NYSTAGMUS IN OTHERWISE NORMAL COAL-MINERS

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For years the popular opinion of coal-miners' nystagmus has been that it is a psychological disease and that the men are hysterical, anxious, obsessional, pathologically truculent, or, indeed, doubtfully genuine (Culpin, 1932). Moreover, Halliday (1948) has implied that the disease is "psychosocial." On the other hand, a previous study (Browne *et al.*, 1950) suggested that miners who develop the disease are very much like those who do not. In the first comparison the men were certified in 1942, and in the second, which is described in this paper, in 1950, so that any reproducibility of the main results after a period of eight years and in different groups of men may lend some weight to the original conclusions.

The problem in this disease is to apportion the cause between the physical conditions of the miner's work and the psychological and social setting of his life.

The Method

Fifty consecutive cases from County Durham were studied. In each case a certificate of disablement for the disease had been granted by the same certifying medical practitioner. They were matched with 50 normal men who were the controls, and who were chosen from the same 29 different collieries at which the men with nystagmus had been working when they were certified. These collieries were visited, and the names were selected at random from their office records to match, by age (so far as possible to the nearest decade) and occupation, the men with nystagmus who had worked there. All but three of the controls attended for examination; one of them developed nystagmus after his name had been selected, and the other two refused to come. One had "never been able to pull himself together" since his son was killed seven years before, and the mere thought of attending hospital upset him. The other was a man with a suspicious turn of mind who could not understand the method of selection.

A special clinic was instituted for this work, where the men were seen throughout by the same clinician, who took their medical and occupational histories and made a simple physical examination. They were also seen by an almoner, who inquired into their social background.

Results of Medical Study

Table I shows the number of miners in each decade and also the mean ages of the two groups. This was 52 years 8 months for the men with nystagmus, and 51 years 2

TABLE I.—Number of Miners in Each Decade and Mean Ages of the Two Groups

Age	No. of Miners	
	Nystagmus	Control
25-34 years	1	0
35-44 "	9	12
45-54 "	19	17
55-64 "	16	15
65-74 "	5	3
Mean age	52 8/12	51 2/12

months for the control group. The usual age of onset given in the literature is 45, and it therefore seems that the age of onset is tending to rise.

The previous illnesses of the two groups were almost identical (Table II). The term "nervous illness" includes psychological as well as neurological conditions, but only

TABLE II.—Previous Illnesses

Illness	Nystagmus	Control
Infections	2	2
Nervous	3	1
Respiratory	9	8
Circulatory	0	0
Digestive	7	8
Peptic ulcer	4	2
Skin	4	7
Bones	5	4
Endocrine	1	0
Total	35	32

two more of the men with nystagmus than of the controls complained of them. The pattern of complaints for digestive diseases, peptic ulcer separately, and skin disease is also about the same in both groups of men. However, the pulse rate (Table III) of the men with nystagmus tends

TABLE III.—Summary of the Physical Findings

Average	Nystagmus	Control	Statistical Significance P
Pulse rate	79	71	<0.005
Respiration rate ..	19	18	0.04
Blood pressure:			
Systolic (mm. Hg) ..	147	136	0.04
Diastolic (mm. Hg) ..	87	80	0.01
Height	66 in. (168 cm.)	67 in. (170 cm.)	
Weight	146 lb. (66.2 kg.)	150 lb. (68 kg.)	

to be a little higher than that of the controls, and the same tendency is shown by the respiration rate and the blood pressure. These are unlikely to be chance findings, but the values, even for the men with nystagmus, can hardly be regarded as abnormal. The heights and weights of the two groups are, however, much the same.

Results of Occupational Study

The number of years the two groups of men spent in various kinds of mining occupation is given in Table IV. It shows that the men who broke down with nystagmus had, on the whole, graduated to face-work earlier than had the controls. They had also served in the responsible position of deputy (or underground foreman) to a greater extent than the others. In the decade 15 to 24 the nystagmus men spent 3.3 years on face-work, but the controls only 2.2, and the next two decades show a similar trend. For the job of deputy in the decade 35 to 44 the men with nystagmus spent 0.7 year and the controls 0.5, and the figures for the next two decades (0.8, 0.7; 0.3, 0.1) are similar. Fewer absolute man-years were worked by the control group, but this is largely because there are three fewer men in it.

