fibres are found to be in a state of spasm, movement of any kind being accompanied by pain. Such is the case in true lumbago. If such muscle fibres happen to be traversed by nerves, as, for instance, in the lower cervical region, these nerves become trapped and neuritis results. In such conditions the tissues when heated become more amenable to the influence of massage and movement. The principle underlying the treatment of all chronic rheumatic conditions is the same—namely, to soften the tissues by heat, and, later, to follow this by massage and movement. Force should not be used in the early stages, and then only gradually applied in accordance with the needs of the particular condition. Nerves are sometimes forcibly stretched under an anaesthetic, but even when immediate relief appears to have been achieved, adhesions resulting from such drastic treatment often reproduce the condition even more severely than before.

Methods of Applying Heat.

Heat is commonly applied by conduction. A water fomentation or a dry pad, electrically or otherwise heated, is employed. The temperature at which the sensation of heat gives place to pain is in the neighbourhood of 115° F., and it is therefore not possible to exceed this temperature at the skin surface. If the part is in any way inflamed even this degree of heat cannot be applied. As, however, heat applied by conduction does not penetrate to any appreciable extent, being carried away by the superficial circulation, its use should be confined to the treatment of inflammatory conditions of the skin and immediately subjacent tissues.

Secondly, heat can be applied by radiation. The rays of the violet end of the visible spectrum are converted into heat directly on the skin surface and have very little penetrative power. As the wave-length increases, the rays, before being converted into heat, are able to penetrate to an increasing extent, the luminous and particularly the red waves being employed when a penetrative heating effect is required.⁶ In the infra-red region the heat rays again diminish in penetrative power, and are consequently of less value for this purpose. Radiation, though not a good means of applying heat for the end in view, is better than conduction.

Diathermy is used when it is required to concentrate heat in deeply situated tissues. The modern diathermy apparatus produces oscillations of a very high frequency, varying from 800,000 to 1,000,000 per second. The diathermy current has no ionizing effects in the tissues, and as nerve endings cannot appreciate stimuli repeated with a frequency of more than 10,000 per second, it cannot produce sensations, painful or otherwise. A much stronger current can therefore be used than could otherwise be tolerated. This current, passing rapidly to and fro, generates heat in the tissues themselves. The temperature depends on the grouping of these tissues in relation to the path of the current, and on the relative richness or poverty of their blood supply.⁷ All of them will, however, be heated to a certain extent. Various precautions have to be taken so as to eliminate the possibility of burns. The pads must be placed at right angles to each other, the parts treated lying directly between them, so that the current may traverse them directly. Such details as the amount of current, the length and frequency of exposures, and the position and type of electrodes can be gauged only as the result of experience.

The value of electrical currents, other than diathermy, in the local treatment of chronic rheumatic diseases is doubtful. It is unlikely that the redistribution of tissue ions caused by the passage of a direct current has any therapeutic effect. Also it is difficult to ascribe any useful purpose to ionic medication; drugs, such as iodine, thus introduced into the system are carried away by the superficial circulation before they can penetrate to the required depth. Beneficial results are sometimes obtained by the use of alternating currents in very chronic cases, and are due probably to their tonic effect upon the wasted muscles, and not to any action upon the disease itself. Sinusoidal baths are perhaps the most useful for this purpose.

SUMMARY.

An attempt has been made to summarize the various aspects of the treatment of "chronic rheumatism." Such treatment must necessarily follow a complete investigation in all cases, and must proceed along systematic lines. Drugs should be used, but not abused, particularly in the relief of pain. Members of the phenazone and exalgin groups, and salicylates, are the most valuable. Iodides probably owe their reputation to their effect in cases associated with endocrine disturbance, but are not so helpful as thyroid extract. Stock vaccines and other protein injections act by producing protein shock and are useful in certain cases. Autogenous vaccines would not appear to have any special advantages. It is suggested that chronic rheumatism is an allergic state produced by a number of widely different antigens in a susceptible subject. For this susceptibility the habits and necessities of modern civilization, especially inadequate stimulation of the skin, are largely to blame. Physio-therapy owes much of its success to the rectification of these errors.

