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ORIGINAL COMMUNICATIONS.

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VISUAL DISTURBANCES SHOWING A CAUSAL RELATION TO DISEASE IN THE SPHENOIDAL SINUSES. WITH THE REPORT OF A CASE, TOGETHER WITH CORONAL AND SAGITTAL SECTIONS DEMONSTRATING THE RELATIONS EXISTING BETWEEN THESE CAVITIES.*

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It is not my intention, in this paper, to go into the history of suppuration in the posterior ethmoid and sphenoid cells, as since the first report of suppuration in these sinuses in 1872,¹ to the present time the literature is prolific on this subject. This is especially the case since 1885, when Schaeffer began to call our attention to the symptoms and treatment of the disease in the living. Nor do I wish to go into an analysis of all of the symptoms which may manifest themselves in disease of the sphenoid and ethmoid cells. I simply wish to confine myself to the report of a case which I have met with recently, in which the eye symptoms were pronounced, and the causal connection seemed traceable to disease in the sphenoidal cells. This causal connection was also confirmed by necropsy. I also wish to exhibit some specimens which were made during my investigation into this subject, and which will illustrate the close relation existing between the contents of the orbital cavity and the ethmoid and sphenoid cells.

The intimate relation existing between these two cavities, and what effect disease in the one can have upon the other, must always be a question of much importance to the rhinologist and ophthalmologist.

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That these cavities are more often the seat of disease than we suspect is constantly being forced upon us by the revelations of the post-mortem room. The suppuration is usually caused by the severer forms of acute rhinitis, while certain forms of influenza seem especially prone to attack the sphenoid cells. There seems to be no question but what sphenoidal and ethmoidal suppurations are more frequently met with now than formerly. In the European clinics of Chiari and Lichtwitz, only about 2 per cent of the cases show sphenoidal suppuration.

In the examination of 600 cases in the Massachusetts General Hospital, Rogers,^a found these cells diseased in 5 per cent of the cases. My experience leads me to believe this higher per cent is more nearly correct for our country.

That the sphenoid is rarely diseased alone but nearly always in conjunction with one or more of the other accessory cavities of the nose seems to be the experience of all observers.

The difficulty of inspecting or even probing the normal sphenoidal opening, which is situated just above the posterior end of the middle turbinate, no doubt accounts for the low percentage of recorded cases. In a number of cut sections in my collection the anatomical relation of the posterior end of the middle turbinate, or the superior turbinate and ethmoid bulla, render the opening exceedingly difficult, if not impossible, to enter with the probe during life. The average depth of the opening is about 7.5 cm. from the anterior nasal opening, and the probe passes in at an angle of 35 degrees with a line perpendicular to the nasal opening. As you can see upon the cut section, the anterior wall of the sphenoid forms the upper edge of the choanae and by keeping this point in mind, as suggested by Gruenwald,¹ the normal opening may more readily be located by the probe.

From the close connection existing between the optic nerves and the cavernous sinuses, with the sphenoidal sinuses, separated as they are by such thin bony walls, or even by a membrane only, it seems strange that disease in these cells is not more often manifested by pronounced eye symptoms. I think we are beginning to recognize more and more that many cases of retro-bulbar neuritis of obscure cause may have their origin in a suppurating sphenoidal cell. This is especially true if the optic neuritis is unilateral in character. Since I have been investigating the subject more closely, I feel quite certain that a causal relation did exist between

several obscure cases of optic neuritis, seen in the past, and a sphenoidal suppuration, but I did not connect them at the time.

Dr. C. R. Holmes,⁶ has recorded a number of such observations, in which there could be no question of the causal connection of the eye symptoms and a suppurating sphenoidal cell.

The fact that the veins of the orbit discharge the greater part of their blood through the ophthalmic veins into the cavernous sinuses, which is only separated from the sphenoidal cells by the thinnest of bony walls, or even by a membrane only explains why an inflammation in the one can easily extend to the other and produce all of the symptoms of a retro-bulbar neuritis.

