M. E.	8	"	23	"
B. G.	5	"	20	"
P. M.	4	Disease active	19	Not fully recovered
J. T.	9	?	24	"
D. M.	6	Good	21	Good

Table V. As might be expected, our one active case was classified by Hardwick as active 15 years previously. Two of the cases we have classified as "not fully recovered" were active when seen by him, one was apparently normal, and in one we have been unable to trace his records. Two of the cases which were active when seen by him have now

TABLE VI.—Fate of 73 Cases of Coeliac Disease, Present Age 17 to 33 Years

	Total No.	No. Died	Not Traced	Recovered More than Three Years	Recovered Less than Three Years	Active or Not Fully Recovered
1938	73	26	10	17	10	10
1953-4	37*	1	11	17	0	8

* The 37 cases in 1953-4 represent all the living patients traced and assessed by Hardwick in 1938.

apparently recovered. When these data are combined with those shown in Table I, a definite impression of the relapsing nature of coeliac disease is obtained. Four cases (aged 10, 12, 14, and 14) who were normal and apparently recovered in 1938 have since relapsed or show evidence of malabsorption now, whereas three patients who were still ill in 1938 (aged 2, 6, and 10) are now perfectly well.

Table VI summarizes our data and those of Hardwick. In comparing our results with those of Hardwick it must be borne in mind that no fewer than four of our eight "abnormal" patients were considered by him in 1938 to have recovered for more than three years.

Discussion

Superficially, the majority of this group of 25 adults who suffered from coeliac disease in infancy appear clinically and biochemically normal. Only three are still under the care of physicians for occasional relapses, and only one of the 18 investigated by us had frank steatorrhoea: the remaining 17 would pass any routine medical examination.

However, careful examination of all the evidence refutes this view. Taken as a group, they are not a representative sample of the population at large. Even if those who are still relapsing are excluded, the remainder tend to be slightly below the average height and considerably below the average weight for their age; the women tend to have a delayed menarche; the men tend to be slow in developing secondary sexual characteristics. They are juvenile in appearance, dependent on their parents, and tend to marry late. These characteristics can be accepted as the result of prolonged periods of malnutrition. They are not to be expected in the future after adequate treatment with a gluten-free diet. None of the subjects under review had been treated in this way, although one (H. V.) had in effect always received such a diet from an early age, and she was quite normal in physique and temperament.

Frank steatorrhoea was found in only one of the patients we investigated in hospital, but it was known to be still present in two others being cared for elsewhere, and was presumed to be present in another who was still having serious relapses. Four more investigated by us had sufficient evidence of malabsorption for us to say that they had not fully recovered, and three of these gave a corresponding history. No fewer than four of these eight patients had been classified as "recovered more than three years" in 1938, whereas three patients thought to be still ill in 1938 were passed by us as normal.

We consider that our data support the view that coeliac disease is essentially a chronic relapsing disease, and that while prolonged periods occur during which the patient is clinically and biochemically normal, yet there is a persisting liability to respond with steatorrhoea to some agent which has recently, in most cases of coeliac disease, been shown to be the gluten of wheat flour.

Summary

Twenty-five young adults who had coeliac disease in childhood and whose condition was assessed by Hardwick in 1938 have been reassessed by us 15 years later.

Four were found to be still relapsing, or to have active disease. In a further four, investigation revealed minor degrees of malabsorption, and they have been classified as "not fully recovered."

Four of these eight patients had been classified as "recovered for more than three years" in 1938.

There was no evidence whatever of osteomalacia in the cases studied.

It is felt that this study supports the view that coeliac disease is a chronic relapsing illness.

Our thanks are due to the medical staff at the British Postgraduate Medical School, who allowed us to use their beds for

the investigation of our patients; to Dr. Christopher Hardwick; and to the physicians of the Hospital for Sick Children, Great Ormond Street, for allowing us access to their case records.

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SIGNIFICANCE OF A FURRED TONGUE

BY

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Belief in a furred tongue as a sign of disease is certainly both old and widespread, and most people to-day believe that a furred tongue is a sign of something wrong, the usual belief being that a furred tongue is a sign of a disordered bowel.

