THE DISEASE KNOWN AS MINERS' NYSTAGMUS.

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Introduction.

Definition.

Coal miners' nystagmus is a condition in which there is impairment of health and resulting impairment of working capacity. It is an occupational disease which is accompanied by definite signs which are characteristic of the ailment. The name NYSTAGMUS which has been given to the condition implies that the chief signs are associated with the eyes, in that, nystagmus, or oscillation of the eye-balls, is always present. The disease is by no means, however, limited to the eyes. It is now realised that the condition is a general one. A syndrome of signs and symptoms accompany the nystagmus, which indicate that there is a general disturbance, organic or functional, of the central nervous system.

The disease known as miners' nystagmus is one of the commonest causes of incapacity among underground workers. When present in a marked degree it may totally incapacitate a man from work of any kind. Cases of lesser severity may cause a man to find other employment on the surface. It may be, and often is, present, but does not manifest itself as a definite disability, but I have no doubt it may diminish a man's working capacity even if he continues at his old employment. In many cases it is present in its initial stages unknown to the man himself and he states it does not

handicap him at his work. I have observed many cases in which the disease could thus be detected in its initial stages. In some cases it appears to be a progressive condition - in others it remains stationary or even retrogresses in which ~~cases~~ case recovery takes place. Its progression is very variable and is modified by various factors. Injury or illness may rapidly increase its severity, or an absence from work underground may aggravate it in some way, so that on a return to work underground its development is accelerated.

There is no more distressing malady from the workman's point of view. The insidious development of the condition and the prolonged absence from work necessary in a severe case, with its consequent worry and anxiety in the case of a man with a family, are only two of the factors which make it a serious condition. From the medical point of view it is also a discouraging condition. Treatment is difficult in view of our ignorance as to a definite cause. Much work has been done and much money spent on the preventive side but, so far, we must admit that we have not received any tangible results. Very little has been done on the curative side.

The disease is a widespread one in mining areas. Clinical material is abundant and, no doubt, many men are

searching for knowledge both as regards cause and cure. We have a vast amount of controversy as to cause or causes, but one does not hear or read much discussion about treatment. There are many severe cases, either totally or partially incapacitated, and the general line of treatment seems to consist of nothing but advice as to obtaining some form of "suitable employment" so that our patients may avoid the evils of idleness or introspection. This advice, combined perhaps with some form of general tonic or nerve sedative treatment, sums up the position and appears to be the general method of treatment adopted.

I, personally, am chiefly interested in the workman himself, but one must not lose sight of the fact that the owners and the State are also losers by this widespread disease. My interest in the subject has been aroused through my work among a mining population over a period of about nine years. During that time I have had continually under my care some cases of this condition - as old cases have drifted off or recovered, new cases have come along to take their places. The length of the illness and the incapacity due to it - the distress in which it involves the patient - and our helplessness from a medical point of view in dealing with it - all make the condition an important one which must appeal to the medical man who meets with it at all frequently.

The signs and symptoms of the disease are quite

definite, but even these seem to have undergone some change recently, at least, a change in the order of their importance. We do not now regard nystagmus or blepharospasm or both as the sine-qua-non of the condition. There are subjective signs which are possibly more important from the point of view of working capacity than mere oscillation of the eye-balls. I have known a number of men with severe oscillation who preferred to continue at work. They definitely state that they are well aware of the condition, but that they have little or no discomfort at work. The signs and symptoms are as obscure as the cause of the condition. We can offer no explanation as to why they should be present.

My object in this paper is to set out an account of the condition known as miners nystagmus based on my experience of 65 cases met with in this part of the Cannock Chase coalfield during the past nine years. I hope to be able to give a number of observations made on these cases, which seem to indicate a new line of investigation, which may help to elucidate some points in connection with the etiology of the condition. These observations also seem to indicate that in following this line of investigation much information may be gained from the patient himself. Most investigators of this condition appear to have concentrated on the man's environment while at work to the complete exclusion of the subject himself. This remark can equally well be applied to the prophylactic measures which

have been so far adopted. It seems to me that this neglect of the patient himself is reflected in our helplessness in treating the condition.

Many theories have been advanced as to the cause of the condition. Is the cause due to some exogenous or endogenous agency? Must this condition be included amongst the deficiency diseases? I shall attempt to give some observations which help towards the solution of this problem. With regard to treatment one feels that in the present state of our knowledge treatment can only be palliative. But much can be done even in this sense to alleviate the discomfort of the condition.

There can be no doubt that so far the patient has been seriously neglected. We have no recognised form of treatment - no definite lines of treatment which should be followed - and the result is that treatment is too often neglected.

SURVEY OF THE EVIDENCE OF VARIOUS WRITERS.

REGARDING THE ETIOLOGY OF THE CONDITION:

The report and findings of the miners nystagmus committee of the Medical Research Council may be taken as typical of the views expressed by the majority of the writers on the condition. Lamps and lighting take precedence in the list of causal agents. The conditions which obtain in a coal mine must be such that the workmen are called upon to perform their work under lighting conditions which, at best, can only be very deficient. On descending the mine and as soon as his eyes have become accustomed to the poor light, the miner must find his way to the stalls in a poor light. This is, of course, a severe undertaking as it frequently involves walking in strained positions for long distances. The distance in this particular coalfield may be anything up to two miles. On reaching his stall one finds him engaged in what is very hard and laborious work of a very difficult nature, in the sense that he has to work in very strained positions, and in addition to this, he works in light which is defective and sometimes very poor. It has been proved many times that the men who are most likely to get nystagmus are the men who work at the coal

face. This has been borne out by the cases under my observation, although in some cases other underground workers have been affected. The black surface of the coal reflects very little light or as Mills says "coal is black and crystalline - two qualities which are of great importance in the production of nystagmus".

In man the "fixation object" is seen by direct or central vision. This image is formed in the Macula Lutea, the point of clearest vision at the centre of the retina. Much of the work of the coal-getter requires this accurate fixation and in order to get central fixation when working in difficult postures he must strain considerably his ocular muscles. If his central vision is imperfect then he sees by indirect vision - i.e. by the rays of light falling on some peripheral part of the retina. This, of course, means that his vision is less clear or indistinct and it is characteristic of the nystagmus worker to say that he cannot see objects clearly - they are blurred or ill-defined. He cannot fix an object definitely - lights appear to be dazzling or dancing in a circle before his eyes.

Some writers think that ocular defects are present in a large number of cases and this is an important contributory factor in the production of the disease. We have no knowledge of pre-work abnormality of the eyes, the underground worker is not medically examined before

commencing work in the pit. In this district, however, within the last few years, men have been optically examined before going underground, but we cannot expect to have any results from this for many years. The fact also that school children are ocularly examined and treated by the educational authorities may result in the elimination of the boy with defective vision from young colliery employees. This may bear some fruit in the years to come in the shape of a reduction in the incidence of nystagmus.

Many writers both in this country and abroad think that the eyes and deficient illumination are the chief origin of the condition. There is much evidence in support of this and the findings of the Medical Research Council are in agreement with this. Some writers consider that excessive indulgence in tobacco and alcohol are also agents in the cause of the condition. It may be that these simply act as toxicants resulting in reduced vitality and causing delay in recovery from the condition once it has become established.

Some writers, and in particular Dr. Freeland Fergus, take a contrary view. They state decidedly and with good reason that neither defective illumination nor refractive errors have any bearing on the incidence of the disease, and that the whole subject must be reinvestigated. Freeland Fergus points out that a miner with a high error of refraction can mine coal quite easily. He states that

the important visual factors in coal mining and in other manual labour are (a) field vision (b) alignment (c) actual distance. Visual acuteness, in the ordinary acceptation of the term, is not involved in manual work.

Robson, in a recent contribution, attributes the cause to a carbon monoxide poisoning due to the presence of this gas in coal mines and produces much evidence in support of his contention.

More recent work suggests that the cause of this condition may be an endogenous one. It has been suggested that this disease is due to some endocrine disturbance or that it may be due to some endogenous intoxication. Some writers have suggested that the disease should be grouped amongst the deficiency diseases. Non-nutrition foods such as tea, white bread, etc. coupled with defective teeth and dyspepsia etc. have been added to the causal agents. Is the condition due to or is it aggravated by some vitamin deficiency? This may also have an important bearing on the period of recovery. The miner suffering from nystagmus, who is receiving compensation, is in a very poor position economically. He cannot afford expensive foods and my experience of miners' households seems to indicate that their ignorance with regard to suitable foods is greater than the ignorance in this matter met with in other artisan communities. It may be that their lack of fresh and suitable food is seriously delaying their recovery.

