FUNCTIONAL CONDITIONS IN THE LIGHT OF HEAD INJURIES.

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A careful investigation of the functional nervous cases seen in a Military Hospital in war time forms an interesting commentary on the various theories that have been propounded as to the causation of functional conditions. The main theories are: (1) That they are pure neuroses; (2) that they are the effects of toxins, endogenous or exogenous; (3) that they are caused by abnormalities of internal secretion; (4) that they are due to psychic causes, and probably the only point upon which all would agree is that civilization plays a very large part in their production. Kultur has brought CO into prominence as a possible cause of neurasthenia and has shed an illuminating light upon the whole question. It is essential to take a wide outlook and it is obvious that in every case it is a general and never a local condition that has to be dealt with, and that names do not mean much. The labels psychasthenia, traumatic neurasthenia, functional paraplegia, hysteria, disorderly action of the heart, debility, shell-shock, and, dare I add, trench-nephritis and trench-feet, often indicate little more than the investigator's point of view and the patient's point of least resistance. We hear much of trench-feet, practically nothing of trench-hands, but they both exist and the difference between the two is only one of degree.

In fatal cases of head-injury, when there is not an obviously adequate cause for death, such as destruction or compression of brain substance, the result as a rule is put down to shock. The nature of shock has been elaborately investigated by Crile and his fellow-workers, who found that a similar clinical condition with essentially similar pathological appearances in the brain followed from four different causes: (1) Any exhausting peripheral or central stimulus; (2) psychic influences; (3) cerebral anemia; (4) poisons, organic or inorganic, including toxins. The effects of shock are seen in different forms in all parts of the body, either as a direct result of nervous impulses or more indirectly as a consequence of vasomotor changes. The frequently prolonged functional effects of head-injuries may be regarded as a chronic phase of the condition which Crile has elucidated, and we must,
therefore, expect to find manifestations of it in every system. Indeed the neurasthenia which may follow a head-injury is probably to be looked upon as the purest of all functional conditions, in that it may arise instantaneously in a perfectly healthy individual from a single cause, though later other factors may, and probably usually do, help to maintain and even exaggerate it. Every case of neurasthenia makes an interesting study in the light of Crile’s four causes: for when the condition has once become established a slight effort or peripheral stimulus, excitement or anxiety, sepsis or alcohol and many similar influences, may have an exhausting effect and precipitate a crisis. A head-injury then has two aspects: (1) an organic, concerned with the actual lesion and its direct consequences; (2) a functional, concerned with the neurasthenic effects upon the body as a whole.

I have spent the last four years in the study of functional conditions; first in general practice, then as resident in a General Hospital, and latterly as resident in a Military Hospital. The conclusion I have come to is that the living body may be compared to an electrical system, which may break down owing to faults either in the circuit or in the battery; and that while an organic nervous lesion may be compared to a break in the circuit, a functional nervous condition corresponds to an inefficiency of the battery affecting the whole circuit, but usually showing its effects more markedly in some parts than in others. There is nothing original about this idea, but the paths that have led me to it may perhaps be of some interest.

I started in general practice at the beginning of 1912. One of my first patients was a servant-girl, aged 26, who had been losing weight for more than a year. She had been subject to frequent headaches all her life; latterly these had become constant, and she was complaining also of giddiness, nausea, pain after food and diarrhoea. I could find no physical signs to account for her condition, and, being rather at a loss for a line of treatment, suggested that her headache might be due to her eyes. She said she was sure this could not be so; she had been sent up to London to have her eyes examined three years before; glasses had been ordered, but they had not helped her. Her headache seemed to be so much influenced by near-work that I persisted in my hypothesis and examined her eyes. She had mixed astigmatism requiring a 1D. cylinder for the one eye and a 0·5D. cylinder for the other. My result differed only very slightly from the old prescription and I hesitated to order the glasses. Still they improved her vision so
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much that it seemed worth doing, and I sent her old frames up to London for new lenses. Before she had had them a fortnight she came back to ask me to get her a second pair in case she broke the first. She looked quite a different woman; her skin was clear and healthy, her headaches had vanished, her giddiness, nausea and diarrhoea had disappeared; in six weeks she put on a stone in weight; the idea of a convalescent home which had been proposed was abandoned, and she still remains perfectly fit.

This result made a great impression on me, and whenever a suitable patient arrived, who would allow me to do so, I worked out the refraction with the greatest care, always inquiring into general symptoms. Many cases were utter failures, but many did extraordinarily well, and the failures when I was certain my glasses were right were very few. My ophthalmic upbringing had been strictly orthodox, and I had thought small "physiological" errors of little consequence: yet almost all my best results were obtained in cases with small errors, and chiefly by the use of cylinders alone.

