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THE OCULAR SYMPTOMS OF AFFECTIONS OF THE ACCESSORY SINUSES OF THE NOSE.*

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A few years ago there were but few specialists in the practice of diseases of the eye who did not combine with the treatment of affections of that organ that of diseases of the throat, nose and ear, also. By reason of the development of each of these several branches of medicine and the increased demands which have been made in consequence on the time and resources of those practicing them, the continuance of this combination of specialties has seemed no longer desirable and physicians are confining themselves more and more to but one subject. While this course is surely to be commended, and while the various departments of medicine will undoubtedly attain their highest development in this way, it should be remembered that the manner in which specialists have divided the body is purely arbitrary and that Nature draws no such lines of limitation, but that each organ has numerous connections and correlations with other organs, which every specialist and practitioner as well must thoroughly comprehend.

At the time when the custom of combining the practice of diseases of the eye with that of the nose and throat was in vogue, but little was known of the accessory sinuses of the nose and their affections, and with the exception of diseases of the lachrymal apparatus, which were clearly recognized to be most often of nasal origin, it was considered that there was but little connection between diseases of the eye and those of the nose; when the separation of the specialties was made, therefore, the divorce seemed natural, and further consideration of the nose and its diseases by the ophthalmologist was deemed unnecessary, while the rhinologist, for his part, regarded the eye as an organ with lenses and strange acting muscles in which he had no interest. Within the past few years, however, an entirely new field has been opened up by a more thorough comprehension of the anatomy and pathology of the air spaces connected with the nose, and by a better appreciation of the intimate relationship which these cells have with the orbit and its contents, so that now both ophthalmologists and rhinologists realize the need of a better understanding of this border-land between their specialties. As a consequence, numerous valuable pathologic and clinical studies have been made, which have done much to elucidate the subject and to re-associate ophthalmology and rhinology, not in the practice of a single individual, it is true, but in the more natural and

better combination of two, of an ophthalmologist in conjunction with a rhinologist.

Thanks to these researches, the profession is now generally conversant with the general symptomatology of diseases of the accessory sinuses, and is familiar with the most striking, at least, of the ocular symptoms. That orbital abscess is usually secondary to disease of the sinuses, that displacement of the globe may be occasioned by encroachment on the orbit by a distended sinus, that blindness may result from an involvement of the chiasm through the roof of the cavity or by an implication of the optic nerve as it passes through its foramen in the sphenoid, as a consequence of an inflammation in the cells within that bone, are facts which are generally accepted. Beyond this point, however, the knowledge of most clinicians does not extend, and it is the purpose of this paper to call attention more generally to other less striking, though perhaps more frequent symptoms, to explain their significance, and by perfecting their symptomatology, to facilitate the diagnosis in a class which in their early stages yield readily to treatment, and are easily curable, whereas, if their nature is overlooked and the pathologic process causing them is permitted to continue, conditions may arise which may not only occasion serious inconveniences and distress in the nose, and greatly interfere with the organ of sight, but may involving the brain, may actually result in the death of the patient.

Before proceeding further, it seems desirable to make several statements in regard to diseases of the accessory sinuses of the nose, of which, it is believed, most practitioners are not cognizant. The first of these is, that very pronounced disease of any, or, indeed, of all the sinuses, may occur without occasioning any subjective nasal symptoms, and, secondly, that repeated rhinologic examinations may fail to discover pus in the nares in sinusitis, the affection of the cavity being only detected by catheterization and irrigation.

The earliest symptoms of many diseases of the accessory sinuses are ocular, and on this account the oculist is often the first to be consulted. I have no hesitation in saying that in such event, most of these symptoms are attributed to eye strain, and refraction advised. By good fortune, however, this error in diagnosis does not always work injury to the patient, for the refraction test often not only entirely relieves the symptoms, but actually cures the sublying condition, not, however, as was intended by the relief afforded the eyestrain by correcting lenses, but by the atropin which was employed to put the ciliary muscle at rest drying up the secretion in the sinuses. In many cases such desirable results do not follow, and the patient is subjected to a repeated series of examinations which fail to accomplish their purpose and permit the development of chronic conditions in the nose and sinuses, which become intractable to treatment and prolong the

* Read in the Section on Ophthalmology of the American Medical Association, at the Fifty-sixth Annual Session, July, 1905.

duration of the case indefinitely. It behooves us, therefore, as ophthalmologists, to be familiar with the symptomatology of sinus affections and to be able to detect the earliest ocular symptoms which they induce, for by so doing we may not only be of service to the rhinologist in diagnosing cases which are often obscure by reason of subjective and objective nasal signs, but also save our patients from the injury of misapplied treatment.

SYMPTOMATOLOGY.