In meeting and dealing with these cases it had occurred to me that this condition more resembles a nutritional disorder than any other condition and it is chiefly with this idea in mind that I have tried to collect some evidence regarding this condition. My observations are, of course, limited. To reach any definite conclusion a very large number of cases would have to be examined - a much larger number than can be met with in an individual practice. Even the small number of cases investigated appears to suggest that some definite conclusions may be reached by investigating this condition along the lines suggested. I am convinced that if we will think more of the subject himself and less of his working environment, we shall obtain some information, which will help towards the elucidation of the etiology of this disease.

A REVIEW OF A SERIES OF 65.CASES.

During the period in which I have been specially interested in this subject, I have made observations on 65. cases. These cases have been met with in the course of my ordinary work and most of them have been under my care and observation for prolonged periods. I have met with the condition at its commencement and in many cases have followed its course throughout. I will give later the signs and symptoms met with in these cases, but I may state here that all the cases had oscillation of the eye-ball present in a greater or less degree. I have regarded this sign as the sine-qua-non of the diagnosis.

The series includes all degrees of severity. The slightest form being the case in which oscillation of the eye-ball is definitely present, but apparently gives rise to no symptoms and is not disabling. In these cases the man continues at work and appears to have no disability. One only finds this type accidentally. Patients do not consult us in this stage of the disease and one only meets it in patients who come under treatment for some intercurrent condition. It would be an interesting and valuable piece of information, if one could find out the percentage of under-ground workers who show the condition in a mild form. It is,however, impossible to obtain this information. A

routine examination of colliery workers would not give any reliable information. We have no infallible test for the detection of nystagmus and I have no doubt that the early nystagmic, who is aware of the condition, can, and does, conceal it. The majority of the men dread it and they equally dread the incapacity and the economic difficulties which arise, when they are forced to go on compensation. It is unfortunate that we cannot obtain more information regarding these early cases. The course of the disease and the result of treatment could very well be observed in these early cases and in addition, the early detection of the condition might enable us to adopt satisfactory prophylactic measures, at least towards the elimination of the severe and prolonged case.

CASES OF MILD DEGREE.

I have observed 18. cases of the mild type - if one may call it such. It is perhaps better described as the incipient type. In all these cases slight but definite oscillation of the eye-ball could be detected. All these 18. cases were found in patients who were under treatment by me for some illness or accident. No sign with the exception of oscillation of the eye-ball, could be detected and in no case did the patient make any complaint which would lead me to suspect the presence of nystagmus. In no case did the patient consult me because of his eyes.

AGE OF OCCURRENCE.

On dividing these mild cases into age groups, one finds as follows -

3. cases between the ages of 20. and 30. years.
3. - - - - - 30. - 40. -
8. - - - - - 40. - 50. -
2. - - - - - 50. - 60. -
2. - over 60. years.

It is thus seen that although the largest number of cases occur between the ages of 40. and 50. years, there appears to be no relation between the development of the disease and the patient's age or the length of time the patient has worked underground.

In none of these cases was it considered that the man was suffering from miner's nystagmus of sufficient severity to incapacitate him in any way, and all cases, with one exception, returned to work underground. The exception was that of a man who came under treatment for an injury, and this injury necessitated his finding employment on the surface.

LATER HISTORY.

The later history is interesting in the other cases. In 3. cases - all in the age group 40. to 50.- the condition progressed, until eventually the men became totally unfit

for work on account of miner's nystagmus. The period which elapsed between the time of the original diagnosis of the condition and the total incapacity was, in the three cases, 3. years, 2. Years, and 18. months.

In 13. cases the men continued at their previous employment in the pit and none of them have, so far, shown any further signs of the disease. The period which has elapsed in these cases since the original diagnosis was made varies from 12 months to 8. years, the average for the 13. cases being nearly 5. years. It is thus seen that the condition may be present in a mild or quiescent form - that it is not necessarily a progressive condition. In a few cases it progresses but in many cases early recovery takes place.

ASSOCIATION WITH OTHER CONDITIONS.

The intercurrent condition from which these men were suffering when the nystagmus was noted was as follows -

Influenza 7.

Respiratory diseases 2.

Myalgia and allied conditions 3.

Gastric diseases I.

Eye disease I. (a case of conjunctivitis)

Accidents 4.

No information can be gained from these conditions, but it has always occurred to me when dealing with miners, that if nystagmus or the potentialities of nystagmus are present in

any case, it usually shows itself when the man is away from work for some time. It either becomes obvious when the man is actually away from work, or within a short period of his return to work. Men who have previously suffered from nystagmus and who return to work underground express this opinion themselves. They state that the eyes are always worse after they have been away from work for some time. It is also noticed in severe cases that the condition appears to be more severe for some time after ceasing work, before improvement begins to take place.

SEVERE OR CHRONIC CASES.

The remaining 47. cases were severe cases of miners' nystagmus and in all cases it was considered when the patient was first seen, that he was quite incapable of doing any work. It is a very difficult matter to decide in these cases the extent of a man's disability, since the symptoms seem to bear such a variable relation to the amount of oscillation present. It is equally difficult to state when recovery has taken place. The man's "willingness to work" seems to be an important factor. The personal factor is certain to creep in when such a disability as nystagmus is under consideration. The nervous symptoms associated with this condition take our minds at once to the familiar "neurasthenic" condition met with in all walks of life.

AGE OF OCCURRENCE:

On dividing these severe cases into age groups, we find -

3. cases between the ages of 20. and 30. years,

7. - - - - - 30. - 40. -

22. - - - - - 40. - 50. -

12. - - - - - 50. - 60. -

And 3. cases over 60. years of age.

These figures indicate the same finding as the mild cases viz. that the largest number of cases occur in men between the ages of 40. and 50. years, but that other ages may also develop the disease.

PERIOD OF INCAPACITY.

All these cases were regarded as totally unfit for any work for a varying period of time. This period varies from a minimum of 3. months to a maximum of 26. months, the average period for the 47. cases being II. months. At the expiration of what may be regarded as the period of total incapacity, it was not considered that the men were fit for work underground, but in most cases they were referred for light or suitable employment. This is usually interpreted at a colliery as surface work. The period of complete recovery - if complete recovery ever takes place - is a difficult matter to investigate. In many instances the partially recovered case of nystagmus is not given employment at a

colliery. He receives a lump sum in settlement of his claim for compensation and he drifts off into other employment, and does not consult his doctor again. In cases who are employed at the colliery, their condition is usually so much better that we only see then at very rare intervals or not at all. One is also handicapped by the fact that we have no reliable guide, as to when recovery can be held to have taken place. The oscillation of the eyeball may cease as a clinical entity, but other signs and symptoms may persist for prolonged periods. I have observed a case who had ceased underground work 10. years ago and who still had slight but definite oscillation present, but who had no other signs or symptoms present. I have observed many cases where oscillation has ceased in various periods under 12. months, but who still complain of various disturbing symptoms such as giddiness and headache.

These men appear to be perfectly genuine in their complaints and in some cases are sufficiently well known to me for me to realise that they do not exaggerate their symptoms. The difficulty seems to be - many cases of mild nystagmus continue at work with no inconvenience, severe cases who have partially recovered are incapable of the same kind of work, and appear to suffer a good deal of discomfort.

Mild cases with oscillation present have no symptoms; severe cases, in which oscillation has ceased complain of

severe symptoms. The difficulty of deciding when recovery is complete is also shown by the after history of cases who have returned to work underground. Included in my series of cases are five of the severe type who returned to work underground again. The period of total and partial incapacity in these cases varied from 10. months to 3. years. These cases were presumed to have completely recovered and in two of them, an ophthalmic surgeon certified that their recovery was complete. In two of them the condition recurred with greater severity after a period of $2\frac{1}{2}$. and 4. years underground. Both these cases are under treatment by me at the present time. The other three cases have been working underground again for periods of 2. to 3. years and all of them have the disease in a well established form again. The latter three cases are still at work underground, but I anticipate that all of them will have to cease work underground at some future date. These five old cases are the only ones which I can trace in my series who returned to work in the mine again and it appears a significant fact that all five of them have again developed the disease. This seems to indicate that the disease does recur when a patient, who has apparently recovered, returns to the old conditions. It may be argued that their recovery was incomplete, but, as I have said previously, we have no means of verifying this. I have no evidence in my series of cases of men who were away from

the underground conditions for a longer period than three years, and who have returned to work underground again.

