in making the diagnosis between that and a limited cortical lesion. I have met with cases in which I was able to make an absolute diagnosis as to whether the paralysis was due to organic lesion or some functional disturbance. As we all know, a few hours' waiting clears the diagnosis in these cases. As a rule, in organic lesions of the cortex, only those muscles affected in the initial spasm will be paralyzed after the convulsion is over. In paralysis due to the effect of a poison, in nephritis and hemiplegia, paralysis of one arm and one leg is common.

Dr. C. EUGENE RIGGS of St. Paul—I think that Dr. Hoppe is to be congratulated on the exceedingly happy way in which he has put this very practical subject before the Section. I am inclined to believe, however, that there is a golden mean that Horace tells about, in which we can probably take a safer position than by saying dogmatically that these are simply due to toxemia, or simply due to hemorrhage. I confess to great sympathy with Dr. Sexton's view. We know that one-third of the cases of organic hemiplegia are probably due to Bright's disease; we know that Bright's disease produces hyaline degenerative changes, and slight pressure will cause this disaster. But we also know that the resulting phenomena depend entirely on the location of the hemorrhage. We all have seen these limited aneurysms in the brain, and if one of these aneurysms happens to break, the first effect is insult to the brain, in which you will find certain phenomena described by Dr. Hoppe, while in a very short time that will all pass away. I think that death may not only be due to the influence of uremia—you have all seen poisons so extremely toxic as to cause death in a short time—but it may also account for the temporary phenomena of paralysis. That seems to me a thoroughly clear and legitimate conclusion. As soon as the kidneys act thoroughly and properly the paralysis will clear up. While the uremic toxemia may account for a number of these cases, still there are a number of other cases due to hyaline fibroid degeneration of the brain.

Dr. C. C. HERSMAN of Pittsburg—I can scarcely conceive the idea that these paralyzes are caused by hemorrhage. In one case that I saw, some time ago, the paralysis was so profound that I was almost persuaded to believe it was a genuine attack of apoplexy, but the clearing up was very rapid, only lasting a few hours. My surprise was, not that it cleared up so soon, but that it was so complete. It seems to me that if a lesion were present, we could scarcely expect such rapid recovery. It is possible, however, that a miliary aneurysm occurring, the profound shock to the part might be the cause of paralysis, and on recovery from the shock, the lesion not being extensive enough to cause a destruction of tissue would answer for the cause and the rapid disappearance. The theory as to vasomotor disturbance has been disputed by many; in fact, all the theories that I have seen suggested have been disputed by others. Consequently we can not say that we have any definite conclusion that we can hold to; but I am inclined to think that the cause is not a lesion or a hemorrhage, any more than it is in the case of epilepsy, or any other convulsion which we might have that is not caused by hemorrhage.

Dr. HEINS—I have noticed that the gentleman in speaking of these cases spoke of them as rather milder cases, and therefore allowed the possibility of recovery in that way. They speak of the percentage of albumin. A case of nephritis is not measured entirely by the amount of albumin that you have. If the gentleman says that 2 per cent. of albumin shows a small kidney lesion, then I would like to ask him what would be a larger percentage? I do not wish to be critical, but it strikes me it is a matter of some importance. It seems to me, too, that it is a bad thing for practitioners of medicine to cast away their anchors, and when you have, as Dr. Sexton has mentioned, an actual lesion that is the probable cause, to throw it aside. It is better to reason it out that way, than to say that there was no hemorrhage, because then you simply have no cause at all.

Dr. HOPPE—In answer to Dr. Hein's question about the percentage of albumin; as a rule the prognosis of kidney trouble is inversely to the amount of albumin present, the most fatal cases of interstitial nephritis being those that have the smallest percentage of albumin. Sometimes men will die without the urine showing any albumin. So the amount of albumin present does not have any bearing on the severity of the attack or the prognosis. The only difference about the paper seems to be as to the immediate cause of the condition in the cortex. We have actual facts at our disposal, and autopsies which have been performed by the best men in the world. I would call your attention particularly to the autopsies made by Jurgens and Israel in Berlin; not only did they make gross pathologic examinations, but they made histologic examinations, and not

any trace was found of any change in the cortex. This is the history, postmortem, of all the cases in which the hemiplegia continued up to the time of death. When the Traube theory of localized edema was still in vogue, some of the autopsies showed edema of the brain. But we know that we find edema even in the brains of drunkards without having any symptoms of paralysis during life.

OCULAR HEADACHES.

Presented to the Section on Neurology and Medical Jurisprudence at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898.