1. *Disturbances in Vision and the Visual Field.*—By reason of the intimate association of the optic nerve with the sphenoid bone, and as Onodi has shown, in many cases with the posterior cells of the ethmoid, this nerve is more or less implicated in the majority of active inflammatory conditions of these cavities. Indeed, were it not for the double layer of periosteum which covers the bone forming the barrier between the nerve and the sinus, and for the protection afforded by its sheath, it would be difficult to comprehend how this nerve could escape implication in any affection of the sinus, for the

separating layer of bone is frequently as thin as paper and contains many dehiscences.

The involvement of the optic nerve, as a consequence of ethmoidal or sphenoidal sinusitis, may vary in degree from a simple edema to an active retrobulbar inflammation. While this latter inflammation is rare, even in cases of marked sinusitis, edematous infiltration is common, although as the change wrought in the nerve is but slight, and the symptoms which it excites are not striking, they must be searched for with some care. As a rule, the patient complains of some dimness of vision in one eye, at times of vertigo, headache and other head symptoms. When the ophthalmoscope is employed, the unaffected eye is usually found to be normal, while in the fellow eye a slight veiling of the edges of the nerve is seen, with a dilatation of the retinal veins and a choking of the lymphatics around the central vessels; in fine, the changes depicted in the sketch, which was made for me from the eye of a patient with acute sphenoiditis.¹ If the sinusitis is unchecked and retention of

the contents of the cavity occurs, the nerve becomes more involved and the familiar signs of a retro-bulbar inflammation of the nerve appear.

In cases of even slight involvement of the optic nerve, the patient is usually conscious of a dimness in the affected eye, although if the vision be tested in the ordinary manner it will be found to be equally good in each eye; in other words, that the vision for form is normal. If the light on the chart be reduced, however, or if Bjerrum's test card is employed, the difference in vision between the two eyes will be at once manifest, and it will be ascertained that the dimness in the affected eye was occasioned by a diminution in the light sense, as a consequence of the edematous infiltration of the highly organized bundle of fibers which supply the macular region.

The extent of the involvement of the nerve may be further studied by the perimeter, by means of which it will often be possible to differentiate relative central and paracentral scotoma, and at times a concentric contraction of the field. If the congestion of the nerve progresses to inflammation and the conducting power of its fibers is further interfered with, then more positive defects in the visual field will appear, and it will be possible to outline absolute scotoma, both central and paracentral, and peripheral contractions in the field, in accordance with the location and the degree of involvement of the nerve. Ziem found contraction of the visual field in a large proportion of cases, especially in empyema of the antrum, and explained it by the cyclitis which he found in such cases resulting from disturbances of the circulation between the nose and the eye. Kuhnt likewise discovered concentric contraction of the field, especially for red and green. As these observations have not yet been corroborated by others, it is probable that the changes in the fields in many of the cases reported by these authors was due to neurasthenia, which may have been induced by the sinus disease.

In this connection, it should not be forgotten that optic neuritis may arise in individuals with sinusitis from other intercurrent causes, such as the abuse of tobacco or alcohol. A chief characteristic of neuritis due solely to sinus inflammation, however, is its unilateral character, for although both nerves may be affected in the optic canal by inflammation of both sphenoidal sinuses, such cases are very rare.

Tumors of the sphenoidal and ethmoid, unless they break through the walls of the sinus and involve the tissue of the nerve directly, do not, as a rule, cause disturbances of vision. As proof of this assertion, may be mentioned the cases of Baratoux, Hajek, Foucher and others, in which large sequestra of the sphenoid were exfoliated and passed through the nose, without giving rise to any defect in vision. In the cases, however, in which vision is affected by such neoplasms, Bull's statement may be accepted as authoritative, that "if an orbital tumor rapidly causes blindness and the latter starts from the temporal side of the field and leaves the region of the macula lutea unaffected to the last, and if at the same time a growth appears in the nose, it is probable that the tumor began in the sphenoidal antrum."

In addition to the various forms of implication of the optic nerve which have just been mentioned, vision may also be impaired by the mechanical obstacle offered to the proper passage of rays of light into the eye, either by reason of swollen lids, or of mucus retained

1. Paper read before the Baltimore Ophthalmological Society, Journal of Eye, Ear and Throat Diseases, March-April, 1905.

in the conjunctival cul-de-sac as a consequence of lachrymal obstruction. Haze of the vitreous from uveitis may also disturb it, and, finally, imperfect focusing of the eyes, the result of interference with the function of one or more of the extraocular muscles may occasion diplopia. While there is evidence that in a very few cases of nasal and sinus disease vision may be affected, and may, for a time, be absolutely suspended, purely by reflex irritation, without anatomic cause, the clinician should be slow to attribute the blindness in such cases to a reflex, and should first carefully exclude hysteria and the possibility of the existence of retrobulbar involvement of the nerve without ophthalmoscopic signs.