HEREDITY

It has been frequently stated that heredity has some bearing on the susceptibility to nystagmus. In this connection I note that in my cases the following instances occur -

(I) Two brothers both had severe nystagmus. In this case there was no previous family history.

(2) A similar case of two brothers. In this case the father had also given up colliery work on account of nystagmus.

(3) One patient included in my series stated that his three brothers and his father had all been disabled with nystagmus.

These cases indicate that heredity does play a part in the development of the condition, but it does not appear to be a very important one.

TYPE OF WORK AND LIGHTS USED.

In this connection I do not find any evidence that either the type of work or the type of light used, has much influence on the condition. The important factor is, that all underground work has its peculiarities :- very hard work in difficult postures and in defective

artificial light. Included in my series of cases are firemen - or underground foremen, timberers - or men who have to repair the underground roadways, and stallmen - or the men who actually win the coal. The latter class predominate, but one expects this, in view of the fact that the number of men who are employed in the other two groups must be numerically much smaller than the number comprising the third group.

The same remarks apply to lighting conditions or rather to the type of light used. Some cases had been using naked lights (candles or oil) for many years, others had been using oil safety lamps for many years, while recently I have met with a few cases who have used electric lights. It is perhaps premature to include the latter type of light, as in this area an electric system of lighting, or a system of using electric lamps, has only obtained for about three years. This has been introduced with a view to providing the miner with a better and stronger illumination while at work, and consequently with a view to lessening the incidence of nystagmus. Nystagmus which I have seen in men who have been using electric light has occurred in men who, for long periods previous to the introduction of electric light, had used the other and less efficient methods of lighting.

SIGNS AND SYMPTOMS.

Principal points mentioned by writers on this condition.

The two definite signs which are characteristic of the condition are -

(a) Nystagmus - oscillation of the eye-balls.

(b) Blepharospasm - involuntary twitching of the eye-lids.

Previous to 1913. the presence of these signs was essential for the establishing of a case for compensation. In a schedule to the Compensation Act (June 30th. 1913) we find the condition altered to "The disease known as miners nystagmus whether occurring in miners or others and whether the symptom of oscillation of the eye-balls be present or not." This addition to the Act seems to denote the change which had taken place in our conception of the condition. The earlier observers regarded it as a local myopathy of the muscles of the eyes, whereas the modern tendency is to regard the condition more as a general neurosis with special manifestations in the oculomotor system. Altered nerve reflexes and tachycardia are now included by most observers as other signs to be noted. Various subjective symptoms - giddiness, headache, sleeplessness, photophobia, night-blindness, and

mental depression - are also included. It has been noted by various observers that these "nervous" symptoms have no definite relations to the degree of oscillation present. Cases with severe oscillation may not show these symptoms to any marked extent, while neurosis may be very marked in cases with little or no oscillation.

Signs and Symptoms in my series of cases.

All cases included in these observations had oscillation of the eye-ball present in a greater or less degree. From observations of the 65. cases referred to above, I have compiled the following resumé of the signs and symptoms to be met with in the ordinary severe case. Incipient, or mild, cases are rarely aware of the condition. They make no complaint and the only sign to be detected on examination of the patient, is slight oscillation of the eye-balls. The condition in this state is no disability and treatment in the present state of our knowledge is unnecessary. It disappears spontaneously in the majority of cases.

VERTIGO OR GIDDINESS.

This is, in my opinion, the chief symptom from the workman's point of view. It is this symptom that results in incapacity. Its onset is frequently sudden although in some cases its development may be gradual. When of gradual onset it steadily becomes more severe, until

eventually it becomes disabling. It is a persistent symptom once it has become established and in many cases it persists for some time after oscillation of the eye-ball has ceased. I give the following as a typical case -

F. W. - aet. 45. - a stallman who has worked underground for 30. years. For 20. years he has been a stallman but during the past five years he has been "timbering." He knows that he has had trouble with his eyes for many years and states that his eyes rolled at times. I have personally known this man for the past five years and during the whole of that time he has had gross nystagmus. On looking at me his eyes have rotated very badly. He always stated that he knew he had nystagmus, but it did not inconvenience him greatly and he preferred to continue at work. On Aug. 15th 1928. he consulted me complaining of giddiness of about a week's duration. This giddiness had come on suddenly while at work and had continued since its onset. He noticed it first on bending forward or on moving from one position to another. On looking up while at work, it became very severe and he had to hold something to prevent him falling down. On being questioned as to his eyes, he said they appeared to be no worse than usual. The man did not realise that his nystagmus and vertigo were one and the same condition.

This is a fairly typical history in a case of severe miners nystagmus, although in some cases the onset is not so sudden and severe. A frequent complaint is of giddiness, which is only noticeable on bending forward. Patients describe it as a sensation of falling forward on to the face.

One can realise the importance of this symptom in the case of a miner. Immediately on descending the mine he must adopt a stooping posture in order to proceed to his work. This immediately aggravates the giddiness and may make it quite impossible for him to proceed. The same applies while he is at work. He is never able to assume the normal upright position, and all other positions aggravate the giddiness. We also must appreciate the importance of this symptom in the case of men who have partially recovered. Vertigo may persist after oscillation has ceased. Partially recovered, usually means capable of light or suitable employment. There is no light work at a colliery and suitable employment in these cases is usually construed as surface work. I, personally, when asked for an opinion, usually interpret suitable employment as "surface work which does not involve stooping."

INABILITY TO SEE DISTINCTLY, is also a frequent complaint. This defect in vision is, in all cases, described as inability to see in a dim light. It is best described in the patient's words as a "dazzling or a dancing of lights."

When he looks at a light, he does not see a well defined light but a circle of lights moving round. On trying to read, the print is steady for a time, but it soons begins to move and flicker and reading is impossible.

When walking in the dark or at dusk, some patients reel "like a drunken man."

HEADACHE: This is also a frequent complaint. The commonest site of the headache is in the occipital region - a dull aching pain in the back of the head. Supra-orbital and temporal headaches also occur.

PHOTOPHOBIA. Severe discomfort is complained of in every case in strong artificial light or in bright sunlight. This is usually described by the patient as "pain behind the eyes."

SLEEPLESSNESS is a common and disturbing feature, and calls for treatment in dealing with this condition.

EXAMINATION OF THE PATIENT.

On examination, cases of the ailment present many striking features. The look of the patient is characteristic. In a well developed case, the head is held slightly extended on the trunk and the eye-lids are partially closed. This is the position which gives greatest relief. The position of the eyes is one of slight convergence and, relative to the head, the position of slightly looking downwards. The patient presents an anxious look. He is usually pallid - a condition common to most miners.

NYSTAGMUS Oscillation of the eye-ball is present or can be elicited. In some cases the oscillation is obvious - a continuous rhythmic movement of the eye-balls, when the patient tries to fix anything, no matter what the position of the object may be. In other cases it is not obviously present, but it can easily be elicited by a few simple tests. The usual test is to make the patient follow with his eyes the examiner's finger which is moved about in front of the patient. Sometimes the oscillation can be noticed when the eye-balls are moved to either side, but it is usually most marked when the patient looks upwards. A test which I have found very useful is the following -

The patient is seated on a chair and he is made to bend forward till the head is between the knees. While in this position the examiner moves the patient's

head from side to side a few times and then tells the patient to sit up and look up towards the ceiling. Oscillation of the eye-ball, if present, then becomes apparent.

Occasionally it may be necessary to place the patient in a dim light and shine a bright light into the eye e.g. - with an ophthalmoscope, before one can detect oscillation. In all cases in which there was total incapacity, I have had no difficulty in detecting oscillation in ordinary day-light when they presented themselves for examination for the first time.