I feel that our knowledge with regard to the network of veins and lymph passages of these cavities is far from perfect, and I feel certain that the more we investigate the relation, the more often we will be able to find a causal connection between certain eye symptoms and diseased sphenoidal or ethmoidal cells.

The number of such cases reported each year is far in excess of those of the past, and I hardly think it can be due to an increased zeal in diagnosis, but rather to a failure on our part to make a diagnosis. As Gruenwald⁷ says, "Ophthalmic troubles, such as asthenopia, scotoma, painful irritation of the ophthalmic nerves, and deterioration of writing power as noted by Schaeffer, are explicable by the neighborhood of the orbital and the basal nerves. Pain is usually more violent in acute inflammation, but then it is, on account of radiation to more distant regions, still more uncertain as a diagnostic sign. The same holds good with disease of the ethmoid bone, only where the troubles are usually more severe than in any other cavity, and here, more especially, that disagreeable complication of constant pain, mental depression and intolerance to nervous excitement may be found. Asthenopia is also frequent, and the pain will be referred to the region of the eyes."

In order to get the experiences and opinions of various ophthalmologists as to the causal relation between loss of sight, or optic neuritis, due to disease in the sphenoid and ethmoidal sinuses, Prof. Onodi⁸ submitted to a number of them a series of questions on this subject. From their answers you will see that even in the large eye clinics of Europe, a causal relation is not commonly recognized.

Prof. Leber, says: "Although I have turned my attention for many years to the connection between the diseases of the posterior

sinuses of the nose, and those of the organs of sight, I have been able to note very little worthy of record with regard to the sphenoidal sinuses and the posterior ethmoidal cells."

Schmidt-Rimpler: "My experiences afford me no proof that empyema of the sphenoid cavities can of itself cause an affection of the nerves."

Prof. H. Sattler: "Unilateral optic neuritis and optic atrophy are in no way characteristic of disease of the sphenoid and ethmoid cavities."

Prof. Axenfeld: "It is my opinion that diseases of the optic nerves, (neuritis, pressure atrophy) are, if we except actual tumors and perforating cases, much rarer than we might expect in diseases of the sphenoid."

From these reports you can see that the number of recorded cases in which the eye symptoms seemed to have a causal connection with a suppurating sphenoidal sinus, and which were proven at the necropsy, are still comparatively rare.

This, no doubt, can be accounted for by the protection of the sphenoidal bone, whose upper and outer walls are much thicker than the anterior, through which the natural opening for discharge occurs.

As you can see upon the coronal section, through the frozen specimen, in which the cavernous sinus is cut through just in front of the optic chiasm, the contained vessels and nerves, going to or returning from the orbit, are protected by quite a thick bony wall from the sphenoidal sinus. Doubtless in rare cases the protection is not so complete, and it is in these cases that a causal relation may exist between a suppurating sphenoid and certain definite ocular symptoms. When extensive necrosis of the body of the sphenoid is present, then the ocular symptoms may be easily accounted for.

While my patient denied a specific history, yet the extensive destruction of bone found at the time of operation, and later at the post-mortem, was strongly suggestive of a syphilitic origin.

In this case with the eye symptoms coming on so suddenly, following the bony necrosis of the sphenoid, I think there can be no question of the causal relation existing between the two.

CASE REPORT.

Mr. E. H., age 32, came on my service at the Cincinnati Hospital, in October, 1906. He was referred by Dr. W. F. Moss, of Maine-

PLATE N^o 1

PLATE NO. 1.

Frozen Injected Coronal Section, showing the relation of the posterior ethmoid cells to the orbital and cranial cavities. I. T. Inferior Turbinate. M. T. Middle Turbinate. E. M. Ethmoid Cells. O. B. Olfactory Bulb. P. E. M. Posterior Ethmoid Cell extending over the sphenoid sinus. I. R. Internal Rectus Muscle. N. O. Optic Nerve. S. R. Superior Rectus Muscle. E. R. External Rectus Muscle. H. Hiatus Semilunaris. A. M. Antrum Maxillaris. I. N. R. Inferior Rectus Muscle.

PLATE NO. 2.