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CHICAGO.

This subject is such a large one, and the views and experiences of ophthalmologists as to the rôle played by the eyes in the causation of this important symptom are so diverse, that it is difficult to give it the careful consideration that it merits in the short time allowed. When we reflect upon the mysterious character of headache and the unsatisfactory explanations advanced to account for it, we can understand the difficulty the ophthalmologist encounters when he attempts to give a reason for the faith that is in him, and to correctly interpret his clinical data. Even the exact seat of the pain is not known. Who can say whether it is in the brain itself or in the membranes covering it? In acute inflammation of these membranes it is quite probable that the severe headache is caused by the irritation of the meningeal nerves, but that is entirely different from the functional affair we are considering.

Just what influence vascular dilatation exerts in the production of this neurosis is equally uncertain. If it should be true, as claimed by some observers, that sensory nerve-fibers exist in the vessels of the brain, we could understand how distention of these vessels would give rise to pain, even without the increase of intracranial pressure. It is not improbable that the congestion of the mucous membrane lining some of the accessory cavities of the nose is accountable for many of the frontal headaches coming on after excessive use of the eyes, and this view is strengthened by the clinical observation that such cases are relieved only when, with the correction of the ocular defect, there is combined suitable treatment for the diseased nasal mucous membrane. That there are headaches induced by eye-strain is undeniable, and the discovery that the relief of the strain is followed by alleviation of the pain marks a brilliant advance in our therapeutics.

Notwithstanding that other general conditions may underlie the development of this neurosis, and the ocular condition may be only one factor, still its presence may for the time be a dominant one whose correction will strongly influence the future history of the case. And should the headaches recur at some time subsequent to the relief of the eye-strain, such recurrence would not disprove the value of the treatment, but would prove that some of the other underlying conditions had become dominant factors. Such complex cases are not infrequent, and show the importance of careful examination of the eyes in all cases of headache in which there is any doubt as to the etiology.

In most cases of so-called ocular headache, there is a history of the pain coming on after either mod-

erate or excessive use of the eyes for near work, but to this rule there are numerous exceptions. For example, some cases of excruciating vertical or occipital headaches coming on without any reference to the use of the eyes are relieved after wearing appropriate glasses. One cannot be certain therefore that no ocular defect exists because pain does not manifest itself in the eyes, or because headache does not come on with or immediately after the use of them. I shall not consider headaches occurring in connection with inflammatory conditions in or about the eye, for this would be foreign to the purpose of the paper, but shall speak only of those caused by 1, exposure to bright light; 2, strain of the ciliary muscle (so-called accommodative asthenopia); 3, strain of extrinsic muscles from incoordinate action (the so-called muscular imbalance).

EXPOSURE TO BRIGHT LIGHT.

Cases are not infrequent in which there seems to be a hypersensitiveness of the retina, which may or may not be associated with other nervous manifestations, and in such cases there may follow on exposure of the eyes to bright light a pain in the head or in the back of the eyes. With such persons a headache results when they look continuously at brightly illuminated and glistening surfaces, such as paintings in a picture gallery, a brightly illuminated page, especially if the paper is finely glazed, or if they are exposed to the glare of the snow or of a white, dusty road. The light from the electric lamps also seems to be peculiarly irritating to some eyes, and sufficient at times to excite a headache. In many such cases an examination will show some refractive error causing strain of the accommodation, which will aggravate the difficulty, but in others no such trouble can be found, or the symptoms persist after the correction of such a defect so that we are forced to conclude that excessive irritation of the retina will act as a cause of headache.

Of course, such hyperesthesia of the retina might be a precursor of inflammatory change, in which case a slight congestion of the vessels in and around the optic disc and the yellow spot would be noticed. But in many the ophthalmoscope reveals no such sign of inflammation, while occasionally there is seen only on careful focusing, a peculiar finely-dotted appearance of the retina in the region of the macula lutea, very much as if a mixture of pepper and salt had been sprinkled on it. Whether this represents a beginning pathologic change in the elements of the retina, or is the normal appearance of a retina that is unusually sensitive I do not know.

STRAIN OF THE ACCOMMODATION.

This is the most important and frequent cause of ocular headaches. When the normal emmetropic eye looks at an object more distant than 20 feet, the rays of light from that object are brought to a focus on the retina and produce a clear image without any effort on the part of the muscle of accommodation. If the object is nearer than 20 feet, rays of light emerging from it will not be focused on the retina of the emmetropic eye without the aid of accommodation, and the nearer the object is brought the more accommodation will be necessary. At 20 inches 2 D of accommodation are necessary, at 10 inches 4 D, at 8 inches 5 D, at 5 inches 8 D and so on.