The oscillation of miners' nystagmus is quite characteristic. In cases which are well marked, I have found that all were rotatory in type. In the milder cases where movement is slight, then it is difficult to say whether the movement is rotatory or in one plane only, but I am of the opinion that all cases are rotatory.

BLEPHAROSPASM: This is an involuntary twitching of the eye-lids. This sign is variable and, in my experience, is seldom to be found in a case when originally seen i.e. in a man who presents himself for examination while he is still working underground. It is a much commoner sign in cases who have not been at work for some time. It appears to develop in a case of nystagmus who has been out of the pit for a short period. This, of course, at once suggests that blepharospasm develops in a case of nystagmus, when the eyes,

already affected, are called upon to accommodate themselves to a greater degree of light than they have been accustomed to for a long time. This symptom is referred to by some writers as "nystagmus of the lids."

HEAD-NODDING: This is a much commoner sign than blepharospasm and is almost uniformly present in cases of the disease. It consists of a continuous to and fro movement of the head. It might equally well be referred to as "nystagmus of the head." Occasionally the sign is well marked and obvious. In cases in which it is not obvious it can usually be elicited by the following simple test. The patient is told to flex his head on the chest while the examiner places his hand on the occiput and keeps up a steady pressure. The patient is now told to raise his head to the normal position. If the pressure on the occiput be kept up, then clonic movement of the head and neck become apparent, when the head reaches the normal position. A similar clonus can sometimes be found in the muscles of the arms, if the forearm is flexed to a right angle and pressure is exerted on the hands towards the position of extention. This is, however, unusual and I have only detected it in two severe cases. Ankle clonus I have never been able to detect in a case of miners' nystagmus.

REFLEXES: The deep reflexes are increased. In all cases the knee jerks are hyper-active and an increase in other

corresponding reflexes can usually be observed.
General tremor is nearly always present and, if not present at the commencement of the incapacity, it usually develops after ceasing work. The tremor is very well marked during a detailed examination of the patient. These cases usually get excited and consequently examination is difficult.

A sign simulating a Romberg is also present. It is best shown, with the patient standing in the usual way, but with his eyes open and looking toward the ceiling. A swaying motion can then be detected.

TACHYCARDIA: An increased pulse rate is generally present. The pulse, while resting, may be anything from 100 to 150. A typical pulse rate is 120/148. the exercise test consisting of six bends forward. In all my cases the heart sounds and rhythm have been normal, so that the only abnormality is an increase in the rate of contractions.

BLOOD: It has been observed by writers on this condition and by Barton especially, that men suffering from this condition have a deficient amount of haemoglobin present in the blood. I have taken no actual measurements of haemoglobin percentages, but it is a noticeable fact that these men show signs of anaemia. The general appearance of the skin and mucous membranes indicates this. Barton states that the percentage of haemoglobin present in cases of miners' nystagmus is, on an average, 75% of normal.

NIGHT - BLINDNESS This is an important symptom in cases of coal miners' nystagmus. I do not think we can refer to it as Nyctalopia or Hemeralopia. Neither term seems to apply to condition. Day-light or strong artificial light causes distress, but objects can not be seen distinctly in deep shade or twilight. The term Nyctalopia, is the more suitable one of the two. I have found in all cases which I have examined that vision is definitely defective in a dim light.

In estimating this I have followed the simple method described by Pichard and Lloyd,which is as follows -

(1) The patient's vision in each eye is taken with Snellen's Test Types in day-light or good artificial light.

(2) Candlelight test In this test, the patient is placed in a dark room with a lighted candle in such a position that the patient and the candle are each at a distance of 10 ft. from the type and 5 ft. from each other. (Pickard and Lloyd used metres instead of feet. Limitation of space made it necessary for me to work in feet.) Under these conditions I have regarded as normal, the ability to read the type 6/15 and this I express as 10/10 or normal. If the patient could not read this type, then the candle was moved towards the type till he could do so and the fraction

expressed as -

Distance of candle from type in feet

10.

The light is then brought back to 10 ft. and the patient moved forward till he can again read. This is expressed as -

Distance of patient from type in feet

10.

In carrying out these tests it must be recognized that no satisfactory test of vision can be taken while the patient's eyes are moving, and in carrying out these tests I have always endeavoured to make my observations when the eyes were steady. With an intelligent patient and with patience on the part of the examiner, satisfactory and reliable observations may be made. In all recent cases of miners' nystagmus where I have carried out the test, I have obtained a positive result i.e. I have found that in all cases of sufficient severity to incapacitate from work, night-blindness was present. Their vision in a dim light was definitely defective.

The following table shows some typical cases taken at random from my series. All these observations were made in recent cases - two cases who were actually at work underground - 3 cases who were under examination because they could no

longer continue at work - and the remaining two cases after periods of 6. and 8. weeks out of the pit.

Initials & Age.	When examined.	Vision by daylight.		Candlelight Test. Light moving.		Patient moving.	
		R.	L.	R.	L.	R.	L.
J.F. 38.	On ceasing work.	6/6.	6/ 6.	3/10.	6/10.	4/10.	5/10.
T.D. 28.	6.weeks on surface work.	6/6.	6/10.	3/10.	2/10.	6/10.	2/10
F.W. 45.	On ceasing work.	6/6.	6/6.	7/10.	6/10.	6/10.	5/10
F.D. 44.	-	6/6.	6/6.	2/10.	4/10.	4/10.	4/10.
J.W.L. 40.	At work.	6/6.	6/10.	5/10.	4/10.	5/10.	5/10.
E.C. 48. with glasses.	-	6/6.	6/6.	8/10.	7/10.	7/10.	8/10.
J.H.B.28.	8 weeks after ceasing work.	6/6.	6/6.	7/10.	7/10.	5/10.	4/10.

In this connection I have also tested a number of miners who were not suffering from nystagmus - miners whom one could regard as normal. In these cases I have obtained the interesting and expected result that their vision in dim

light is very acute. In this test I regard the ability to read 6/15 with each eye, as normal, but I found that a miner with normal vision could read 6/6 or 6/10 with each eye, under the conditions of the test.

These results clearly indicate that in cases of miners'nystagmus, a condition of night-blindness is present.

This symptom may not be met with in old cases. I have carried out the test in a few old cases who were presumed to have recovered from the condition and have found that, in these cases, recovery from night-blindness has taken place. I have not been interested in this particular symptom for a sufficiently long period, to be able to state how soon recovery takes place, or how long it takes for this symptom to disappear, but I believe its presence, or absence, forms a useful indication as to whether recovery has taken place or not.

LIGHT SENSE:

Percival defines night-blindness as diminished light sense, which is the faculty of recognising different luminous intensities. It has been suggested by Percival, and others, that some useful information could be gained by observations on the light sense in these cases. Recently my attention was directed to this aspect of the subject by reading a paper by Percival on the light sense, and I have since carried out a few observations in this connection.

I have used Percival's method and simple apparatus. The apparatus consists of black and white discs with white and black sectors of various sizes on them. These discs, when rotated on pins, show grey circles of various intensities. The patient's ability to distinguish these circles gives us a reading for his light minimum and light difference. I have not been able to obtain observations on the light sense in a large number of cases, but in the few cases in which I have observed it, I obtained some striking results. As to whether these results will be verified by a large succession of cases, is a difficult matter to predict, but a large series of observations of the light sense in cases of miners'nystagmus, would doubtless yield some valuable information.

LIGHT MINIMUM OR L.M.

I have carried out this test in eight cases who were actually at work. All were severe cases of miners' nystagmus, with oscillation of the eye-balls and other signs definitely present. All of them were working underground at the time of examination. In 6. of these cases, the patient's light minimum value was 200. and in the remaining 2. cases it was 100. - using the various values assigned to the discs by Percival. These figures appear to indicate that the light minimum in recent cases of this disease is at least normal.

It has been recorded that in older cases, that is, in

cases who have ceased work underground, the light minimum is reduced. I have been able to confirm this in five of the above cases. These five cases ceased work underground after my original records of their light minimum had been taken. The after history of these five cases is, as follows -

	L.M. in each eye on ceasing work :		L.M. after 5 or 6 mths out of pit.	
	R.	L.	R.	L.
(1)	200.	200.	100.	50.
(2)	200.	200.	100.	100.
(3)	200.	100.	50.	50.
(4)	200.	200.	100.	100.
(5)	100.	100.	50.	50.