2. *Changes in the Orbit.*—It is now generally recognized that inflammation of the orbit of endogenic metastatic origin is rare, and that most diseases of this cavity are ectogenic, being occasioned by an inflammation of one or more of the accessory sinuses of the nose. The character of the symptoms and the form of inflammation which the disease of the sinus excites in the orbit, depends first on the particular sinus or group of sinuses affected, and secondly on the nature of the inflammation in the sinus. Thus, for example, a chronic distention of the walls of a sinus (hydrops) may occasion dislocation of the globe, with the necessary attendant of more or less functional derangement of the ocular muscles, giving rise to asthenopia or actual diplopia; or the refraction of the eye may be altered by pressure, causing changes in the axis and amount of astigmatism, and, finally, disturbance in the proper canalization of tears may result from a displacement of the puncta lachrymalia, or by a lesion in Horner's muscle in the lid. In chronic cases, vision is but rarely affected, for even when there is exophthalmus, the sigmoid flexure in the optic nerve permits it to elongate and escape injury from the traction to which the displacement of the globe subjects it; in acute inflammatory processes of the orbit, on the other hand, vision is apt to be more or less involved, either from the very pronounced displacement of the globe which occurs in this class of cases, or from a direct implication of the nerve itself in the inflammatory process.

One of the earliest signs of involvement of the orbit is a change in the contour of the orbital ring. Usually this is occasioned by a distinct projection into the orbit cells, but at times the rim may be simply raised and roughened, either wholly or in part, by periostitis. In some cases of sinusitis an acute cellulitis of the orbit may develop without premonitory signs, and lead to the formation of an abscess which may point and discharge itself either externally through the skin of the lid, or in rarer cases into the antrum, nose or tear sac. In other cases, the sinusitis causes a circumscribed swelling to appear in various parts of the orbit, which may be either as hard and unyielding as bone, or may convey to the finger the impression of containing fluid.

Although it is frequently impossible by means of the ocular symptoms alone, to make a differential diagnosis of the particular sinus involved, in many cases the character of the displacement of the eyeball is of significance. Thus, disease of the frontal sinus, which is the most frequent form of sinusitis to occasion dislocation of the globe, by reason of the extreme thinness of the bone which separates its cavity from the orbit, causes the eyeball to be displaced down and out. Mucocoeles formed from the ethmoid cells are circumscribed, and do not, as a rule, occasion any considerable diminution in the size of the orbital cavity; when displacement of the

globe does occur, however, it is usually up and out. Dislocation from a mucocoele of the sphenoid cells is uncommon, as in the rare cases in which mucocoeles develop in these sinuses, the anterior wall, being the thinnest, is the first to give way and the orbital cavity escapes compression. The orbit enjoys a similar immunity in hydrops of the antrum, for the inner wall of these cells is the thinnest and is the first to yield, and the nasal cavity is encroached on. Proptosis always indicates pressure from behind the globe.

The location of the pointing of the abscess may also be of value, as indicating the particular sinus which is affected, abscesses of the frontal sinus tending to perforate at the middle of the upper lid, or at the superior internal angle of the orbit, those due to ethmoiditis at its lower, inner angle. A general orbital cellulitis may be occasioned by an acute perforation of any sinus. Disease of the frontal sinus may frequently be diagnosed by redness and swelling of the skin over the sinus, and by the pain which may be elicited by pressing on the roof of the orbit in the neighborhood of the pulley of the superior oblique muscle; indeed, it is often possible to outline the area of the sinus by noting the extent of the tenderness.

Disease of the sphenoid, as a rule, manifests itself by an early involvement of the optic nerve, either by perineuritis or by pressure on the fibers of the nerve, as it passes through the optic foramen, or along the outer wall of the sinus itself. In affections of this sinus, involvement of the ocular muscles is not uncommon, and cranial symptoms of more or less severity may arise, by reason of the connection which the sphenoid has with the floor of the middle cranial fossa. These latter symptoms may also be occasioned by perforation of the posterior wall of the frontal sinus, though this accident is of rare occurrence.

Ethmoidal disease chiefly manifests itself in the intraocular and conjunctival circulatory disturbances and in the production of asthenopia by interference with the extraocular muscles.

Inflammation of the antrum of Highmore is attended by orbital symptoms less often than that of the other cavities, but it may give rise to osteo-periostitis of the roof of the cavity and cause upward dislocation of the globe, and retrobulbar optic neuritis may result from infection through the lymphatics.

While this special symptomatology may hold good in many cases, it often fails, on account of the frequent variations in the anatomy of sinuses, for, as shown by Holmes, Cryer, Onodi, Turner and others, the relationship which the sinuses bear to one another and to the orbit is not by any means constant, and, while in most cases the cavities are separate, they may communicate. Thus, Onodi has demonstrated, by means of frozen sections, that the posterior ethmoidal cells frequently aid in the formation of the optic canal, and has noted that when this anatomic relationship is present, the layer which separates the sinus from the nerve is as thin as paper and is often perforated with dehiscences. It has been found, also, not rarely, that the frontal sinus forms the inner wall of the orbit, and that abscesses of its cavity may point in the neighborhood of the lachrymal sac.