I kept notes of my cases and learned to expect results in every system of the body, though those on the skin were the most obvious both to myself and others. My chief troubles were (1) the difficulty of persuading people that glasses could possibly help them; (2) the objection that many had to wearing glasses constantly; (3) the question of expense, for accuracy is hardly ever obtainable at the first attempt. Many patients had many different pairs and some were very difficult to keep, but in spite of prophecies of disaster my practice quadrupled in two and a-half years.

It is more than forty years since Thomson and Norris's discoveries were made known to, and published by Weir Mitchell. Since then much has been written on this subject. Most ophthalmic surgeons are agreed that patients may be divided into two classes, those who can deal comfortably with any errors however great, and those who cannot deal with the smallest errors. The important point is not the amount of the error, but the nervous energy of the subject. The relief of nervous symptoms by glasses is often regarded as due to suggestion, and neurasthenia frequently looked upon as due to a defective will-power. But the functional effects of head-injuries are not as a rule regarded in this light, and the patient does not incur the stigma which is apt to attach to the patient with say "shell-shock." I will give three examples of neurasthenia following head injury: in the first there was undoubted destruction of brain-substance; in the second there was a fracture of the skull, but no definite brain lesion; in the third there was neither a
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fracture nor, as far as is known, any destruction of brain-tissue.

Case 1.—Pte. K., aged 24, was wounded on July 19, 1915, in Gallipoli. A rifle-bullet entered the left side of the back of the neck and came out above the right eyebrow. He was unconscious for about a quarter of an hour, "vomited" blood at intervals for twenty-four hours, and had pyrexia for several days, the highest temperature recorded being 104·4. On admission to this hospital (September 1) there were many opacities in his right vitreous and with this eye he could only count fingers at one metre. There was a marked thrill beneath the upper part of his left sternomastoid and a roaring murmur widely transmitted could be heard there. An arterio-venous aneurysm was diagnosed probably between the internal jugular and the internal carotid. Other evidence led to the conclusion that there was damage to the right frontal lobe, the right optic nerve, and the left motor-cortex in the face region. He was sent away to the country and returned in January, 1916, when he was very depressed, was sleeping badly, complained of constant headache, frequent giddiness, and palpitation. The question of tying his carotid was discussed and a neurologist suggested that his right visual field might be of interest. His visual acuity was now right $\frac{7}{8}$ and left $\frac{3}{4}$. Under atropine with right $+1.50\ S. +0.375\ C.$ vert., and left $+1.50\ S. +1.25\ C.$ vert., he could read $\frac{4}{5}$ with either eye. He was ordered these cylinders with smaller spheres and in a week looked quite different and was sleeping better; his skin was healthy, his giddiness had gone, and he had very little headache. His palpitation soon disappeared, and he left hospital on March 27, quite cheerful and without having had his carotid tied.

Case 2.—Serjeant B., aged 28, was wounded on the right side of the head in Gallipoli, on August 9, 1915. He was unconscious for two days. On August 16 he was trephined in Egypt, and sent back to England in September. He was invalided for Home Service, but at his own request was sent to Salonika, in March, 1916. On the voyage the site of the wound became swollen, he had acute headache and a "fit." As soon as he landed he was taken to hospital, where the swelling was opened up, pus evacuated and a small depressed fracture found. On admission to this hospital he was complaining of frequent headache, double vision at night, palpitation, head-noises, and numbness of both feet. He could only read for a few minutes at a time. His visual acuity was $\frac{3}{4}$ with each eye, and right $+0.50\ C.$ vert. and left $+0.50, 75$ do. gave
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him §. He said he would much rather be trephined again than wear glasses but finally consented to try them. With them he found that he could read as long as he liked; he had no diplopia, giddiness or head noises, and in a few days the numbness of his feet had disappeared, while his headache was very much less.

Case 3.—A wet sand-bag weighing about forty pounds fell upon the head of Serjt.-Major P., aged 28, on November 24, 1915, in Gallipoli. He was removed to —— complaining of intense headache and giddiness. A week later he developed a bilateral internal strabismus with constant diplopia and head noises. He was considered to be suffering from cerebral tumour or specific basal meningitis. While on the voyage home the diagnosis was changed to disseminated sclerosis or neurasthenia. When he reached this hospital he could not move either eye outwards beyond the middle line of the orbit, the up and down movements were poor and there was slight lateral nystagmus. He had not been able to stand or read since his accident (six weeks). His visual acuity with each eye was less than 6/6. With right +0·375 C. vert. and left +0·25 S. +0·25 C. 70 do. he could read 6 with either eye, had perfect binocular vision and could read ordinary type comfortably. Within a week he could stand without support and walk with the aid of a stick, while his headache, giddiness and head noises had ceased. Whenever he took off the glasses his strabismus and diplopia returned instantly. Two other combinations were tried, but failed to relieve his symptoms. This case was seen by all the four ophthalmic surgeons on the staff of the hospital.