It is thus seen that a reduction in the light minimum, in all cases, has taken place during the first 6 months away ~~say~~ from work underground.

The remaining three cases are also interesting. All of them are still working underground and the period of time which has elapsed, since the original record of their L.M. varies from 3.to 6.months. I have again carried out the test in these cases and find that they all retain their previous L.M. sense. There has been no reduction in the case of men who have continued to work underground.

This seems to indicate that some change takes place in the light minimum sense, when a man with nystagmus ceases to work underground. Whether this change also occurs in the non-nystagmic miner, I have not, so far, been able to investigate.

In older cases still, who have been away from underground work for long periods, the light minimum sense returns to normal. I have been able to find four old cases of nystagmus who were now at work on the surface and their L.M. values are as follows -

Period since ceasing work underground.		L. M. R.	L.
(1)	5.years.	200.	200.
(2)	6.years. (2nd. attack)	100.	100.
(3)	4.years.	200.	200.
(4)	4.years.	200.	200.

I have also carried out the test in a number of non-nystagmic miners and in no case have I found any deviation from the normal. All had values of 200. in each eye and could differentiate the circles without any difficulty.

In the few cases which I have been able to investigate it would thus appear that the L.M. sense undergoes some striking variations in cases of miners' nystagmus. While

working underground this sense is normal - on ceasing work underground there is reduction in the L.M. sense and as recovery takes place the L.M. sense returns to normal. This conclusion is in agreement with the findings of Percival.

LIGHT DIFFERENCE OR L. D.

This test I have carried out in the same cases, with results which are very similar. The light difference in recent cases who are still at work underground, does not deviate from normal. After a period of surface work, or rather absence from underground work, the L.D. is reduced. After a prolonged period on the surface the L.D. again returns to normal. A point of interest in my observations on L.D. is, that although one may find a normal L.M. in partially recovered cases, who still have a small degree of oscillation present, the L.D. in these cases is still sub-normal. It appears to take a longer period for the L.D. to recover than for the L.M. to recover. I have observed three cases of severe nystagmus who are working underground and who showed an L.M. sense of 200. in each eye, but whose L.D. sense in each eye was 50. Two of these cases were in patients who were developing a second attack of the malady. Both had been held to have recovered from previous attacks and had again commenced work underground. It may possibly be that these men had returned to work underground before their L.D. had returned to normal.

These observations on light sense must be regarded as very incomplete and inconclusive, in view of the small number of cases which I have been able to investigate. It does indicate, however, that some useful and perhaps helpful information may be gained by such observations in cases of miners' nystagmus.

The importance of the fact that neither light sense is reduced in cases of nystagmus while actually at work underground is realised in the case of firemen. Part of the duties of these men consists in testing lamp caps for gas. Cases of nystagmus at work underground can and do read these caps correctly. I recently had occasion to examine a large number of firemen from three collieries for renewal of their certificate and amongst them I found three men who had definite signs of nystagmus. All could read the caps without difficulty.

DIAGNOSIS.

The diagnosis of the condition is never difficult in the recent case. The difficulty arises in assessing a man's capacity to work in old cases, or in deciding when recovery has taken place. I believe that "miners neurosis" as we know it is a sequel of the true condition of nystagmus. The two may co-exist, but in all cases I have seen, nystagmus was the precursor of the neurosis. I should never diagnose miners' nystagmus in the case of a miner at work underground unless oscillation of the eyeball is present.

I have only on one occasion had difficulty in the diagnosis of a recent case. In this case nystagmus was present but the case did not conform to the usual type in many features. At a later period in the history of the case a blood test was indicated and a positive WASSERMANN was reported. The diagnosis in this case was probably Syphilitic Cervical Pachymengitis. This man no doubt had the incipient type of miners' nystagmus which would not incapacitate him, his incapacity was due to the other more important lesion.

The malingerer is seldom difficult to detect. The severe case who is recovering but is suspected of malingering is a more difficult problem. It is in this connection that I consider the various light sense tests may prove extremely useful. I personally use these tests now in all cases.

The test for night blindness is equally useful.

I regard the following as cardinal points in the diagnosis of a recent case -

(1) Oscillation of the eye-balls, with perhaps head nodding and increased reflexes.

(2) Tachycardia.

(3) Night blindness.

(4) A normal Light Minimum and Light Difference which later is reduced.

I presume a case to have recovered in which -

(1) Oscillation of the eye-ball had ceased.

(2) There is no night blindness.

(3) Light Minimum and Light Difference are normal.

AN ANALYSIS OF THE PRE-NYSTAGMIC MEDICAL HISTORY IN MY CASES.

It had occurred to me that some valuable information might be gained by an investigation into the previous medical history of men who develop miners' nystagmus. With a view to ascertaining if any information could be gained by such an investigation, I have considered the various illnesses or accidents for which these patients came under treatment by me, for a period of 12.mths. previous to the onset of the nystagmus.

For this purpose, I arranged the various diseases for which treatment might be required, into groups, as follows -

SIMPLE INFECTIVE CONDITIONS, including in this group all simple infections, such as - influenza - catarrhal cold - follicular tonsilitis - and similar conditions.

MYALGIA, ETC. Muscular and joint pains - muscular rheumatism - teno-synovitis - and similar conditions.

RESPIRATORY DISEASES: Bronchitis - pneumonia etc.

GASTRIC DISEASES: Dyspepsia - gastritis - and all conditions of the gastro-intestinal tract.

EYE CONDITIONS: Diseases and injuries.

INJURIES: Simple and severe.

OTHER DISEASES: Any conditions not included in the above groups.

The total number of cases considered was 65.
In seven of these cases, the patients were unknown to me previously. My first knowledge of them was when they came under treatment by me for nystagmus, so that, these seven cases must be omitted from my investigations.
There are thus 58. cases who were known to me for a period of at least 12.months previous to the onset of nystagmus, and in all these cases I should have been consulted for any illness or accident of sufficient severity to require medical attention. I find that 42. out of the 58. cases - or 69% - required treatment in the period under consideration.
The conditions for which treatment was required is as follows -

SIMPLE INFECTIVE CONDITIONS:	12.	or	21%
MYALGIA ETC.	26.	or	45%
RESPIRATORY DISEASES:	7.	or	12%
GASTRIC DISEASES:	3.	or	5%
EYE CONDITIONS:	1.	or	2%
INJURIES:	7.	or	12%
OTHER DISEASES:	3.	or	5%

In 13. cases there was a combination of two or more, and in the group "Myalgia" 10. in the 26. required treatment on two or more occasions.

These figures would be quite valueless unless we

compared them with other patients under similar conditions, and for the purpose of comparison I have taken similar observations on non-nystagmic miners - at least - in miners, none of whom have so far shown any sign of developing the condition. In this investigation I have intentionally taken men who were all in the age group 40. to 60. - since this is the age group in which the greatest number of cases of nystagmus occur.

I have investigated 300. miners of this age group over a period of 12.months, not limiting the period to a single year, but taking various groups over the years 1925. to 1928.

The figures obtained are as follows -

SIMPLE INFECTIVE CONDITIONS:	9%
MYALGIA:	20%
RESPIRATORY DISEASES:	11%
GASTRIC DISEASES:	5%
EYE CONDITIONS:	1%
INJURIES:	8%
OTHER DISEASES:	8%

The number requiring treatment for any condition, being 58%.

In only 2% of cases do we find a combination of two conditions occurring in one patient, and in the "Myalgia" group the number requiring treatment on more than one

occasion is less than 1%.

I have also taken 100 miners (who were normal) over a period of five years and find that 39% of them required treatment for conditions included in the "Myalgia" group.

The incidence of myalgia in the pre-nystagmic miner in comparison with the normal miner, is the most striking feature. It would appear that 45% of men in the pre-nystagmic condition, get severe attacks of myalgia a short time before nystagmus develops and that almost 50% of these get several attacks. This condition of myalgia is certain to be a common condition in miners, in view of their hard muscular exertion at work, and in view of the changes in temperature to which they are subject. But we find that the incidence in normal miners, taking the same conditions as I have applied to the pre-nystagmic miner, is only 20%. This would appear to be a significant fact.