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THE DISEASE KNOWN AS MINERS' NYSTAGMUS.*

BY

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FOR close upon a century coal miners have been known to suffer from ocular trouble associated with their work; in 1831 C. Turner Thackrah wrote in reference to colliers:

"Their eyes, from swelling of the lids, appear small, and are affected with chronic inflammation and intolerance of full light, and many, after a few years' trial, are obliged . . . to leave the mine."

Nystagmus as a definite disease was first described by Decondé in 1861, but little attention was given to the question until about 1875, when reports, though still somewhat isolated, began to appear in British and Continental medical journals, and were followed by a prolonged and heated discussion as to the causation of the oscillation of the eyeballs. This controversy is still unsettled, and will be carefully avoided in this paper, which proposes to deal with "the disease known as miners' nystagmus whether occurring in miners or others, and whether the symptom of oscillation of the eyeballs be present or not," as notified in the schedule of the Workmen's Compensation Act of 1906 on July 30th, 1913. It may be noted that the earlier observers regarded the disease as a local myopathy of the elevator muscles of the eyes or the result of excessive accommodation, whereas the modern tendency is to refer it to a general fatigue of the whole oculomotor system, or a general neurosis with special manifestations in the oculomotor apparatus.

Since 1907, when miners' nystagmus was added to the schedule of industrial diseases in the Workmen's Compensation Act of 1906, the number of notified cases has steadily risen, and when the definition of the disease was altered in 1913 the Home Office statistics showed a sharp rise in the rate of incidence of nystagmus from 0.16 to 0.26 per cent., and the latter rate has been maintained since. These numbers refer to cases of invalidity from the disease, and must not be confused with the rate of prevalence of nystagmus in miners. Oscillation of the eyeballs, it has been estimated, may be found in about 25 per cent.

* Read at a meeting of the Midland Ophthalmological Society, December, 1928.

of working miners, but something like 99 per cent. of them are unaware of the condition. It is obvious, therefore, that oscillation of the eyeballs *per se* need not be a cause of invalidity, and when a miner who has shown oscillations becomes incapacitated for work some new factor is introduced, and this in itself, or in addition to the oscillations, gives rise to working incapacity. There is no doubt that severe oscillations in the primary positions of the eyes, when mere standing up causes giddiness and marked unsteadiness or reeling, would be regarded as a cause for total disability. In many cases, however, when oscillations are difficult or impossible to elicit, subjective symptoms are apparently more distressing than in the cases with severe oscillations.

It would appear that there is no strict relationship between the degree of oscillation and the severity of such subjective symptoms as giddiness, headaches, sleeplessness, photophobia, night-blindness, and mental depression. In fact, these symptoms often appear to increase as the oscillations diminish. During the last few years these "nervous" symptoms have increased enormously in frequency, perhaps in intensity, and at the present time they may be said to dominate the whole picture of miners' nystagmus. From notes of cases of miners' nystagmus referred to me for compensation purposes, I find that during the years 1910-19 about 5 per cent. only presented anxiety neurotic symptoms of any degree, whereas among those examined during the period 1919-24 29 per cent. presented very definite symptoms of the kind. The figures with regard to giddiness and headache are still more striking.

Giddiness complained of :

1910-19	...	...	50 per cent. of cases examined.
1919-24	...	...	78 per cent. " "

Headache complained of :

1910-19	...	...	30 per cent. of cases examined.
1919-24	...	...	70 per cent. " "

What is the explanation of this change, which amounts to a definite alteration in type, if not to a new disease? I think there can be little doubt but that the widening of the definition of miners' nystagmus in 1913 is responsible for this change in type, as well as for the extraordinary increase in the number of cases certified. This development is in no sense to be regarded as due to increase of malingering; in fact, deliberate malingering appears, from the same records referred to above, to be less frequent. From 1910 to 1919 it was about 8 per cent.; from 1919 to 1923, about 4 per cent. The development must be regarded as the inevitable result of making it an easy matter (by the Act) for the neurotic to escape from a psychologically intolerable position caused by failure to adapt himself to his environment.