As points of practical interest in connection with the diagnosis and treatment of orbital abscess, it should be remembered that the degree of the exophthalmus often varies in sinusitis, and that it may at times disappear entirely, being dependent on the patulency of

the orifices of the sinus, the amount of protrusion of the eye being naturally more marked when the size of the cavity is increased by retained secretion. This tendency for the degree of the exophthalmus to vary should be recognized, and should not lead to its being confused with the rare cases of intermittent exophthalmus which are dependent on a dilatation of the veins of the orbit. Finally, it may be remarked that even slight transient acute sinus affections may cause actual suppuration in either the periosteal or fatty tissues of the orbit; and that infection of the orbit may occur without an actual perforation of its walls, this being true not only of the very thin walls of the ethmoid cells, but also of the much thicker ones of the frontal sinus, the infection, in such cases, being carried not by way of the necrosed bone, but through the diploe, or along any one of the fine emissaries, either vascular, lymphatic or nervous.

3. *Affections of the Lachrymal Apparatus.*—Sinusitis may indirectly, by way of the nasal mucous membrane, be a frequent cause of disease of the lachrymal apparatus, but is the direct agent only in those rare cases where an empyema of one of the sinuses discharges itself into the sac, or, what happens more frequently, into the neighborhood of the sac, giving rise to phlegmonous inflammation of the tissues around the sac.

These prelachrymal abscesses may result from an empyema of the frontal sinus, as a consequence of an anomalous distribution of the cells, or, finally, from an abscess of the deeper parts of the orbit, the purulent matter gravitating into the region of the sac by the peculiarity of the insertion of the fascia. The differential diagnosis between these cases and true instances of lachrymal disease is often difficult, this being especially true of the class of cases described by Peters,² in which there are all the signs of abscess, and the sac itself appears dilated, but where the Bowman incision and the passage of probes into the nose does not release the pus, the purulent matter escaping only after the probe is withdrawn and passed horizontally into the cells forming the inner orbital wall. Peters points out that there is actually an ectasia of the sac in these cases, which is occasioned by a stoppage of the orifices of the sac by the pressure exerted externally by pus, which comes either from an empyema of the frontal or ethmoidal cells, from the maxillary antrum, or from a maxillary periostosis excited by a carious tooth.

4. *Affections of the Lids.*—Edema of the lids is one of the most significant symptoms of disease of the accessory sinuses, and may often be the means of calling attention to the existence of an inflammation in these cavities, the extreme thinness of the skin of the lids, and its loose attachment to the sublying parts, causing even a comparatively slight sinusitis to give rise to this condition. The puffiness is usually most marked in the upper lid and particularly on the nasal side, though the entire lid may be swollen. This edema is to be distinguished from the inflammatory swelling and thickness of the lid which results from cellulitis, as it is entirely non-inflammatory in origin, as well as in appearance, and also from the ptosis which is at times present as a result of a palsy of the levator of the lid. The swelling is usually most marked in the mornings and disappears during the day, but it is also apt to be brought on by bending the head forward. Like all other ocular symptoms of sinusitis, the edema may disappear for a time, with the discharge of secretion from the sinus, but re-

appears when the fluid reaccumulates and the congestion of the mucous membrane becomes greater.

A persistent blepharitis is not uncommon in association with the chronic inflammation of the conjunctiva which sinusitis sometimes excites, and yields to treatment only after the cause has been removed.

5. *Affections of the Extraocular Muscles.*—By reason of the juxtaposition of some of the eye muscles with the walls of the orbit, and the very close association of the nerves which supply them with the sphenoid cavity, as they pass along the outer wall of this sinus, paresis, and even paralysis of one or more of the eye muscles, may occur as a consequence of sinusitis. While complete paralysis demands an inflammatory process of considerable intensity, and is usually occasioned by a cellulitis of the apex of the orbit secondary to either an active sphenoiditis or ethmoiditis, or more rarely to antral disease, paretic conditions of the muscles may complicate comparatively mild cases of sinusitis, and may occur when the rhinological examination reveals only a congestion of the mucous membrane lining the cavity.

Chronic empyematous conditions of the sinuses rarely occasion marked muscular insufficiencies unless signs of active inflammation arise, for the distention of the walls of the sinus under such conditions is gradual and the displacement of the globe which follows is so slow that the muscles have an opportunity to adjust themselves to the changed conditions of the visual axes under which they are forced to operate. In acute cases, the paresis is occasioned either by direct inflammatory infiltration of the long, broad, flat belly of the muscles themselves, as they lie in association with the walls of the sinus, or by an involvement of the nerves supplying them as they enter the orbit. As in many of these cases the function of the muscle is but slightly interfered with, diplopia is but rarely complained of, and can be detected only by careful search in the periphery of the field by the aid of a colored glass. Under such circumstances, the diagnosis may often be facilitated by requesting the patient to indicate in which direction movement of the eyes is especially painful, as considerable distress is often excited when the eyes are rotated into the position in which fullest demand is made on the affected muscle.