The incidence of simple infective conditions is also much greater in the pre-nystagmic miner than in the normal miner. The liability to infection is twice as great in the former as in the latter. I find that 21% of pre-nystagmic miners require attention for infective conditions, while the figure for normal miners is only 9%. This, also, may be an important fact.

With regard to all other conditions for which treatment is required, I find practically no variance between the pre-nystagmic miner and the normal miner. The only feature

worth noting, is, that there is a slightly higher incidence of injuries in the pre-nystagmic miner than in the normal miner.

DENTAL CONDITION:

It is a well known fact and it has frequently been commented upon, that miners with nystagmus have very unsatisfactory teeth. In my observations, in all cases, with perhaps one or two exceptions in the case of the younger patients, the condition of the teeth and gums was very unhealthy. The common condition is:- teeth very carious with profuse pyorrhoea. I have not seen a case of nystagmus whose mouth and teeth could be regarded as in a healthy condition, when the disease originated.

VISION: The question of defect in vision has been given prominence in the list of possible causal agents of the condition. I do not find any evidence that this has much bearing on the incidence of the disease. In my 65. cases I have found 7. who had any defect in vision. If defective vision plays any part in the development of the disease, it is only a minor one.

DEAFNESS:

This is mentioned by some writers as a contributory cause of nystagmus. I can find no evidence in my series of

cases that deafness has any influence on the development of the disease.

From an investigation into the pre-nystagmic medical history of my cases, it would appear that the following conclusions can be reached.

(1) That there exists a certain pre-nystagmic condition, in which there is a variation from normal health.

(2) That the condition is characterised by -

(a) a greater incidence of myalgia than in normal miners

(b) a predisposition to infection.

(3) That dental caries and pyorrhoea, or some abnormality of the gums, is present in all cases.

VITAMIN DEFICIENCY

During the war Pickard and Lloyd found that a number of men who were invalided, suffered from a syndrome of symptoms which they associated with a mild form of scurvy, due to a vitamin deficiency from insufficient supply of vegetables. They maintain that anaemia, pains in joints and muscles, echymosis, swollen gums with suppuration, bleeding and loose teeth, and night blindness, constitute symptoms of scurvy in a mild degree. Night blindness was the symptom that established the diagnosis in these cases. It seems that some resemblance exists between the symptoms in these cases of scurvy and cases of miners' nystagmus.

Still more recent investigations into the properties of the various vitamins also suggest, that a possible explanation of some of the symptoms in this disease may be arrived at by a consideration of the properties of these complex bodies.

VITAMIN A. This has been called the anti-infective vitamin. It has been shown that deficiency of this vitamin results in histological changes in epithelial tissues and it has been suggested that these changes predispose to infections. Mellanby has described an important action of fat soluble vitamin in the prevention of certain lesions in the central nervous system, and this action he ascribes to

vitamin A. rather than to vitamin D. He states that degeneration of the spinal cord can be produced after a few months' feeding on certain cereal products and that this lesion can be prevented by an adequate supply of fat soluble vitamin. Vitamin A. appears to be responsible for the neutralising property.

The functional visual defect known as Hemeralopia, or night blindness, is now commonly attributed to vitamin A. deficiency. Series of cases confirming this have been reported by Aykroyd, Hift, and Zak. In these cases the defect cleared up when the patients' diets were adjusted so as to include food rich in fat soluble vitamin.

VITAMIN D. The skin contains a small quantity of ergosterol and consequently a supply of vitamin D. can be manufactured by an animal for itself by exposure of its surface to natural sunshine or ultra-violet light.

This is the anti-rachitic vitamin. There is some unknown mechanism by which this substance favours the utilisation of calcium and phosphorous by the tissues.

A profound influence of vitamin D. in dental caries has been proved in children by M. Mellanby. The onset of caries - the spread of existing foci of caries - and the appearance of new foci, can be controlled to a considerable extent by the giving of anti-rachitic vitamin, and definite evidence was obtained that by adequate dosing with this

vitamin existing caries could frequently be arrested and healed.

WATER SOLUBLE VITAMIN B COMPLEX

B_1 in this complex, is the anti-neuritic factor. A quantitative relation between the amount of B. required and the other constituents of the food appears to exist, but this has not yet been definitely settled.

VITAMIN C

This is the anti-scorbutic vitamin.

DEFICIENCY DISEASES DUE TO A & B AVITAMINOSIS

Wright has investigated these conditions and concludes that the earliest symptoms of A avitaminosis are mucous membrane phenomena viz - various degrees of glazing of the tongue due to the filiform papillae and sometimes a soreness or smarting on taking hot or spiced foods, but the smarting is not always complained of. He suggests that the earliest indication of the onset of the nervous symptoms due to B avitaminosis is a tremulous condition of the tongue. If the condition persists this is followed by changes in the knee jerks, paraesthesia of the limbs and dimness of vision. He also states that the nervous symptoms take a long time to recover and that the sight is usually the last to recover if it has been severely involved. These cases, however,

ultimately respond to dietetic treatment.

Margaret Emslie associates certain symptoms which precede the more acute symptoms of rheumatism in children with B avitaminosis. Such symptoms are sore throat, muscular pains, pallor, shortness of breath, general nervousness and digestive derangements.

It would thus appear that a fairly close resemblance exists between symptoms which are due to avitaminosis and the symptoms which are found in miners' nystagmus. Such a condition would explain many of the symptoms which have previously been so obscure. Recent work on vitamin deficiency indicates that -

(1) A avitaminosis may give rise to

(a) a predisposition to infection.

(b) certain toxic effects on the central nervous system.

(c) a functional visual defect known as night blindness.

(2) B avitaminosis may give rise to

nervous symptoms - the first indication being tremor of the tongue, followed by change in knee jerks, paraesthesia, and dimness of vision.

(3) C avitaminosis may give rise to scurvy. Mild scurvy is associated with anaemia, pains in joints and muscles, swollen gums with suppuration or bleeding, loose teeth and night blindness.

(4) D avitaminosis may give rise to caries of the teeth and, if the deficiency persists, the caries spreads and new foci appear.

These results of investigations by recent observers into the question of vitamin deficiency at once suggested to me a complete explanation of the obscure symptoms to be found in miners' nystagmus.

THE DIET AND HOME CONDITIONS OF MINERS WHO DEVELOP NYSTAGMUS.

I have made many inquiries into the diet of miners who have developed nystagmus. From my inquiries I find a great similarity in the food taken. The following items occur:

Breakfast. bread - butter - tea
This is the usual breakfast - occasionally I find the following additions - cake porridge, and bacon.

Meal taken to work. bread, bacon, and cheese with cold tea or water. There is a noticeable consistency about this meal, the only variation I found in a few cases is bread, butter and jam.

Dinner meat and potatoes with another vegetable on occasions only. Pudding (usually milk).

Supper bread and cheese, with ale, tea, or cocoa.

These are the usual diets obtained from these patients. There is practically no variation from case to case - the similarity is very evident. Bread, bacon, and cheese are the predominating articles, and these appear to be taken in considerable quantities. The reason for this is probably to be found in the fact that the two latter articles of diet contain great energy values and are consequently

most valuable in the case of the miner. From an energy value point of view we must admit that the diet may be excellent, but on the other hand, it has many deficiencies. It contains much too small a proportion of fresh foods for a satisfactory diet. Fresh fruit does not enter into the diet at all, and fresh vegetables, with the exception of potatoes, are only occasionally met with. Green vegetables and legumes, fresh or dried, if eaten at all, are only taken at rare intervals. Bread is invariably of the white variety. Neither bacon or cheese can be regarded as satisfactory from a vitamin-content point of view. The former must be very deficient in view of its curing and cooking, while the latter is uncertain, although it is usually regarded as a good source of vitamin A.

From my experience of miners' households, I doubt the statement of these men, that they have fresh meat and potatoes daily. I agree that such a meal may be taken on a few days in the week, but on the other days, I think that preserved or tinned foods replace the fresh variety. I also think that in many cases butter does not figure so largely in the diet as the patients would have us believe. I have noticed that lard, and I suspect that margarine, enter largely into the diet of miner's households as a substitute for butter. Both these substitutes are notoriously

deficient in vitamins. It is a difficult matter to get a man to admit that he and his family partake of these substitutes. The chief deficiencies in the diet may be summarised in the absence of

(a) eggs - the yolk of which is our richest source of vitamin A. B. and D. in an ordinary diet.