The type of lamp used by the two classes of men was not appreciably different (Table V), since both spent about 60% of their working lives in oil light, about 27% in hand electric, about 6% in a naked light, and about 6% with the modern type of electric lamp which fits on to the protective hat.

From the time of Snell (1892) it has always been thought that nystagmus was found more often among men who worked in low seams. It is not easy to find figures to support this, but it is indeed a reasonable supposition on clinical grounds, because oscillations of the eyes are elicited most easily either when a man is stooping or when he is looking up—both of which he has to do when the roof is not high enough for him to stand up straight, or low enough to force him to be on his face, side, or back. Table VI shows the heights in which the men worked.

TABLE IV.—*Relative Number of Years Spent in Each Mining Job*

Age:	15-24		25-34		35-44		45-54		55-64		Total	
Occupation	Nys.	Cont.	Nys.	Cont.	Nys.	Cont.	Nys.	Cont.	Nys.	Cont.	Nys.	Cont.
Surface ..	1.0	0.8	0.5	0.9	0.2	0.2	0.6	0.2	1.3	1.3	3.6	3.4
Haulage ..	2.7	3.0	0.4	0.7	0.1	0.4	0.4	0.8	2.0	2.0	5.6	6.9
Putting ..	3.0	4.0	0.4	0.4	0.0	0.1	0.0	0.0	0.0	0.0	3.4	4.5
Face-work ..	3.3	2.2	8.6	8.0	9.0	8.8	8.2	8.4	6.4	6.6	35.5	34.0
Deputy ..	0.0	0.0	0.0	0.0	0.7	0.5	0.8	0.7	0.3	0.1	1.8	1.3
Total ..	10.0	10.0	9.9	10.0	10.0	10.0	10.0	10.1	10.0	10.0	49.9	50.1
Absolute man-years worked	500	470	499	470	460	423	325	259	122	91	1,906	1,713

TABLE V.—*Types of Lighting Used*

Lighting	Nystagmus		Control	
	Years		Years	
	No.	%	No.	%
Naked light ..	104	6.1	112	6.9
Oil safety ..	1,057	62.4	951	58.5
Electric, hand ..	442	26.1	461	28.4
„ cap ..	90	5.3	102	6.3
Total ..	1,693	99.9	1,626	100.1

TABLE VI.—*Heights in Which the Men Worked*

Height of Seam	Nystagmus		Control	
	Years		Years	
	No.	%	No.	%
Under 3 ft. (91 cm.)	257	22.8	337	31.8
3 ft.—4 ft. 11 in. (91–150 cm.)	519	46.0	332	31.3
Over 5 ft. (152 cm.)	352	31.2	391	36.9
Total ..	1,128	100.0	1,060	100.0

The nystagmus group spent about 15% more time in seams of 3 ft. to 4 ft. 11 in. (91 to 150 cm.), and consequently less of its time in seams higher or lower than this. The odds against this connexion between nystagmus and working in this seam height being due to chance are less than one in a thousand ($\chi^2=37.0$, $P<0.001$). There is therefore statistical support for Snell's original idea that nystagmus is found more often among the men who work in low seams. However, it is not the lowest seams that do the damage, but those of intermediate height, which cause the men to bend forward and look up at the same time.

Results of Social Study

Fourteen of the men with nystagmus and 17 of the controls were born and bred in the village in which they were living. Twenty-eight in each group came from elsewhere in County Durham, and only eight with nystagmus and two controls came from outside it, while all the men started their working lives within the area of the Durham coalfield (Table VII).

TABLE VII.—*Number of Men by Birthplace, Father's Job, and Their Own Preference for Work*

	Birthplace			Father's Job			Own Job Preference		
	Present Village	Other Village Same County	Elsewhere	Coal-miner	Other	Unknown	Coal-mining	Indifferent	Other
Nystagmus	14	28	8	41	8	1	21	19	10
Control	17	28	2	42	4	1	15	20	12

Seven men with nystagmus and six controls had their early home life upset by the death of one or both parents, and one in each group had an acutely disturbed childhood deprived of normal parental care. But only one man in

each group spoke of childhood as an unhappy period; the man with nystagmus had finally run away to live with a sister; the control said that "drink was his father's downfall." All the other men in both groups appeared to have had normal home backgrounds. Varying degrees of poverty had been endured, but even when it had been "scrub and go" it did not seem to have blighted the home. Many of these men had gone short of clothes as children, but they had seldom gone short of food.