As a consequence of this paretic condition of the muscles, vision is often blurred, and while, as just stated, many of the palsies are not sufficiently marked to induce diplopia, when the eyes make their ordinary excursions, the imbalance created is sufficient to confuse vision, to cause vertigo, to excite reflex gastric symptoms and to render the near use of the eyes difficult. By reason of their anatomic relationships, paralysis of the levator, of the superior rectus and superior oblique muscles, serves to indicate a probable involvement of the frontal cells; paralysis of the internal rectus, an involvement of the ethmoidal; and paralysis of the inferior rectus or inferior oblique muscles, an inflammation of the antral cells. As sphenoiditis may, however, implicate any or all of the nerves supplying these muscles, the value of differentiating the precise muscle affected, as a localizing symptom indicating the involvement of any particular sinus, is not great. Diplopia in the periphery of the field does not always indicate that a muscle has been paralyzed, for it may be induced by a slight displacement of the globe, either by exudation or by the distended wall of a sinus.

Ptosis from paralysis must not be mistaken for drop-

2. Zeitschrift für Augenheilkunde, 1892, ii, 2.

ping of the lid from edema. This differentiation is not always easy, for, as in all other signs and symptoms of sinusitis, both the edema and the palsy may be transient and may disappear, only to reappear after several hours or days, or even much longer intervals. It is by reason of this transient character that palsies of extraocular muscles due to sinusitis have been confused with the palsies which occur in connection with the rare affection known as "migraine ophthalmoplegic," or recurrent oculomotor palsy. In this condition, paralysis of one or more of the eye muscles supplied by the third nerve—though muscles supplied by other nerves may be affected—occurs in connection with an attack of migraine. The attacks come on in periodical crises and recur at irregular intervals. I recently had under my care a case of transient palsy of a part of the right third nerve, which appeared in association with great pain in the eye and temple, and the occurrence of a spectrum, where the symptoms were undoubtedly induced by an acute inflammation of the ethmoidal and sphenoidal cells. Although a careful analysis of a majority of the recorded cases of migraine ophthalmoplegic indicates a probable sinus origin in the number, I do not believe that such cases are true instances of this rare form of disease, as I consider that, while the pathology of the affection is in doubt, the strongest evidence points to its being of central origin.

I am of the opinion that if many of the cases of palsy of extraocular muscles attributed to rheumatism were analyzed that an affection of a sinus would be found to be the underlying cause in many instances. Such palsies may appear after "catching cold," and are associated with more or less pain on moving the eye, and possess other characteristics which suggest the presence of an acute sinusitis.

6. *Affections of the Conjunctiva.*—In chronic disease of the sinuses, the mucous membrane of the nose is not infrequently affected, and the thickening and congestion which exist there are often transmitted to the mucous membrane which lines the lids and covers the eyeball, not only by direct continuity of structure, by way of the tear passages, but also as a consequence of the general venous and lymphatic congestion of all the parts about the eye, occasioned by the disease of the sinus. In acute cases the conjunctiva is not rarely inflamed, probably by direct infection from the mucous membrane lining the sinuses, and presents the appearance of a typical attack of catarrhal conjunctivitis. In many of the chronic cases, the follicles of the conjunctiva become enlarged, and it is the involvement of these bodies, together with the turgescence of the conjunctiva, which occasions the feeling of heaviness of the lids and aggravates the asthenopia which is so frequent a symptom of sinus disease.

7. *Affections of the Cornea.*—Disease of the accessory sinuses rarely gives rise to keratitis except indirectly, as a consequence of the exposure to which the cornea is at times subjected in extreme degrees of displacement of the globe by a distention of the walls from empyema or by cellulitis, or as a part of a panophthalmitis which may be excited by the cellulitis. Occasionally, however, herpetic-like blisters may form on the cornea, as in cases recently reported by Ellinger³ and myself,⁴ as a consequence of implication of the fifth nerve as it passes along the outer wall of the sphenoid sinus.

8. *Pupillary Changes.*—A slightly dilated pupil may at times direct the attention of the clinician to the existence of an inflammation in the posterior ethmoidal or sphenoidal sinuses, being occasioned by the optic neuritis and the consequent diminution in vision and the reduction in the light sense which accompanies the inflammation of the nerve. This dilatation increases disproportionately when the illumination is diminished and is unattended by any restriction in the play of the iris to direct or indirect light stimulus. In cases of active inflammation at the back of the orbit, the pupil may be widely dilated and fixed, from serious involvement of the third nerve.

9. *Affections of the Uveal Tract.*—When the enormous extent of mucous membrane which is spread over the nose and its sinuses is taken into consideration, and account made of its large venous and lymphatic channels and the very close and intimate association which these vessels have with the blood vessels and lymphatics of the eye, it seems extraordinary that the eye should not be the seat of active inflammatory processes in all cases of sinusitis, and that the uveal tract, especially, should not be frequently involved. And yet it would appear, despite the claims of Zeim and others, that involvement of the interior of the eyeball, either by emboli or direct infection, is very rare. The thought occurs that, in order to obviate this, there is some controlling mechanism, some peculiar arrangement, perhaps, of the vessels, of which we are as yet unaware, which protects the eye from participating in these inflammatory conditions, just as there is some subtle mechanism which controls and regulates the intraocular circulation and makes it more or less independent of that of the general system.