(b) green vegetables and cereals - which are excellent sources of vitamins A. B. and C.

(c) milk - which contains B. C. and D.

The normal diet of a mining community is of a much more varied character than the above diet which I have obtained in cases of nystagmus. I have never noticed in my experience that the diet amongst miners varied much from the diet of other workers. In all communities one must find a certain small proportion of people who, from poverty or ignorance, are compelled to live on deficiency-disease producing diets. I would suggest that the small proportion of miners who develop the disease are drawn from this class, and that a great factor in the severe case of miners' nystagmus is to be found in an underlying or pre-nystagmic condition, which is brought about by a vitamin deficiency. One must also realise that there is considerable variation in the susceptibility of different individuals to the lack of vitamins and apparently, some fed on deficient diet do not develop diseased conditions to any noticeable extent.

It has been stated that this is probably due to their getting vitamin-containing foods at various times of the year and that thus they escape. It has also been suggested that a careful investigation into these cases might show that they had certain slight symptoms which could be attributed to vitamin deficiency.

In addition to the consideration of diet in cases of miners' nystagmus, some valuable information can be obtained by a consideration of the home conditions of these men. I consider that the home conditions of a man and his family form a useful guide to his mode of life in general and also to the type of food which he is likely to have. It generally occurs that people who live in poor homes obtain poor food. I do not think that we can assess the quality or quantity of food taken by a family according to the family income. There are several important factors in addition to variation of income, which influence diet. It is in this connection that I think alcoholism influences nystagmus. One must realise that where a portion of the workers' income is spent on alcohol, a correspondingly less amount is available for the provision of wholesome food and healthy home conditions. It has been pointed out by various writers in this connection that alcohol appears to favour the development of the disease. My series of cases confirm this. From my personal knowledge of the families concerned, I have noted that in 24. cases, the subject of the disease took alcohol to excess.

In practically all cases the patients admit taking a "moderate" amount. In only 4. cases, have I seen the disease develop in men who were abstainers, and in one of these cases his wife was a drinker. This is important in the consideration of the home life of these men.

Another significant fact in my series of cases is that in 39. cases the men were living in "slum dwellings." In my district, as in other colliery districts, there are certain poor or slum areas in which the housing conditions are bad. The word slum conveys the impression of the unhealthy, dirty, and over-crowded condition of these houses better than any other term. On careful investigation of all cases, and from a personal knowledge of each family, I would arrange my 65. cases as follows:-

39. cases - home conditions unhealthy or of the slum type.
19. cases - home conditions fair, clean but poor homes.
7. cases - home conditions good.

It is thus clear that in a mining community cases of nystagmus are drawn chiefly from the class of miner who lives in bad or unhealthy surroundings. In only 7. cases, out of a series of 65. were the men amongst what might be called the prosperous or moderately prosperous type. It cannot be that it is a question of income. It appears to be more a question of judicious or efficient spending.

On dividing my series of cases into the years in which they occurred, I find :-

3. cases in 1921

16. cases in 1922.

13. cases in 1923.

15. cases in 1924.

6. cases in 1925.

2. cases in 1926.

4 cases in 1927.

4. cases in 1928.

and

2. cases in 1929. (to Sept. 30th.)

It is interesting to note that in 1921 and 1926, in both of which years, there were long strikes, the smallest number of cases occurred.

The most interesting feature, however, is that 44. cases occurred in the years 1922.-3 -4. During this period it is a well known fact that the prosperity of the miners was gravely depressed. The men were working almost full time throughout this period, but wages were very low. It was admitted by everyone that the economic position of the coal miners was very grave, and the question received attention in Parliament on several occasions. Many of the families were burdened by debts contracted during the prolonged stoppages in 1921, and wages at that period were admitted to be about 20% above the 1914. standard, while the cost of living was standing at 81% above the standard of 1914. Conditions in the coal-fields at this period were so serious that a committee of

the Medical Research Council was appointed to investigate and report on the nutrition of miners and their families. This report was published in 1924. It thus appears that in a series of 65. cases taken over a period of about 9. years, 44. cases occurred during a period of 3.years, when the economic condition of the miners was at a very low ebb. The largest number of cases of nystagmus occurred in my experience during a period when economic conditions were such that the nutrition of the miner was likely to be impaired.

AN EXPLANATION OF THE ETIOLOGY OF THIS DISEASE.

In my opinion the disease known as miners' nystagmus is primarily a deficiency disease. A deficiency diet constitutes the foundation on which the complete condition is built up. An investigation into the diet of miners who develop the disease shows that a great similarity exists in the diet in these cases. Certain individual items occur with great frequency and the variety of items is very limited. An analysis of the diet shows that from a vitamin-content point of view, it is far from satisfactory. It has always been difficult to explain why a certain small minority of miners develop the disease, while the majority of miners escape. There is no difference in working conditions, and it has been noted by all writers on this condition that no type of underground worker can be regarded as immune. The explanation that the disease is a deficiency one would amply explain this. Home conditions vary with each individual The susceptibility of individuals to vitamin deficiency varies likewise.

I have shown that there exists a pre-nystagmic condition which is characterised by several factors which can be explained well by the theory suggested. Men in the pre-nystagmic state show a greater incidence of attacks of myalgia, a greater susceptibility to infection, and they all have diseased conditions of the teeth and gums. These are

almost cardinal signs of vitamin deficiency.

With regard to the well developed case, the clinical picture is no less definite. The symptoms are referable to the central nervous system, withbthe main symptoms referable to the oculomotor apparatus. It is a noticeable feature that the nervous symptoms are all of the same type - viz: clonic contractions of various muscles or groups of muscles - and that the muscles involved are those which are under great strain and are consequently liable to fatigue while the miner is at work. His eye muscles are strained in his attempts to get good vision in a defective light, the muscles of his head and neck are strained for the same reason. The clonic movements sometimes met with in the arms would be explained by the same reason. Associated with these symptoms in the severe case, is the important symptom of night-blindness. These symptoms in the severe cases can again be explained by the theory of vitamin deficiency. Night blindness is to be associated with A. B. and C. avitaminosis while the symptoms referable to the nervous system are explained by A. and B. avitaminosis.

These explanations of the symptoms to be found in this condition are confirmed by recent investigators into deficiency diseases. Many points still require clearing up in the field of deficiency diseases, but it has been shown that all diseases in this group have certain symptoms in common, although the grouping of the symptoms may vary. The diagram reproduced from Darling well illustrates this.