Injected Frozen Coronal Section through the optic chiasm and the cavernous sinus, showing the relation of its contained vessels and nerves. S. S. Sinus Sphenoidalis, right and left, showing ostium Sphenoidalis. P. E. M. Posterior Ethmoid Cell extending back over the sinus. O. C. Optic Chiasm. C. A. Carotid Artery in Bony Canal. I. C. A. Internal Carotid Artery in Cavernous Sinus. 3rd N. Third Nerve. 4th N. Fourth Nerve. 6th N. Sixth Nerve. 5th O. Ophthalmic Division of Fifth Nerve. 5th M. Sup. Maxillary Division of the Fifth Nerve.

PLATE N^o 3

PLATE NO. 3.

Injected Frozen Coronal Section through the Cavernous sinus just back of the optic chiasm, showing the relation of the sinus to the sphenoidal cells and the position of the arteries and nerves in the cavernous sinus. C. A. V. Cavernous Sinus. C. A. Carotid Artery-Internal. 3rd N. Third Nerve. 4th N. Fourth Nerve. 6th N. Sixth Nerve. O. 5th N. Ophthalmic Division of Fifth Nerve. L. S. Left Sphenoid. R. S. Right Sphenoid. I. C. A. Internal Carotid Artery in Bony Canal of Sphenoid. M. 5th. Sup. Maxillary Division of Fifth Nerve. O. C. Optic Chiasm. A. C. Anterior Cerebral Artery, right and left. O. A. Ophthalmic Artery.

PLATE NO. 4.

Sagittal Section, showing the relation of the sphenoid with the optic nerve. Turbinated bodies atrophied. S. S. Sinus Sphenoidalis 30 m.m. long; 25 m.m. broad; 20 m. m. deep. E. Bougie in Eustachian Tube. N. O. Nervus Opticus. O. S. Ostium Sphenoidalis. O. M. Ostium Maxillaris. M. T. Middle Turbinate atrophied. A. E. Anterior Ethmoid Cell. E. B. Ethmoid Bulla. I. T. Atrophied Inferior Turbinate. P. Probe passing through Ostium Sphenoidalis.

PLATE NO. 5.

Sagittal Section, showing the relation of the sphenoid with the optic nerve and the ethmoids with the frontal sinus. S. S. Sinus Sphenoidalis. E. T. Bougie in Eustachian Canal. S. T. Sella Turcica. N. O. Nervus Opticus. O. S. Ostium Sphenoidalis. P. E. Posterior Ethmoid Cells. M. T. Middle Turbinate. A. E. Anterior Ethmoid Cell. S. F. Sinus Frontalis. I. F. Infundibulum with probe passing from the Frontal Sinus. I. T. Inferior Turbinate.

PLATE NO. 6.

Sagittal Section of the left half of the head, showing sphenoid and ethmoid cells. E. T. Eustachian Tube. H. P. Hard Palate. I. T. Inferior Turbinate. M. T. Middle Turbinate. E. C. Ethmoid Cell in Middle Turbinate, with probe passing back into sphenoidal opening. S. Superior Turbinate. O. S. Ostium Sphenoidalis. N. O. Nervus Opticus. S. T. Sella Turcica. S. S. Sphenoidal Sinus.

ville, Ohio, for an empyema of the right accessory cavities of the nose, followed by great mental deterioration, with sudden paralysis of the right external rectus muscle and blindness of the right eye. The doctor states that the patient was apparently well up to three months ago and was able to follow his calling, that of a conductor on a traction line.

Status Praesens:

The patient walks with a staggering gait, so that he has to be assisted. His mental condition is such that he can not give a clear history of his case. There is some exophthalmos of the right eye which turns toward the nasal side from complete paralysis of the external rectus muscle. The position of the eye ball is about 5 m. m. below the horizontal line of the other eye. Vision of the right eye nil. Vision of the left eye about normal. Ophthalmoscopic examination showed almost complete atrophy of the optic disc, more marked on the temporal side. The blood vessels, however, were nearly normal in size and number. This is the last expression of a retro-bulbar neuritis, doubtless secondary to an inflammation in the right posterior ethmoidal and sphenoidal cells. Examination of the left eye showed it to be normal.