The nervous symptoms referred to are headache, giddiness, photophobia, night-blindness, or rather a fear of going about in the dusk or midlights, sleeplessness, with distressing dreams during the short periods of sleep, amblyopia, perhaps contraction of visual fields, mental depression, and often a change of character, sometimes passing to definite mental illness and even suicidal tendencies. When these symptoms are met with we find tremors of the head and limbs, lid spasm, and endocrino-sympathetic disturbances, such as disordered action of the heart, vaso-secretory disturbances, etc. These symptoms differ in no way from the symptoms of psychoneurosis met with in other spheres and among other members of the community, and it is obvious that a miner might be incapacitated by such a neurosis without showing any oscillations of the eyeballs at all. Hence the justification for the alteration in the terms of the Act in 1913. It is a fair question to ask, What is the relation of the nystagmus to the psychoneurotic symptoms? I am inclined to think that it acts as one of the exciting factors, but an important one. The coal miner, in this country at any rate, seems to be peculiarly predisposed to the development of a psychoneurosis owing to the nature of his work, his environment, and heredity (through inbreeding). A state of oscillation of the eyeballs would probably excite in him the psychopathological feature of fear already present to some extent

in consequence of the recognized riskiness of coal mining, and possibly also of its association with scotopic vision—we are all a bit "afraid of going home in the dark." This would be followed by anxiety as to the effects of the oscillation on his sight, and on his general health and his capacity for earning a living and keeping the home together. His condition would be aggravated by the knowledge that many of his fellow workers have been incapacitated from work for prolonged periods through nystagmus. Any inadvertent remark by doctor, solicitor, or friend as to possible loss of sight will inevitably confirm him in his neurotic state. Some slight irritation of the lids, due perhaps to conjunctivitis, to which miners are particularly liable, sets up headache and spasm of the lid and other muscles of the face. These, along with his fear and anxiety, produce loss of sleep, which in itself is an aggravating factor in the complex, and as a means of easy escape from a distressing psychological position he resorts to the avenue of the Workmen's Compensation Act.

If we assume that these symptoms are due to causes which have, perhaps justifiably, been described as the "dungeon complex," are we to regard them as a cause of disability, and if so, whether for pit work or for surface work or for all work? In many cases the giddiness set up by mere stooping—such as in tying a bootlace—or sudden movement is so intense that the patient is unable to stand, and in such cases it is obvious the man is incapable of doing any work, except perhaps in the sitting position. Percival is convinced that the incapacity for working in the pit varies directly as the degree of giddiness on stooping, by which he means "that if a patient shows nystagmus in a dark room, and the other signs such as the characteristic tremors, rapidity of pulse, etc., giddiness sufficient to render him incapable of pit work may be reasonably attributed to miners' nystagmus." But this is taking rather a restricted view of the causes of disability in miners' nystagmus, and it does not enlighten us as to what degree of giddiness is sufficient to render a man incapable of pit work. It must be that a good many miners suffering from giddiness of varying degrees and causation are capable of earning full wages at the coal face, while some, who do not complain particularly of giddiness appear to suffer so acutely from pains in the head when they are asked to fix a point of light that it seems hopeless to expect them to do any form of work.