This accommodation is accomplished, as we know, by a change of shape in the crystalline lens, brought

about by the contraction of the ciliary muscle, and if this contraction is excessive there results a strain of this muscle, and even in certain cases a spasm of it, with resulting discomfort and sometimes headache. Children often contract a pernicious habit of sitting in a crouched position with the head bent forward close to the book, thereby putting a great strain on the ciliary muscle, and on account of the compression of the superficial veins of the neck, producing a congestion of the head which may lead to the development of myopia or even more serious complications. Often such children are precocious subjects—inordinate readers, as their parents will tell us—and of a nervous, restless temperament, and they are frequently brought to the specialist for eye-ache and headache. In some of them no error of refraction is discoverable, or the error is so small as to be quite insignificant, and they are benefited by correcting the method of reading and having them use the eyes less for near work.

The hypermetropic eye, by reason of its antero-posterior diameter being too short, is unable to focus parallel rays of light upon the retina, and accordingly accommodation is necessary to see even distant objects distinctly. This places an additional amount of work upon the ciliary muscle, and if astigmatism is also present, the strain is even more severe, for the muscle is constantly trying to correct the unequal meridians of curvature of the cornea, and is therefore contracting unequally. Such an eye is using its accommodation constantly, even for distant objects, and the work of the ciliary muscle is necessarily much greater when near objects are to be seen distinctly. In such a case the ciliary muscle undergoes to a limited extent a compensatory hypertrophy, and is able for a time to do the work assigned to it. But let its nutrition suffer because of impairment of the general forces of the economy, and that work becomes a burden that formerly was done with ease, and the unhappy subject is made aware of the presence of his eyes. Or if additional demands are made upon the accommodation, as for continuous reading, writing, or sewing, the muscle is found unequal to them, and pain is felt not only in the eyes but in the head. This is noticed also when the attention is closely fixed upon distant objects. Astigmatics frequently complain of headaches after going to the theater, or when traveling and looking at the passing landscape, or after a round of shopping.

In London they speak of an "Academy headache," the result of gazing intently at pictures during the exhibition. Such a headache may be partly due to the glare of the light from the brilliant colors on the canvas, and partly to the physical exhaustion incident to the loitering through a picture gallery.

Even slight degrees of astigmatism may be sufficient to cause considerable eye-strain under such conditions, particularly so if the astigmatism is of the oblique variety, in which the principal meridians of curvature of the cornea are no longer horizontal and vertical. The ciliary muscle seems to find greater difficulty in overcoming this kind of astigmatism.

When the individual is in perfect health he may be able to overcome a very considerable refractive error without experiencing any ocular distress, but if for any reason his vitality becomes impaired—particularly his nervous vitality—then he feels the additional strain, which may manifest itself in headaches. This is very noticeable in patients having hypermetropia

or astigmatism who are recovering from some severe exhausting disease, in young persons at the time of puberty, and in persons suffering from neurasthenia. A good illustration of this is to be found in a case of paresis or paralysis of the ciliary muscle following diphtheria. Even after the muscle partly recovers its power, it is very weak and easily becomes fatigued with slight accommodative effort, much more so if it has to overcome also a refractive error of hypermetropia or astigmatism, and this manifests itself by reflected pain in the head.

MUSCULAR INSUFFICIENCY.

We now come to the third cause of ocular headaches—the strain of the extrinsic muscles from lack of balance, so-called “muscular insufficiency” or “muscular imbalance.” This term assumes that one or a group of the eye muscles is too weak for its opponent, and there is therefore a tendency for the optic axes to deviate from the normal. This usually concerns the recti muscles, and of these the internus and the externus are the ones most frequently affected, although the superior or inferior rectus may show signs of weakness, and it is even claimed that at times the oblique muscles are at fault. If this deviation of the optic axes is apparent without tests, there exists strabismus, but if it is only latent, each eye fixing the object, and binocular single vision being present, it is spoken of as insufficiency of one or the other muscle. To this general condition the term “heterophoria” has been given by Stevens, and this is specifically divided into “esophoria, a tending of the visual axes inward; exophoria, a tending of the lines outward, and hyperphoria (right or left), a tending of the right or left visual line in a direction above its fellow.”