Dr. D. T. Vail, saw the case in consultation and verified the ophthalmoscopic examination, and considered the condition due to suppuration in the sphenoidal sinus.

The patient complains of great pain at the occiput and at the base of the brain. There is a most offensive discharge from the right nostril, both anterior and posterior. The probe shows extensive necrosis of the posterior ethmoidal cells and the sphenoid sinus. The left side was not affected. Transillumination showed very dark area over the right maxillary antrum with absence of the pupillary reflex. The left maxillary antrum was clear and the pupillary reflex well marked. There was no difference between the reflex in the right and left frontal, both showing clear. Two X-Ray pictures were taken and both corresponded in every particular with the transillumination test.

Under chloroform anaesthesia the right frontal sinus was opened, to be sure no infection was present, since it seemed hardly possible for any sinus to escape, so extensive was the necrosis on the right side. However, the sinus appeared perfectly healthy and the wound was at once closed. The middle turbinate was removed and the necrotic ethmoid cells broken down. The maxillary antrum was entered through the canine fossa. When the antrum wall

was exposed it was found to be black from the necrotic condition present within the antrum. When the antrum was opened a most sickening odor escaped along with pus and necrosed bone. The nasal wall was removed by the Caldwell-Luc method.

The sphenoid could now be inspected and upon attempting to remove the anterior wall it was found that the whole right half of the sphenoid bone was necrosed and movable. With a finger in the pharynx, this loosened condition could be easily made out. Under the guidance of the finger in the pharynx, alligator forceps were passed in through the opening in the canine fossa, and several large pieces of necrotic bone were removed. Others could be felt but I feared to remove them lest the cavernous sinus might be injured. There was present the most extensive bone destruction I had ever encountered and lead me to believe that the disease must have existed longer than three months, as stated by the patient. It was difficult to see how a patient could exist with such an extensive necrotic condition present.

The cavity was packed with iodoform gauze through the opening in the canine fossa. The patient rallied nicely from the operation and on the following morning said he felt much better than he had for a long time, since the pain at the top of the head and back of the neck was gone. He never complained of the pain afterwards.

For several weeks following the operation his mental condition improved. The wound over the right frontal healed by first intention. Three weeks later he succeeded in tearing the wound open, by constantly picking at it, and the frontal sinus became infected. About this time also, the right ear began to discharge. On the fourth week following the operation a persisting and exhausting diarrhoea developed followed by a diffuse and severe bronchitis and the patient died, December the third, five weeks after the operation.

POST-MORTEM NOTES.

Post-mortem by Dr. Frank Hegner, Pathologist to the Cincinnati Hospital. Adult, male, markedly emaciated, phthisical chest, post-mortem rigidity absent. Above internal angular process of the right eye there is a small wound of a previous operation. Foul odor about the head.

Brain—On removing the calvarium and opening the right frontal sinus, a sero-purulent exudate was found in the latter cavity. This

same inflammatory condition was found in the tissues of the orbital fossa, and with increasing severity to complete necrosis in the right anterior and posterior ethmoidal cells. also the right sphenoidal sinus, and the left posterior ethmoidal sinus. To a less degree in the left anterior ethmoidal cells. The process caused necrosis of the floor of the orbit, and extended directly into the antrum, the posterior and lateral walls of which were completely necrosed. Nothing remained of the sphenoidal sinus excepting debris.

Communication between the right middle cerebral fossa and the pharynx was direct. The right middle and internal ear showed sero-purulent inflammatory changes.

Membranes—Dura in the right middle fossa was markedly thickened and very firmly adherent to the sphenoidal fissure and adjacent bone. Over the body of the right sphenoidal bone this thickened dura formed the only barrier between the brain and the necrotic sphenoidal sinus.

Pia and arachnoid showed over the right hemisphere, anteriorly and inferiorly, marked lepto-meningitis. On section no macroscopic lesion was found in either hemisphere.

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