The question has been raised as to whether a miner who has once suffered from incapacitating nystagmus should be allowed to work in the mine again; the argument being that under the conditions of coal mining the disease is bound to recur, even if it is admitted that it may be cured for a time. I am not convinced that we possess any statistics or other form of information which would enable us to give an incontrovertible opinion in the matter. The vast majority of nystagmus patients do return to their old work and continue to earn full wages. An analysis of cases I have reported upon gives the following results. Return cases (two or three attacks): 1910-19, 9.5 per cent., 1919-24, 14.2 per cent. The percentages of third attacks were 1.5 and 4.7 for the same periods. There was no indication that the severity or the duration of recurrent attacks was any greater than that of the initial attack, neither did the working periods appear to get increasingly shorter. It must be remembered that relapses, like the original attack, are generally due to factors outside the actual occupation—for example, physical illness or injury, domestic worries, and particularly the economic state of the coal industry and of the labour market generally. Thus there was a tremendous accession of nystagmus cases, primary and otherwise, during the period of the coal stoppage, and there is always the same rush to the certifying surgeon when a mine closes down. It does not appear, therefore, that it is essential for the nystagmic miner to change his occupation in all cases. It is not an easy matter for anyone to change his occupation in middle or later life, and it is particularly difficult in the case of a miner, who has probably never had experience of any occupation other than his own specialized work. I do not think the miner himself is particularly enamoured of the suggested change, and the present state of the labour market does not

encourage it. For the same reasons industrial colonies staffed by disabled miners cannot be regarded as a sound economic proposition.

My main purpose in bringing up the question of miners' nystagmus again is not to discuss its etiology and symptomatology, but to appeal to ophthalmologists to take interest in the matter of its curative treatment. On the preventive side it must be admitted that a vast amount of work has been done and much money spent, though the tangible results so far have not been very great. Improvement in the hygiene and illumination of the mines seems to have had some salutary effect. Probably still better illumination, which would definitely substitute photopic for scotopic vision, would result in a very definite reduction in the incidence of miners' nystagmus. But what are we doing to relieve the patient who is already afflicted with this truly distressing complaint? There are hundreds of cases not receiving any form of treatment, apart from encouragement to get some work to do to avoid the evils of idleness and introspection. I consider this a reflection on the enterprise and public spirit of the ophthalmologists in mining areas. It may be true "that there would appear to be a disease, miners' nystagmus, the nature of which, as far as the eyes are concerned, we, as ophthalmic surgeons, can appreciate, accurately measure, and record; there is another disease, miners' psycho-neurosis, of which we, as ophthalmic surgeons, have no special knowledge,"¹ but that is no reason why we should not make good that knowledge, with or without the help of psychological and other experts. The psychologists could deal with the factors of innate nervous instability and the psychic disability, but we could certainly deal with the toxic factor, which is probably present in all cases. The mining engineer will attend to the question of toxicity due to exogenous agents such as gases, but it should be our duty to find out the part played by endogenous toxins in establishing and sustaining the disease, and to adopt methods to counteract their action.

Mr. Frank Thomas of Swansea has obtained some favourable results by dealing with obvious oral and nasal sepsis in these cases, but if we are to attack the problem properly we shall need to go into the whole question of sepsis, and especially of intestinal toxæmia, and its correction. Investigations into these matters involve the institutional treatment of the patients, and obviously the institution must have the staff and equipment necessary to carry out these investigations.

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A NEW METHOD OF APPROACH IN GASTRIC SURGERY.

BY

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THE two cases of carcinoma of the stomach which I am about to describe in detail belong to a small group which at first sight might appear to be inoperable. From the point of view of a radical excision of carcinoma of the stomach cases fall into three categories. There are (1) cases in which the growth is confined to the stomach, where the stomach is not fixed, and which are suitable for an immediate partial gastrectomy; (2) cases where there are secondary deposits in the liver or elsewhere, which are obviously inoperable; and (3) cases where there are no secondary deposits, but where on account of the local conditions, the size and fixation of the growth, it is doubtful whether an excision can be done. It is to this last group that these two cases belong. They were both operated on by Sir Berkeley Moynihan, under whose care they were at the General Infirmary, Leeds.

Briefly, the method is to open the abdomen and give a big dose of deep x rays directly on to the tumour. A second operation is done six weeks later, when the growth is found to be considerably shrunken in size, and to be much more freely movable.