Most of them had taken it for granted that they would go into the pits as soon as they left school. Even those who had the offer of different work often chose the pits in order to remain with their schoolmates, and a few went into mining in spite of strong opposition from their parents. The range of youthful ambitions among those who would have preferred some other work was much the same in both groups. None seemed to have been strenuously opposed to the idea of mining.

Two of the men with nystagmus were under 20 when they married, and one was over 35. Five of them were single. Seventeen of the controls were under 24 when they married, 4 were over 35, and 2 were single, which represents only an insignificant difference between the two groups (Table VIII).

TABLE VIII.—*Number of Men by Age at Marriage and Type of House*

	Age at Marriage (Years)							Housing			
	20	24	29	34	34+	Single	Unknown	Colliery	Council	Other Rented	Own
Nystagmus ..	2	21	15	6	1	5	0	19	19	7	5
Control ..	0	17	18	5	4	2	1	20	16	6	5

After marriage, most of them moved into a house of their own after a few months spent in rooms or with in-laws, and a waiting period of longer than a year was uncommon. Three in each group had to wait over five years before they could set up as a separate household, and one control had lived apart from his wife for six years until a house became available.

Two men with nystagmus and two controls were widowers. Two other men with nystagmus and one control had lost their first wives and married again later in life. One of the widowers with nystagmus had remarried, but had lost his second wife as well. One man with nystagmus and three controls mentioned other serious domestic tragedies. What was probably by far the heaviest emotional load had been carried by one of the controls whose wife had never fully recovered from a mental illness following the loss of her baby. One man with nystagmus whose wife "suffered with her nerves" may have had a rather difficult home background, and one other had a wife who was diabetic and probably had low social standards as well. There was no indication of severe matrimonial difficulties except in the case of one control who was separated from his wife.

Five men with nystagmus and two controls remained unmarried. One in each group lived in lodgings. The single man with nystagmus had been in the same lodgings for over 40 years. The control had changed lodgings twice in the past 27 years. One man with nystagmus was living by himself in his own bungalow. The other single men lived with relatives.

The homes were not visited, but only two men with nystagmus and one control said that their houses were in poor condition and overcrowded. There were no complaints from any of the others.

The men were asked what they liked doing in their spare time, and Table IX shows what they put first in their spontaneous answer, as well as the other activities which they

TABLE IX.—*Leisure Activities*

	Nystagmus		Control	
	Main Interest	Other Activities	Main Interest	Other Activities
Garden, greenhouse, or poultry...	13	8	11	8
Joinery, cobbling, and similar hobbies	2	2	—	4
Taking part in sports or games, and walking	11	7	7	10
Choir or band	2	—	1	—
Work for union, chapel, or other group	2	2	1	2
Family outings, and travel	2	—	1	1
Watching football and other sports	9	12	12	9
Club and pub	3	4	5	7
Pictures	2	3	—	4
Reading	—	2	1	1
Doing nothing	4	—	8	—

mentioned. Twenty-one men with nystagmus and 19 controls liked gardening, though some of the nystagmus group had been forced to give it up because it meant stooping. Twenty-one in each group enjoyed watching football or other sports. These were the most popular spare-time occupations, but a variety of others, both active and passive, were mentioned. One man in each group spent most of his leisure time on trade union work. Twelve men with nystagmus and ten controls had three or more separate spare-time activities apiece. At the other end of the scale, nine men with nystagmus and twelve controls had scarcely any outside interests at all.

Two men with nystagmus and three controls seemed well below the average in intelligence. At the upper end of the scale there were some highly intelligent men in both groups, but the gradation to these from the rank and file was in small stages, and the differences could not fairly be judged subjectively. The general impression was that there was not much to choose between the two groups.

One man in each group combined high intelligence with an unusually strong and stable personality and an active interest in outside affairs. Among the other memorable characters was a man with nystagmus who summed himself up by saying that "the three best things in life are singing, dancing, and rearing flowers." One of the elderly controls, an original and enterprising man, was keen to discuss the history of wood-carving in various countries.

Two in each group were excitable and voluble men who seemed a good deal less stable than the rest. Four men with nystagmus and two controls were very negative in temperament, backward in social contacts, and lacking in drive. These include the two men who had spent most of their childhood in institutions; they both seemed also of limited intelligence and both had remained unmarried. Another of the single men with nystagmus is included here, and a married control whose wife managed all his affairs for him. But in both groups the majority of men were solid ordinary miners with no outstanding characteristics.