Diplopia is so dreaded by the mind, and desire for single vision is so great, that extra effort is made to compel the so-called weak muscle to keep the optic axes in the right direction, and this effort is supposed to cause an unequal strain on the muscular apparatus of the eye that may excite all kinds of neuroses. Headache, megrim, chorea, neuralgia, insomnia, chronic gastric and digestive disturbances, epilepsy, nervous prostration and insanity are some of the conditions that are supposed to result from such eye-strain; and it has even been claimed of late by some of the enthusiasts in this work that an organic disease like trachoma owes its origin in many cases to insufficiency of some of the eye muscles. It is much more difficult to determine the effect produced upon the nervous system by strain of the extrinsic eye muscles, than it is to demonstrate such effect by strain of the ciliary muscles, even with extensive clinical data at hand. In the first place, the tests for heterophoria are not so accurate as those we use for estimating the refraction of the eye, and in the very nature of things they can not be. In the second place, we are dealing with a muscular apparatus far more complex than that which controls accommodation—a muscular apparatus which is innervated by three distinct motor nerves and is intimately connected with the sympathetic system; a muscular apparatus which is double, and must perform wonderful co-ordinate and conjugate movements.

It is extremely difficult to determine with positiveness whether the muscular insufficiency is due to weakness occasioned by organic defect of the muscles themselves, whether it is due to imperfect innervation of the muscles because of some trouble in the nucleus,

or whether it concerns some of the higher centers presiding over co-ordination. In many cases it is even impossible to say whether a given muscle is too weak or its opponent is too strong. In the third place, we have not yet obtained accurate data as to the normal limits of mobility of the eye, and we are therefore not in a position to fix the abnormal.

The assumption that normal abduction must be sufficient to overcome a prism of 8 degrees and normal adduction equal to a prism of from 30 to 50 degrees is purely an assumption. While I am not prepared to deny that heterophoria or muscular insufficiency may in some cases be the cause, or one of the causes, of headaches and other neuroses, yet I hold that the results obtained by many ophthalmologists in the treatment of these cases, and adduced as proofs of the proposition are very far from conclusive. It is true there are cases in which operation on the muscles of the eyes seems to have accomplished results that are indisputable. I have had a few such cases myself, but the majority of them present such complex nervous symptoms, sometimes verging on the hysteric, that it is difficult to say whether, in treating the muscular anomaly, we are attacking the disease itself or only one of its effects.

In considering the location or variety of ocular headache it is impossible to specify any positive characteristic that will differentiate it from headache arising from other causes. In general we may say that the headache brought on by eye-strain is of a dull heavy character, although at times it may be sharp, excruciating and neuralgic, sometimes being so severe as to cause nausea or vomiting without its being a true megrim. Its most frequent seat is in the supra-orbital or frontal region over the frontal and ethmoidal sinuses, a brow-ache, or it may be described as a pain in the back of the eyes or deep in the orbits. The next most frequent location is in the temporal region, and the pain here may be throbbing in character. Occipital headaches are also observed, the pain being sometimes referred to the base of the skull or the nape of the neck, and even reflected to the back and shoulders. Ocular headaches affecting the vertex are, in my experience, less frequent than any of the others.

The most characteristic sign is the occurrence during or after excessive use of the eyes, as in reading or other near work, sight-seeing, shopping, etc., but, as I have mentioned before, this rule is by no means absolute. A person may awake in the night or rise in the morning with a headache apparently excited by an uncorrected astigmatism. As far as true megrim is concerned, my observation leads me to believe that eye-strain, whether accommodative or muscular, is much less frequently a cause of it than of any other variety. It is true that the attack may be aggravated by a refractive error, but I have seen so many severe cases in which no error or muscular anomaly existed, that I am constrained to believe that when such errors are present they do not act as a direct cause of the trouble.

TREATMENT.

As far as regards the treatment, it may be summed up very briefly. Every case of headache, the etiology of which is at all obscure, should receive a careful examination of the eyes, and this should include a most complete examination of the refractive condition as well as a thorough study of the action of

the muscles. Nothing short of an examination by the use of a mydriatic that will completely paralyze the accommodation is sufficient, as it is impossible to discover low degrees of hyperopia and astigmatism if the ciliary muscle is active. Lenses representing the full correction of the refractive error, less .25 or .5D, should be prescribed and their constant wear insisted on. They will not be tolerated unless the eyes are under the influence of a mydriatic, but with its help the eyes adapt themselves to the new relation. Some persons will be able to lay aside the glasses after the functions have returned to normal, without the recurrence of the headaches, or any of the symptoms that prompted their use. This is often noticed in certain cases at the age of pubescence, at which time the nervous equilibrium being so unstable, headaches may occur because of any excitement or irritation, and a slight hyperopia or astigmatism may furnish the cause. The correction of this defect by relieving the ciliary strain, may remove one of the factors and so prevent the headaches.