There are several points of interest about these cases. The highest cylinder ordered was 0·50. The first patient was sent to the Ophthalmic department, not to have the refraction estimated, but to have the visual field worked out. Though his error was, the astigmatism of the right eye was three times as much as that of the left. If this patient had been ordered +0·25 C. for each eye, he would almost certainly have found the glasses intolerable, as they would have produced an artificial indirect astigmatism of an eighth of a dioptrre in the left eye, and have left an uncorrected direct astigmatism of the same amount in the right, the most pernicious of all varieties of asymmetry. In Case 3 there was asymmetry of every variety—spherical, cylindrical, and axial. It is a remarkable case from whatever point of view it is looked at. Asymmetry is always of the utmost importance, and the mere covering of one eye will frequently give the greatest possible relief in cases of head injury or other forms of neurasthenia, provided it
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is the non-dominant eye which is covered. The compensation of the dominant eye—usually, of course, the right—is almost always better than that of the other. Pte. H., who had a hernia cerebri, and was under the care of Mr. H. W. Carson, discovered for himself that he was much more comfortable if he brought his head-bandage down over his left eye. He did very well, but after some weeks tried to use both eyes together; in less than an hour he had intense headache and general convulsions, and was put back to bed unconscious. A so-called amblyopic eye may be a great source of trouble unless the image formed by it is entirely suppressed.

It must not be thought that these cases are exceptional. The mere shock of a head injury may kill, and in any case it lowers the efficiency of the whole nervous system, quite apart from the direct consequences of the actual lesion. The patient becomes, temporarily at least, a neurasthenic—one who cannot fulfil the normal functions of life in the normal way. Ordinarily the refractive errors, which exist to a greater or lesser degree in almost everyone, are compensated by a continuous neuro-muscular effort, so habitual as to have become practically a reflex. No one would be surprised at the compensation for, say, a mitral stenosis breaking down under the strain of the War. The same reasoning applies to the compensation for refractive errors.

Pte. R., aged 23, was buried in a mine explosion in France; during the few days he spent in hospital he complained of not being able to see as well as formerly; a −3.0 sphere was ordered for each eye, with which he could read 8. He went back to the trenches, and wore the glasses for three months with comfort. He was then again buried; his general condition was this time much worse, and he was sent back to England. He complained that ever since his second accident his glasses had been intolerable, and that he could not wear them for more than a few minutes at a time. His visual acuity with his glasses was right 1/8, and left 1/8. With right −2.75 S. −1.00 C. vertical, and left −2.75 S. −0.75 C. vertical, he could read 8 with each eye easily, and they were perfectly comfortable. The −3.0 spheres created an artificial mixed astigmatism of right + 0.25 S. −1.00 C. and left + 0.25 S. −0.75 C. While he was fit he could deal with these artificial errors quite easily; after his second accident he had become neurasthenic and
could not compensate them. Just as this patient could not deal
with his artificial errors, so the men who had been made neurasthenic by their head injuries could no longer correct their natural
defects.

The discovery of one functional condition should lead to the
routine search for others. Life itself is a nervous phenomenon, and
there are manifestations of lowered nervous energy in every system.
Mental changes of any variety, from a mere transient confusion to
actual insanity, may take place. There may besomnolence or
insomnia. Headache is very common, eye symptoms abound, and
giddiness, which may be caused by a failure of any link in the chain
upon which equilibrium depends, is general. The ear with its
delicate mechanism is easily upset, fails to hear what it should hear,
and hears sounds that do not exist. The skin may lose its healthy
tone; the hair becomes scurfy and tends to fall. The sweat-glands
are often obviously affected, and it is not unreasonable to suppose
that other glands also are disturbed, producing excessive, deficient,
or unnatural secretion. Crile has shown the acute effect of shock
upon the suprarenals, and fright is an accepted cause of Graves's
disease. The alimentary canal may show abnormalities of peristalsis,
of secretion, and of absorption, absorbing what it should not
absorb and failing to absorb what it should absorb. A colectomy
undoubtedly diminishes the absorption of toxins, but the question
at issue would appear to be rather why the colon absorbs toxins at
all. The rate and rhythm of the heart may be affected, and want
of tone may lead to dilatation. The respiratory manifestation
would appear to be spasmodic asthma. Some forms of anæmia
may be expressions of neurasthenia affecting the blood-forming
tissues. Afections of the motor nerves are shown in tremors,
convulsions, and pareses; while on the sensory side there are
neuralgias, anaesthæsia, hyperæsthesia, paræsthesia. One effect on
the vasomotor system is seen in Raynaud's disease, which bears a
striking similarity to certain cases of trench feet. Resistance is
lowered; infections that have lain dormant for years, or have
previously been strictly localized, may become active or spread.
Psychic influences, fear and excitement, grief and anxiety, may
have effects they would not have upon a normal individual.