Likewise, most doctors would probably regard inspection of the tongue for furring as a useful part of the physical examination of their patients; yet, when one considers how often the tongue is inspected, and for how long a furred tongue has been regarded as an important physical sign, it is surprising how little seems to be known of the causes of furring. Present-day textbooks usually quote the supposed connexion between a disordered bowel and a furred tongue, but mention, in addition, a variety of other conditions, including local disease of the mouth and throat, as causes of furring; but Gans (1954) concluded that a furred tongue is as common in health as in disease, and is therefore of no clinical significance whatsoever.

The aim of the present investigation was to answer three questions: (1) Is a furred tongue more common in disease than in health? (2) If so, is a furred tongue more common in any one disease or group of diseases than in any other? (3) As a corollary to the first two questions, is a furred tongue a useful clinical sign?

Method

It was decided to investigate this problem by inspecting the tongues of all patients seen in general practice over a period of about six months, until the necessary facts on 700 patients had been collected. There was no selection of cases and no patient was included twice in the series. One hundred cases of accidents of a minor nature, such as bruises, sprains, and lacerations, formed the control group; the remaining 600 consisted of 200 children and 400 adults.

In every case the state of the tongue, the diagnosis, the presence of fever, the bowel habits, the smoking habits, and

the state of the teeth were recorded by a simple code. Tongues were classified into Group 1, consisting of definitely clean tongues; Group 2, the intermediate group, consisting of all cases in which there was doubt whether to classify the tongue as clean or furred; and Group 3, consisting of definitely furred tongues. Wherever possible the tongue was inspected before any questions were asked, so that a decision on furring could be made before the diagnosis was known.

Smokers were classified as "light" if they smoked fewer than five cigarettes a day, "moderate" if they smoked five to fifteen a day; and "heavy" if they smoked over fifteen. Teeth were recorded as "healthy, mildly decayed, grossly decayed, or edentulous."

A fever was recorded as present if the patient was found to have a raised temperature or if there was a clear and definite history of fever within the last twenty-four hours.

No attempt was made to differentiate furring of the back of the tongue from furring of the front. In most cases the fur is thickest at the back and along the middle of the tongue, and thinnest at the edges, probably because the teeth rub the fur off the edges. If the tongue was clean except for a small patch of fur at the back it was classified as clean, and a tongue was regarded as furred when the fur covered most or all of the dorsum of the tongue.

Results

Control Group

In this group of 100 casualty cases furring was found in 12% and a clean tongue in 55%, with 33% in the intermediate group. However, when this group is analysed for smoking habits, it will be seen that most of the people with furred tongues were moderate or heavy smokers (Table I). This tendency for smoking to produce a furred tongue was found constantly throughout the investigation, for, although the figures in the control group are small for statistical certainty, the same effect of smoking is shown in Table II.

TABLE I.—Control Group (100 Cases)

	Children	Adults				Whole Control Group
		Non-smokers	Light Smokers	Moderate Smokers	Heavy Smokers	
Clean tongues ..	22 (75.9%)	25 (67.6%)	4 (40%)	3 (20%)	1 (11.1%)	55
Intermediate ..	5 (17.2%)	10 (27.0%)	6 (60%)	9 (60%)	3 (33.3%)	33
Furred tongues	2 (6.9%)	2 (5.4%)	0	3 (20%)	5 (55.6%)	12
No. of cases	29	37	10	15	9	100

TABLE II.—Effect of Smoking on the Tongue (234 Cases of Non-infectious Diseases)

	Non-smokers	Light Smokers	Moderate Smokers	Heavy Smokers	Totals
Clean tongues ..	74 (65.5%)	35 (63.6%)	9 (22.5%)	4 (15.4%)	122
Intermediate ..	33 (29.2%)	18 (32.7%)	23 (57.5%)	11 (42.3%)	85
Furred tongues ..	6 (5.3%)	2 (3.7%)	8 (20%)	11 (42.3%)	27
Totals ..	113	55	40	26	234

Table II consists of 234 cases selected because they were suffering from some illness other than an infection, since, as is shown later, infections are themselves sometimes a cause of furring. Smoking is in fact one of the commonest causes of a furred tongue, and for this reason the proportion of moderate and heavy smokers is shown in all subsequent tables.

The conclusion from the control group, therefore, is that in healthy people only about one out of twenty will have a definite furred tongue, unless the person is a smoker, in