In cases where the trouble is not relieved by such measures, and it has been determined that a muscular anomaly exists, this should be treated by prisms, exercises, and means to strengthen the weak muscle before its apparently stronger fellow is operated upon.

In conclusion, I wish to emphasize a few of the points made in this paper:

1. There may be headaches which we may be justified in calling "ocular headaches," for in many of them there seems to exist a demonstrable causal relation between the eye-strain and the neurosis. Just how this operates it is impossible to explain at the present time. Possibly when the presence of sensory nerve-fibers in the walls of the blood-vessels of the brain has been demonstrated, such an explanation as the following may be plausible: "The irritation of the sympathetic nerves in the ciliary body by constant contraction of the muscle and the presence of the products of metabolism, causes through the vasomotors a contraction of the blood-vessels, followed by a dilatation and distention with resulting irritation of the sensory fibers."

2. While there may be a number of underlying conditions at work to cause a headache, eye-strain of any kind, if present, may be a dominant factor exciting the attack, or in aggravating it, and the relief of this strain will often exert a most favorable influence.

Finally, no study of headache is complete that does not reckon with the conditions that may exist in the eye, and when etiology is not perfectly clear these conditions should receive careful attention.

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DIAGNOSTIC CHARACTERISTICS OF HEADACHES ACCORDING TO THEIR ORIGIN.

Presented to the Section on Neurology and Medical Jurisprudence, at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898.

BY H. GRADLE, M.D.

CHICAGO.

The object of the present paper is to point out those peculiarities of headaches which can serve as guides in the search for their origin. The author's experience pertains principally to headaches dependent upon affections of the special senses. But valuable lessons, too, have been learned—in a negative

sense—from the study of those cases which, on investigation, proved to be of different character.

Before proceeding to details, I wish to explain the point of view from which I have been led to regard headaches of peripheral origin. While I agree with the general experience, that a large number of headaches start from some anomaly of the eyes or of the nose, I do not think that the detection of such a peripheral origin ends the investigation of the case. We must consider not merely the peripheral lesion, but also the condition of the nervous system. There are, indeed, certain peripheral conditions which will necessarily cause headache in every case; for instance, acute inflammation of the ciliary body, or acute supuration of the nasal sinuses. But, on the other hand, inflammatory affections of a more chronic character and mere refractive anomalies lead to headaches only in some, but by no means in all patients. As I have elsewhere shown (*New York Medical Record*, Dec. 17, 1895), the difference in the symptoms hinges on the condition of the nervous system. Errors of refraction do not cause headaches in absolutely normal subjects, they simply produce local discomfort in the eyes. In those instances in which optic defects lead to headaches we can demonstrate a neurotic tendency by close examination of the patient, his family record, his personal history, or sometimes only his subsequent history. The more pronounced the instability of the nervous system, the more likely will comparatively trivial peripheral disturbances lead to headaches.

The characteristics of headaches are: 1, their location, and 2, their time-relations. Their severity is a less reliable guide for evident reasons.

Location.—The most important question concerning the site of a headache is whether it is wholly or predominantly one-sided. One-sided headache is always due to a lesion on the same side of the head, either intracranial or in one of the organs of sense. The only exception is that form of migraine which, though one-sided at the time, alternates regularly between right and left, for in this case the source is not one-sided, if it be peripheral at all. Conversely, however, one-sided lesions may in some instances cause headache not limited to the same side. This is sometimes true of unilateral errors of refraction, as well as of affections of one ethmoid or sphenoid cavity. Apart from the side of the head, the location of a headache furnishes no positive indication as to its source. Although headaches are, as a rule, located in the vicinity of the organ whence they are started, there are so many exceptions to this rule, especially in neurotic subjects, that it has but little diagnostic value.

Time-relations.—From the point of view of their time-relations, headaches can be classified as: 1, paroxysms recurring at *a*, irregular or *b*, regular intervals; 2, attacks following some specific act; 3, more or less continuous pain. In this connection, too, must be considered the date of suffering, and its manner of onset.

1. *a*. Paroxysms of headache of similar intensity and duration and occurring at variable intervals constitute the form called migraine. The experience of oculists is very definite regarding the ocular origin of many instances of migraine. How large the proportion is, the oculist, however, can not state, as his cases are relatively selected. If wholly or predominantly one-sided, migraine is surely dependent on