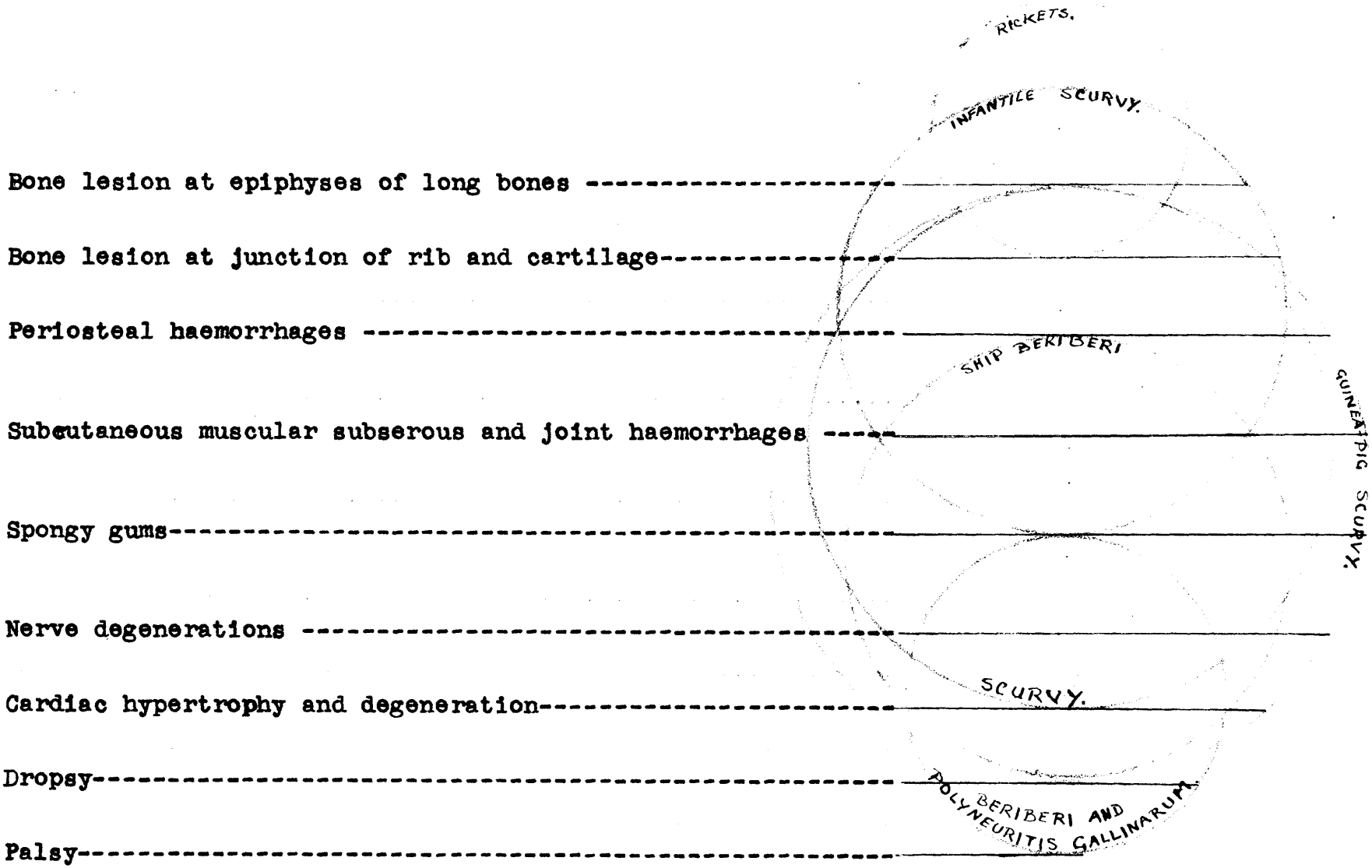

CHART SHOWING AFFINITIES OF THE FOOD DEFICIENCY SYNDROMES

It appears that miners' nystagmus should be included in this group of diseases.

It must be realised that other factors have an important bearing in the development of this disease. It occurs almost exclusively in coal miners, although it is exceptionally found in other workers. Cases have been recorded in chauffeurs - the so-called chauffeurs' nystagmus. It is, however, rare in any workers other than coal miners. As I have mentioned previously, the peculiarity of the working conditions of the coal miner must have a great bearing on the development of the disease. The disease may be found in all underground workers, irrespective of age or type of work. Working underground in deficient artificial light, frequently in an atmosphere which is badly ventilated, can at once be included as a factor in the cause of a deficiency disease. Natural sunlight and fresh air are unknown quantities under the working conditions of the miner. One need only instance rickets as a type of deficiency disease, in which environment plays an important role in the production of the condition.

There are thus two important factors in the production of miners' nystagmus.

(a) A deficiency factor due to diet.

(b) Another factor due to the peculiarity of the

miners employment underground. This may also have an influence on the deficiency condition.

We have no information as to what the late results of this disease would be, were the patient to remain under the same conditions which have produced the disease. At a certain stage of the disease the urgency of the symptoms compels the collier to give up work underground, and in all cases recovery appears to take place. We do know that prolonged absence from underground work, open air life, with good food, and good hygienic surroundings, restore the patient to good health. In some cases the disease is followed by a neurasthenic condition which persists for long periods.

This appears to indicate that the disease is a deficiency one, and it may be that the long period taken to recover in many cases is due to the fact, that, in treating the condition we are only getting rid of one factor in its causation. Our patients cease work underground and as a consequence they are either in receipt of compensation or of a reduced wage as a surface worker. In either case their financial position is less satisfactory than before they ceased their ordinary employment.

The obvious result is that they are relatively in a worse position from the point of view of obtaining good food and

good home conditions. I believe that this is the explanation of the slow recovery to be met with in many cases. One must also bear in mind, however, the fact that recent writers on deficiency diseases state that in cases where the nervous system or the eyes are involved, recovery takes a long time.

SUMMARY AND CONCLUSIONS.

(1) Nystagmus is an occupational disease, occurring in coal miners.

(2) There are two types of the disease -

  (a) an incipient type, with early recovery.

  (b) a severe or chronic type.

(3) Nystagmus of the former type is not disabling, but the latter type may disable a man for long periods.

(4) The subjective symptoms may be more important than the objective signs in disabling a man.

(5) It may occur in all ages, but is most commonly met with in men between the ages of 40 and 60. years.

(6) It may occur in any underground worker.

(7) The period of total incapacity may be many months, the period of partial incapacity may be several years.

(8) Subjective symptoms have no definite relation to the amount of oscillation present.

(9) Cases who apparently recover and resume work underground usually develop the condition again.

(10) Heredity is a minor factor in the production of the disease.

(11) Type of work and lights used have no influence on the disease.

(12) Symptoms vary in severity considerably.

(13) Signs are definite in severe cases - various clonic muscular contractions, tachycardia, anaemia, and night blindness with diminished light sense are present.

(14) There exists a pre-nystagmic condition.

(15) This condition is characterised by -

(a) an increased incidence of myalgia.

(b) a predisposition to infection.

(c) abnormality of teeth and gums.

(16) Recent work on vitamin deficiency shows a syndrome of symptoms very similar to miners' nystagmus.

(17) This similarity is more apparent when the pre-nystagmic condition is also considered.

(18) The diet in cases of miners nystagmus is unsatisfactory, and can be regarded as a deficiency disease producing diet.

(19) Lack of sunlight and fresh air may be accessory factors in the production of a deficiency disease.

(20) A satisfactory explanation of all the symptoms in the disease is found in the fact that it is a deficiency disease.

CONCLUSION:

I find that the disease known as miners' nystagmus is a condition of impaired health occurring in coal miners. The intensity of the disease and the disability resulting from it varies considerably in different cases. Any underground worker may develop it, irrespective of age or work done, but it is commonest in men who work at the coal face and in men between the ages of 40. and 60. years. It may occur in an incipient form, from which early recovery is likely to take place. In a few cases of the incipient type, the disease is progressive. The severe type of the disease is disabling in a collier, and the disability may persist for some years. Open air life with fresh air, good food and good hygienic conditions result in a cure of the condition, but it may be accompanied or followed by a neurosis which may persist for a long period.

I find that the condition is associated with endogenous and exogenous factors. The former is the more important, but the condition would not arise were the latter not present. The endogenous factor consists in a nutritional disorder of the deficiency type, which shows itself to be present previous to the onset of nystagmus. These early manifestations of

a deficiency condition can be explained by vitamin deficiency. The exogenous factor is referable to the occupation of the miner. It is due to the special conditions of this occupation that the main symptom in the severe case arises. This symptom consists of clonic contractions of various groups of muscles which are under great strain when the collier is at work. There is a similarity between this sign and signs to be met with in other deficiency diseases. Other signs and symptoms can also be explained by a vitamin deficiency. A similarity exists between the signs and symptoms of miners' nystagmus and the various signs and symptoms of other deficiency diseases. It has been pointed out by many writers that there is an affinity between the syndromes of all the known deficiency diseases.

The diet of men who develop the disease is very limited and can be regarded as a deficiency-disease-producing diet. His working conditions - underground in air frequently poorly ventilated - would be an aggravating cause of a deficiency disease.

There appears to be a definite basal factor in the production of the disease known as nystagmus.

This factor is responsible for the development of the disease, and consists in a nutritional disorder of the vitamin deficiency type. This results in an impaired condition of health. If the deficiency persists, then the syndrome developes. In this syndrome certain signs and symptoms appear to be aggravated by the peculiar conditions obtaining at work. This tends to make these special symptoms unduly prominent in the resulting picture. The condition is a general one, not one involving merely the oculomotor system or even the central nervous system, but one involving the whole organism. It can fully be explained by the complicated action of these complex bodies, the vitamins, and it is not inconceivable that here we have an ample explanation of the etiology of this obscure disease.

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