On some such lines as these it would appear that a functional
case should be investigated. Whatever the route by which it has
been reached, the condition once established is undoubtedly
a general one: fatigue, poisons, psychic influences, glandular
deficiencies, injuries, may form links in a vicious circle: the intro-
duction of a single element may produce a crisis, its removal may effect a cure.

Neurasthenia, in the widest sense of the term, can, as I have said before, be compared to the effects upon an electrical system of an inefficient battery. The body, unfortunately, cannot be provided with a new battery, but much can be done to give the old battery less work to do. The patient who has had a serious head injury is put to bed and rested in every possible way.

During the period of rest in bed, almost the only organs of his body upon which any constant voluntary effort falls are his eyes. At first the mere stimulus of light may be intolerable to him and he lies as far as may be with his eyes shut. If he opens them, blurred and ill-fused images only increase his headache, nausea and giddiness. The sudden paresis of an external ocular muscle may cause headache, giddiness, and nausea; the effects of a paresed ciliary muscle may be the same, but the cause is not equally obvious. Later he is probably comfortable as long as he lies still, but any change of position is apt to reproduce his symptoms. The next step is probably an attempt to read, and the difficulties of near are added to those of distant vision. When he gets up more frequent changes of position and increased efforts of every kind cause a recrudescence of his troubles. In fact, throughout his convalescence he is dogged by difficulties caused him by his eyes, because without them he can do little or nothing. A large proportion of his diminished available nervous energy is spent upon them, the rest of his body is starved and various functional effects follow or are kept up. It can easily be proved that in the vast majority of these cases the visual acuity depends upon the refractive error, and most of them can be made to read $\frac{2}{5}$, $\frac{3}{5}$, or $\frac{4}{5}$ under atropine. What has happened to them is that, just as they would probably find a ten miles' walk an impossibility, so they cannot maintain their ocular compensation or only do so at the expense of other parts of the body.

An accurate correction of the refractive errors removes a constant insidious source of nerve-waste, takes much work off the battery and in the debilitated conditions described frequently makes all the difference to the patient. It is not a question of what the man sees but at what expense to himself he sees. If a neurasthenic can read $\frac{2}{5}$ or more without glasses he is almost certainly doing so to the detriment of some other part of his body. The object to be aimed at is to leave a minimum, and, as far as possible, equal defect for each eye to correct, without changing
the nature of the defect. An over-correction does no permanent good and may do a great deal of harm. An under-correction of the astigmatism generally leads to an over-correction of the spherical element. If the real error is \(-0.25\) C. axis-vertical and \(+0.25\) C. axis horizontal is ordered, the effect is to change the original myopic astigmatism into a pure myopia, and substitute an unnatural for a natural defect. The ordering of \(+0.25\) S. \(+0.25\) C. when the prescription should be \(+0.50\) C. creates an artificial myopic astigmatism of a quarter of a dioptre.

Anyone who cares to take the trouble to accurately correct the refraction of neurasthenics will find that he will get extraordinary results, but he will only get them by very patient labour and hardly ever, except in some cases of simple astigmatism, at the first attempt, and he must always remember that he is playing with edged tools. The best results are to be obtained with small errors normally well within the patient's powers of compensation. A big defect is very easy to correct approximately, but when that has been done one still has to search for the accurate correction which will put the eyes practically out of the circuit. There is an enormous field in this direction: refraction work of the ordinary type is of the dullest; once it is looked at from the point of view of general symptoms it becomes fascinating and throws light upon problem after problem. But no one who attempts it must expect to be regarded as anything but a charlatan even by his patients. Just as a patient will believe that anything is wrong with him rather than his eyes, so he will believe that anything has cured him rather than his glasses—until he breaks them.

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