CASE I.

A woman, aged 45 years, was admitted with a three years' history of attacks of abdominal pain and nausea. Five months previously she had begun to vomit, and since that time she had been unable to retain any solid food whatever. For the last two months she had been in bed. There was a fixed tumour palpable in the epigastrium. An x-ray examination showed a filling defect in the stomach, involving both curvatures and extending from the pylorus about two-thirds of the way to the oesophageal opening. A fractional test meal showed a complete absence of free hydrochloric acid. She was given two transfusions of blood, and on August 31st, 1923, the abdomen was opened, using hedonal as an anaesthetic. A large mass of growth was found in the stomach; its extent was as shown by the x-ray examination, and the condition was described as a leather-bottle stomach. Glands were present along both curvatures, but there was no sign of any malignant deposit elsewhere. The abdominal wall was retracted, everything except the growth protected by mackintosh clothes and lead plates, and the growth itself was exposed to the direct action of the deep x rays for forty minutes. The abdomen was then closed and the patient sent to a convalescent home.

A second operation was done on October 12th, when the growth was found to have shrunk to roughly half its original size. In addition, it could be moved about quite freely and a partial gastrectomy was done without much difficulty. The patient had an uninterrupted convalescence and left hospital finally on November 3rd. She was still in good health four and a half years after the operation, except for a secondary anaemia. A recent blood count was as follows: Erythrocytes 4,180,000 per c.mm., haemoglobin 36 per cent., colour index 0.42, leucocytes 6,100 per c.mm.—a reading which is very definitely not of the pernicious type.

CASE II.

A man, aged 60, was admitted in July, 1924, with a history of indigestion since the preceding December. He complained of pain coming on three to four hours after a meal, and said that food relieved his pain. His appetite was fair, he had not lost much weight, but looked pale. An x-ray examination showed a filling defect in the middle third of the stomach, and a test meal revealed an absence of free hydrochloric acid. He was given three transfusions of blood, and on August 8th his abdomen was opened under local anaesthesia. There was a growth in the middle third of the stomach, mostly on the anterior surface. It extended into the great omentum and appeared to be dangerously close to the transverse colon. It was adherent posteriorly, so that it was quite impossible to lift the stomach up into the wound. There were no secondary deposits elsewhere. As in the previous case, an application of deep x rays was given directly to the growth for thirty minutes.

The second operation was done on October 1st, when it was found that the growth had shrunk considerably in size, that the posterior fixation had disappeared, and that it was quite possible to get between it and the transverse colon. The stomach was removed, and a note made at the time says that the upper division of the stomach was very close to the edge of the growth. The patient left hospital on November 11th and is still in good health more than three years after the operation.

A pathological examination of the specimen showed it to have been a spheroidal-celled adeno-carcinoma. The interesting point about this case is that in spite of the stomach having been divided closer to the growth than would ordinarily have been considered advisable there has been no recurrence. This is what we might expect, for as well as an action on the main mass of the growth, an effect must be produced on the clinically imperceptible permeation round it.

These two cases illustrate very well the changing of an apparently inoperable into a definitely operable state. At first sight there is no doubt that it would have been absolutely impossible to attempt to excise the stomach, while at the second operation the conditions for its removal could hardly have been more favourable.

An alternative method is, of course, to give a preliminary exposure of deep x rays to every case of carcinoma of the stomach which is to be operated on. To give a dose of the strength which can be applied directly to the growth would be to run the risk of an x-ray burn, and experience shows that one big dose is considerably more efficacious than a number of smaller applications applied to the growth at intervals by the cross-fire method.

Cases of this type belong to a very small group, for the conditions must be as I have described them for this line of treatment to be possible. It is a very high recommendation for the method that these two patients, the only ones to undergo treatment by this method, are alive without any signs of recurrence, in the one case four and a half years, and in the other five and a half years after operation.