Zeim, Fromaget, Fish and others have recorded a number of cases of uveitis due to sinusitis, and attribute the inflammation to the general impediment in the circulation and to the irritation of the maxillary branch of the fifth nerve, occasioned by the empyema of the sinus. These authors claim to have seen marked improvement in cases of this nature follow treatment of the sinus. As yet, however, cases of uveitis from sinusitis have been recorded by but a few, and further observations are necessary before the correctness of these views can be established.

10. *Cataracts.*—Equally problematical is the claim of Zeim that cataracts may be occasioned by disease of the sinuses. This author asserts that he found chronic suppuration in the nose in many cases of opacity of the lens, and adds that in a number of cases of unripe cataract he improved vision by treating the sinuses. Kuhnt partially supports this statement, as he states that he frequently saw spoke-like opacities of the posterior cortical in antral disease, especially in young individuals, with no other changes visible in the fundus or general system. The same author has seen vitreous opacities clear up after treatment of the sinuses. He attributed both the change in the lens and vitreous to an interference with the nutrition of the ciliary body, which he considered to be of a circulatory nature. An observation of Eversbusch which is especially interesting may be cited in this connection, of a swelling of the middle turbinate body preceding a so-called sympathetic inflammation of the other eye. As a consequence of this experience, he makes it a rule to examine the nose in cases where there is any ground to suspect sympathetic trouble, enucleation of the affected eye being advised as soon as nasal symptoms arise.

3. Zeitsch. f. Aug. 1, p. 174.

4. Journal of Eye, Ear and Throat Diseases, March-April, 1905.

11. *Refraction.*—Diseases of the sinus may occasion change in the refraction directly by the pressure exerted on the globe by the wall of a dilated sinus, and it is not unlikely that in early childhood disease of the nose may indirectly alter the refractive condition. Thus, it is well known that the form of the orbit determines, in large measure, the shape of the human eyeball. As a further step, Zeim has proved by experiments on dogs and rabbits that blockage and purulent inflammation of a nares will occasion marked inflammation in the skull and side of the face, and Kuhnt has deduced that the same facial asymmetry may result in human subjects from a deviation of the septum which is consecutive to a chronic swelling of the nasal mucous membrane. Batten and Fish consider sinusitis to be an etiological factor in myopia, as a consequence of congestion and spasm of the ciliary muscle, thereby retarding its natural contraction and relaxation and reducing accommodation.

12. *Asthenopia.*—Asthenopia is not rare in sinusitis, and the failure of proper lenses to relieve such symptoms is explained by the fact that they originated, not in an error of refraction, but in an inflammation of a sinus. In many of the cases the asthenopia may be attributed to the conjunctivitis which sinusitis excites, but in others it is traceable to an interference with the ciliary muscle, and actual testing will show a diminution in the range of accommodation. Hoople, who has contributed an interesting article on this subject, thinks that a moderate amount of pressure or mechanical irritation of the middle turbinate and adjacent septum will temporarily impair the function not only of the ciliary muscle, but, to a more or less variable extent, that of the internal rectus muscle as well, thereby aggravating the asthenopic symptoms still more. De Schweinitz, also, has called attention to asthenopia as a consequence of intranasal disease, and thought these cases particularly interesting, because in each instance the refraction error and the faulty muscle balance were of such a character that the symptoms of which the patients complained would naturally be ascribed to these anomalies, and because the patients were, to a great extent, unaware of, or at least indifferent to, any serious or decided lesions in the naso-pharyngeal region. In an analysis of a large number of cases of asthenopia, Grandle found chronic catarrhal rhinitis, with secondary hypertrophy, or with stenosis due to deviations of or excrescences on the septum, in about 3 per cent.

13. *Headache and Neuralgia.*—Headache and neuralgia are rather constant symptoms of sinusitis, and, though they frequently possess no features which serve to differentiate them from similar pain due to other causes, at other times they present characteristics which are significant of sinusitis, and it is very essential that ophthalmologists should be conversant with these qualities, since the laity, who are ignorant as yet that headaches may have a nasal origin, and impute all forms of head pain to eyestrain, seek them first for relief.