Discussion

To select a group of conditions with well-marked but relatively inexplicable signs and symptoms, and to call them

psychosomatic—as has happened in the case of coal-miners' nystagmus—is apt to have a number of results which are not always beneficial to the patients. Research into the physical aspects and prevention of the disease are impeded. Sooner or later it gets around among the people suffering from it that they are "neurotic" or "no good," and the same attitude is apt to infect both their employers and their doctors, with the result that once they are labelled or certified they are apt to drift without adequate medical management. The past history of coal-miners' nystagmus illustrates all these points. The pulse and respiration rates and blood pressures of men with this disease are higher than normal, and the reason for this is not immediately obvious. The previous study (Browne *et al.*, 1950) showed that five years after removal from the conditions which caused the disease their systolic blood pressures were normal, but their diastolic pressures were still significantly higher than those of the controls. On the other hand, as workmen and as family men they are not worse but, if anything, rather better than other coal-miners. Both investigations suggest that men who eventually contract the disease are, until this, rather better workmen than the others. This tends to support an opinion among mine managers that the disease attacks the more conscientious men. They live in the same sort of homes as other miners and have the same sort of interests. There is, however, a connexion between working in seams of intermediate height and the onset of the disease in susceptible men which appears to be unlikely to be due to chance.

It may perhaps be objected that the number of men seen is too small or the methods used are too coarse to display any differences between the groups. But if the test of life itself, so far as it can be simply measured, fails to reveal a difference between two groups of 50 men, they are surely, for practical purposes, identical. Workers (Ohm, 1916; Riesen, 1950; Browne, 1951) widely separated by both time and space have shown that nystagmus can be produced in animals, whose visual apparatus is analogous to that of man, by simply keeping them in the dark, and that they recover when replaced in the light. This finding, together with the repeated demonstration that men with and without nystagmus are alike in other respects, suggests the conclusion that the cause of the disease is somatic rather than psychological.

Summary

Fifty consecutive men with coal-miners' nystagmus, who were given certificates of disablement by the same certifying medical practitioner, are compared with 47 randomly chosen miners without the disease, matched in respect of age, detailed job, and colliery.

The medical histories, heights, and weights of the two groups were similar, but the men with nystagmus had slightly higher pulse and respiration rates and blood pressures. The nystagmus group did not suffer more psychological disease than the controls.

The men with nystagmus climbed their professional ladder a little more quickly and spent slightly more time at higher positions. They spent the same times in the different kinds of mine lighting, but had worked more in seams of medium height.

The men with nystagmus marry at the same ages, live in the same types of house, and have the same work preference and interests outside work as do men without the disease.

The results of this study confirm those of one made of men certified with the disease eight years before, and, when related to the experimental production of the condition, lend no support to the opinion that coal-miners' nystagmus is primarily a psychological rather than a somatic condition.

There is a relation between the development of the disease in susceptible men and working in coal seams of intermediate height—3 ft. to 4 ft. 11 in. (91 to 150 cm.).

Acknowledgments are due to the National Coal Board for an expenses grant, to the National Union of Mineworkers for help in the organization of the work, and especially to the miners who acted as the control group, many of whom made long journeys to come for examination.

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TREATMENT OF PERNICIOUS ANAEMIA WITH ORAL VITAMIN B₁₂ WITHOUT KNOWN SOURCE OF INTRINSIC FACTOR

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Several groups of workers have investigated the effect of orally administered vitamin B₁₂ in the megaloblastic anaemias. The majority of the reports have come from America, and include those by Berk *et al.* (1948), Spies *et al.* (1949), Hall (1950), Meyer *et al.* (1950), Conley *et al.* (1951, 1952), Glass *et al.* (1952, 1953), and Unglaub *et al.* (1954). British publications are those of Ungley (1950, 1951-2), and Girdwood (1953).

It appears from these reports that single oral doses of vitamin B₁₂ of less than 1,000 µg. have, in general, little effect, and that, while repeated daily doses of 50-100 µg. may cause some haematological response, the degree and length of improvement have been very variable. In some instances no responses were obtained. Spies and his colleagues concluded that a daily oral dose some 30 to 60 times that of a single intramuscular injection is necessary to obtain similar effect.