The headaches of sinusitis occur usually in the morning and are characterized by continuous pain with severe exacerbations, which radiate around the orbit and within the zone of distribution of the fifth nerve; or they may take the form of a general head pain, of a facial neuralgia, or of a toothache, and may be constant or recur in severe paroxysms. Injection of the conjunctiva, lachrymation and photophobia are often present. The location of the pain is significant, for, while it may be reflected to a part of the head remote from

the affected sinus, and may even be felt in the opposite side, yet its localization is generally characteristic and may enable the clinician to differentiate the particular sinus affected. Thus, neuralgia of the supraorbital nerve is very significant of frontal disease, and dental neuralgia will frequently indicate the existence of antral disease. Frontal headache is suggestive of ethmoidal and frontal disease, while occipital pain is usually caused by sphenoiditis, though disease of the frontal sinus may evidence itself in pain in that locality also. Pain in the vertex and at the back of the eyes is usually caused by sphenoiditis, though, on account of the close proximity of the fifth nerve to the lateral wall of the sinus and the nearness of the sphenopalatine ganglia, reflex pain to any part of the head may be occasioned by disease of that cavity. A distressing pain across the bridge of the nose is peculiar to ethmoid disease.

The headache of sinusitis may take the form of hemi-crania, and may simulate migraine, or even the rare condition known as "migraine ophthalmoplegic." Pain is almost always present in acute affection of the sinuses and may attain great severity, while in chronic cases all suffering may be absent; in some cases, however, where secretion has been long retained and where there is a hyperostosis of the walls of the sinus as a consequence of repeated attacks of sinusitis, the suffering may be prolonged and severe. A symptom of very great value in the diagnosis of sinusitis is the sensation which is evoked by palpation of the affected areas. Thus, in frontal sinusitis exquisite pain is occasioned by palpating the forehead and the roof of the orbit at its upper, inner angle, and the same is true of the region over the antrum when that cavity is the seat of an acute inflammation.

In addition to head pain, there may be other symptoms of a general character, such as fever, evidences of cerebral irritation and congestion, neurasthenia and gastric disturbances. The increased temperature is due to absorption of pus and is generally irregular. Gastric symptoms are occasioned by swallowing some of the fetid discharge of the sinuses, and loss of appetite or a true gastritis may result. Such cerebral symptoms as malaise, inability to concentrate the mind, and actual depression, verging almost on melancholia, are observant more frequently in chronic cases. Delirium and mania betoken a state of actual involvement of the cerebral activity. When cerebral symptoms arise in sinusitis, they indicate either an involvement of the meninges without perforation of the wall of a sinus, or more usually an actual perforation, in which latter event abscess of the brain rapidly follows. Abscesses of the orbit not rarely give rise to cerebral complications, and meningitis, abscess of the brain and thrombosis of the cavernous sinus may follow.

DISCUSSION.

DR. C. R. HOLMES, Cincinnati, said that a large field is still unexplored in the relation between the accessory cavities and the eye. He has taken many fields of vision in these cases but has not found that many patients exhibited contraction. He has found that in many chronic cases there is a rise of temperature, sometimes of one or two degrees daily. He thinks this a chronic septic condition. Dr. Holmes said that in sphenoidal cases the pain is generally referred to the temple. He passed around a section from such a case, showing how easy it is for a disease in the sphenoidal cavity to invade the optic nerve and the eye. He said that this is the first case on record in which there was total blindness following trouble with the sphenoid on one side. The patient was

not able to see an electric light before the eye, but after opening the sphenoid his sight was completely restored.

DR. E. J. BROWN, Minneapolis, fifteen years ago reported the case of a boy about ten years of age who had suffered from diminution of vision and very contracted fields. The boy had very large adenoids and Dr. Brown ascribed the trouble largely to that. On removal of the adenoids the fields were immediately restored to normal. The patient remained under observation for many years and is still under his care. Dr. Brown found later that the boy had sphenoid disease and the optic atrophy which resulted from that condition has persisted. Dr. Brown had a patient who came to him complaining of slight tenderness at the inner canthus, over the root of the nose and having a slight amount of astigmatism to which his trouble was at first ascribed. Correction of that, however, gave no relief. He came back, and on entering a small probe into the frontal sinus Dr. Brown caused the exudation of a small amount of pus. Removal of the head of the middle turbinate on that side gave relief to all his symptoms. Another case of similar character was relieved in that way within a few weeks.

DR. W. H. SNYDER, Toledo, called attention to the fact that a number of prepared sections show perfectly the relation of the mucous membrane after the bone has been removed and there seems to be no normal shape and size of the sinuses. In a number he prepared last spring there was no opening into the sinus. Simple probing through the nasal cavity would not bring pus in such cases.

DR. F. W. HILSCHE, Spokane, declared that he has seen a great many patients in whom symptoms of this character have been going on for a great while with more or less destruction of vision and that have been through the hands of men otherwise competent. He has had cases in which he did not discover pus at all in the sinuses but in which there was pressure between the turbinates and septum that gave rise to the same symptoms. He thinks, therefore, that we need not always expect to find pus to account for these symptoms. Just contact of the surfaces will produce them. He mentioned the case of a middle aged lady with a hypermetropic error who declared that whenever she took the glasses off she had a great deal of tinnitus.

DR. S. D. RISLEY, Philadelphia, said that his attention once having been called to the important relation between certain obscure affections of the eye and the diseases of the sinuses contiguous to the orbit he was surprised to find how frequently they occur and rather reproached himself for not having observed the fact before. This condition need not cause surprise, however, when it is remembered that these sinuses all drain into the nasal cavities and the numerous circumstances in life which lead to the blocking up of the ducts and the close anatomic relationship which exists between the sinuses and the orbit are taken into consideration. Dr. Risley was struck with the statement with regard to the absence of choroidal disease in the cases observed by Dr. Posey. Dr. Risley published a group of cases some time ago in which defective vision was associated with disease of the sinuses and in all there was marked choroidal disease. He thinks, therefore, from personal observation, that choroidal disease should not be excluded as one of the associations with this form of trouble. He recently had a patient with exophthalmus, and optic neuritis of obscure origin, in whom it was only after probing the frontal sinus on that side that the diagnosis was cleared up. On opening this Dr. Risley found a large collection of pus which had escaped into the orbit and collected back of the eyeball. In another case of exophthalmus, transillumination showed the trouble to be in the maxillary antrum on that side. These conditions are varied and, therefore, in obscure cases of eye disease the study of the case should never be considered complete until we have observed, by transillumination and other means open to investigation, the condition of the accessory sinuses.

DR. LEARTUS CONNOR, Detroit, said that it has been a habit of his for many years when any case of eye trouble was not satisfactorily disposed of within a reasonable time to investigate the sinuses. He has sometimes been reproached by his colleagues for calling attention to these matters. The expert

management of these conditions in their gravest form calls for manipulation that not all ophthalmologists desire to enter into.

DR. EDWARD JACKSON, Denver, declared that one point of Dr. Posey's paper needs to be reiterated, and that is the allusion to the difficulty of recognizing sinus disease. Dr. Jackson has so frequently referred patients when he felt that sinus disease was the cause of the eye trouble, to expert rhinologists and had them come back with the report that there was nothing the matter. He now feels more confidence in a certain clinical association of symptoms than in the ordinary rhinologic examination and in some cases certainly the examination must go as far as the removal of considerable tissue and very careful examination before a negative reply can be accepted. A few months ago Dr. Patterson, of Colorado Springs, published a paper on the connection of sinus disease with vitreous opacities. Dr. Jackson is inclined to think this a rather common cause of uveal trouble; sometimes producing vitreous opacities and sometimes not.

DR. J. A. DONOVAN, Butte, Mont., said that those who have watched adenoid children must have noticed the effect of that trouble on vision, especially on accommodative power. A diagnosis in these cases is a very important matter and he is convinced that often the symptoms are due to pressure and are much the same as those of ordinary rhinitis. The history is often the same as in rhinitis. It is almost impossible to make a diagnosis in these cases at one examination and it is not absolutely necessary, for the first treatment is not directed to the sinuses. Relieving the pressure of the anterior end of the middle turbinate often relieves the patients at least for some time.

DR. J. A. L. BRADFIELD, La Crosse, Wis., said that four months ago a woman, aged 32, was referred to him as a case of glaucoma. The fields for color were contracted. Vision was 20/100 and there was history of right hemiparesis. Examination of the nose showed the middle turbinate to be large and cystic and on its removal recovery was rapid. Within a week vision was almost normal.

DR. H. STILLSON, Seattle, Wash., stated that last year he published a paper on the relation between diseases of the nose and diseases of the eye. In that paper he reviewed the literature on the subject and published statistics from his own practice. The subject is a very old one, there having existed considerable literature fifty years ago, but it is a subject that has been forgotten until recently and it is only just now that the extreme importance and the extreme frequency of the diseases of the eye and brain in their relation to diseases of the nose has been realized. Ideas of the symptomatology of the diseases of the accessory cavities of the nose are still extremely hazy.

DR. WILLIAM C. POSEY said, in reply to Dr. Bradfield, that the diminution in vision in the case he cited might have been due to edematous infiltration of the optic nerve. Sometimes if the vision be tested in cases of this kind it will be found to be normal, but on lowering the light the vision will be found to fall much lower than would be the case in the fellow eye, showing an interference in the conducting power of the fibers of the optic nerve. Dr. Posey agreed with Dr. Jackson that the great difficulty is in diagnosis in these cases. It is true that it is not necessary to find pus to account for these symptoms; simple congestion of the sinuses may produce them.

Malaria in British Central Africa.—Dr. H. Hearsey, principal medical officer British Central Africa, states, in the *Journal of Tropical Medicine*, that there are two forms of malarial fever in that country—the tertiary and the æstivo-autumnal. The tertian variety is by far the more common, and it frequently takes the type of a double infection. Multiple infection by tertian parasites is met with, causing the so-called irregular fever, and is the only variety of the fever which is generally resistant to quinin. Dr. Hearsey is inclined to regard hemoglobinuric fever as a "pernicious" form of the æstivo-autumnal, the absence of the parasites in the peripheral circulation being probably due to their having left the peripheral circulation for the spleen and bone marrow.