Ungley (1950) first showed that a single massive oral dose of 3,000 µg. of vitamin B₁₂ without any intrinsic factor was therapeutically effective in cases of pernicious anaemia

in relapse, and this was confirmed by Conley *et al.* (1951) and Chalmers *et al.* (1951). The haemopoietic effect of smaller doses of oral vitamin B₁₂ has been shown to be enhanced by giving it with normal gastric juice and other sources of intrinsic factor (see Ungley, 1950; Glass and Boyd, 1953; Latner *et al.*, 1953). Haematological responses have also been reported in cases of pernicious anaemia treated with oral aureomycin (Lichtman *et al.*, 1950), and oral and parenteral penicillin were found to be effective in the megaloblastic anaemias described by Foy *et al.* (1952). If the intrinsic factor present in normal gastric juice acts by protecting vitamin B₁₂ from utilization by intestinal bacteria, as was indirectly suggested by the work of Ternberg and Eakin (1949), these antibiotics may have increased absorption of the vitamin by alteration of the bacterial flora. Ungley (1950) tried to prove this by introducing vitamin B₁₂ into a washed portion and a partially sterilized portion of the intestines of patients with pernicious anaemia in relapse, but no responses were obtained.

In Ungley's investigations the patients were given oral doses of vitamin B₁₂ when fasting, and this condition was strictly observed in the following experiments, in which oral vitamin B₁₂, in amounts ranging from 9,000 µg. in a single dose to repeated daily doses of 50 µg., was administered without known source of intrinsic factor to cases of megaloblastic anaemia in relapse.

Material and Methods

Twelve of the patients studied were suffering from pernicious anaemia in relapse, with typical blood values, megaloblastic marrows, and histamine-fast achlorhydria. Three others had undergone gastrectomy, but resembled cases of pernicious anaemia in other respects, including their ultimate complete response to treatment with vitamin B₁₂. No free hydrochloric acid was found when test meals were attempted on these patients, and there were no symptoms or signs of steatorrhoea. Fat-balance studies were not made. Oral vitamin B₁₂ was given after different periods of observation to ensure that there was a maintained fall in pre-treatment blood-count values; Case 11, who was known to have suffered from pernicious anaemia previously and to have responded to parenteral liver extract, did not want treatment restarted "until it was necessary," and provided for us a prolonged period of control observation.

When in hospital, the patients were placed on a diet from which offal was excluded, with restriction of eggs, meat, milk, and cheese. Patients receiving single amounts of oral vitamin B₁₂ were given the dose when fasting at 9 a.m., and no food or drink was permitted for four hours afterwards. When daily doses were employed it was found convenient to give the vitamin at midnight, no food or drink being taken between the hours of 6 p.m. and 6 a.m.

TABLE I.—Cases of Pernicious Anaemia and Post-gastrectomy Megaloblastic Anaemia treated with Single Oral Doses of Vitamin B₁₂

Case	Age and Sex	Single Dose Oral Vitamin B ₁₂	Initial Blood Values (Pre-Treatment)			Values on 15th Day after Single Dose of Oral Vitamin B ₁₂			Reticulocyte Response			Marrow after Treatment. Day of Test in Parentheses
			Hb G. %	R.B.C. Mills. per c.mm.	P.C.V. %	Hb G. %	R.B.C. Mills. per c.mm.	P.C.V. %	Max. %	Day of Maximum	Type of Response	
1	53 F	9,000 µg.	9.9	2.30	29	12.7	3.44	40	11.4	5	Sharp	—
2	70 F	6,000 "	5.2	1.14	15	8.9	2.80	31	22.5	5		—
3	38 M	3,000 "	11.1	2.35	30	13.9	3.80	40	13.0	5		—
4	65 M	3,000 "	8.1	1.95	23.5	10.7	2.80	32	32.0	5		Normoblastic (6)
5*	56 F	3,000 "	7.4	1.55	23	11.1	2.95	38	32.0	6		Marked increase of normoblasts. Megaloblasts disappearing (2)
6*	40 M	2,000 "	11.5	2.80	34	13.3	3.70	39.5	9.5	5	Low flat	Some increase of normoblasts, but still many megaloblasts (3)
7*	47 M	1,000 "	6.8	1.42	19	7.1	1.50 (9th day)	21	8.6	6		

* Megaloblastic anaemia occurring in patients who had undergone gastrectomy.