BRAIN INFECTION FROM SINUS DISEASE.*

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Although for a long time otitic brain infections have been known and studied throughout the world it is only of late that attention has been paid to those of nasal origin, in spite of the fact that such cases have been observed in every large clinic. During a recent trip through Europe the writer had occasion to discuss the subject with many of the leading men abroad and was astonished at the large number of fatal accidents that had occurred in many of the prominent clinics. Alas! these cases are often not reported abroad and seldom in this country. I know of a large number of fatalities in my own city but have yet to see them published.

The first question of interest is: In what way is an infection carried to the cranial cavity after any operation on the nose or throat, or even without an operation? There are four possibilities: It may be propagated (1) by continuity; (2) by way of the blood-vessels; (3) by way of the lymphatics; and, finally (4) by way of the lymphatic sheaths of the olfactory nerve.

Hajek directed attention to the possibility of brain involvement resulting per continuation even though the bones and dura mater may appear intact on macroscopic inspection. In one case published by him he proved the correctness of this statement by microscopic examination. He and Hinsberg also demonstrated the second mode of infection—viz., the transmission of the micrococci through the blood-vessels. Hajek had previously found streptococci in the veins in rhinogenic endo-cranial infection and later this observation was corroborated by others.

Of great importance as regards the third mode of possible infection are the experimental researches of Zwillinge of Budapest on animals and men. His studies on the lymphatics of the upper portion of the nose and their relation to the peri-meningeal lymphatic cavities resulted in the following conclusions presented by Zwillinge at the last International Medical Congress in London and kindly communicated to me by the author:

1. The relation of the perimeningeal spaces of the subdural and subarachnoid space with the lymphatic network of the mucosa of the frontal sinuses by way of the nasal mucous membrane in animals

(rabbits) is a matter of knowledge. 2. The direct relation of the peri-meningeal lymph spaces with the lymphatic network of the mucosa of the frontal sinus has been demonstrated. 3. The relation of the peri-meningeal lymph spaces with the lymphatic network of the mucosa of the frontal sinus by independent routes passing through the bones has also been determined. 4. Anatomical evidence of the relation of the lymph channels of the mucosa of the frontal sinus with the lymph spaces of the central nervous system in human beings has also been adduced. 5. The paths concerned in the occurrence of intracranial and cerebral complications of the frontal sinus comprise, besides those already known, the lymph channels of the mucosa of the frontal sinus which are in direct relation with the peri-meningeal lymph spaces.

The fourth possible channel of infection is by way of the lymph sheaths. In view of their anatomical features they should constitute the best reservoir for all invading bacteria (Miodowski). In a case of post-operative meningitis, Killian was able to macroscopically demonstrate the path of infection from the ethmoid cells upward, but the microscopical proof was lacking. Such evidence has but recently been afforded by Felix Miodowski at the clinic of Prof. Brieger in Breslau. Miodowski supplied the missing link, viz., the histological proof of the infection ascending along the sheath of the olfactory nerve. This was shown in three cases of submucous resection, and thus we are safe in stating that he has established this fact positively.

When an infection is once carried into the cranial cavity, no matter by what path, it is generally the frontal lobe that becomes involved and it is either its basal portion or the anterior or median region that is affected. If pus is formed it may go its own way, as, for example, through the orbit, or, as in the case of Westermeyer, from the antrum through the pterygo-palatine fossa to the brain.

Very peculiar is a case published by Hansberg, in which the right frontal sinus was affected (pus). The patient died and it was expected that an abscess would be found in the right frontal lobe. Instead, an old abscess was present in the left lobe. The right ethmoid cells were necrotic, while on the left side there was only a thickening of the mucosa of the frontal sinus and ethmoids. It is, therefore, likely that the infection found its way from the mucosa of the left frontal sinus to the meninges through the blood-vessels. (See also Oppenheim and Cassirer.) In many other instances such small abscesses have not been recognized intra vitam as they do not manifest symptoms. The diagnosis of rhinogenic brain complications, therefore, is occasionally extremely difficult. The reason for this
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is not alone the smallness of an abscess, as in the above case, but often, as Gerber has pointed out, it is attributable to the fact that the primary affection of the sinus may be latent and may not give rise to any symptoms whatsoever, and for that reason an examination of the nose is often omitted. Finally, we must remember that a fully developed rhinogenic meningitis is in no way different from any other form of meningitis, so that for this reason also a case may be overlooked.

We now come to the most important question: When shall we operate? As regards acute cases, the idea has prevailed that almost every one of them improved without operation. This does not coincide with my experience. Too many cases have returned for treatment after they had been successfully treated by others, as well as by myself. Sometimes an increase of an existing coryza or a slight attack of the grip* has caused a lighting up of an empyema that has been considered cured. In some instances this process recurs once or twice a year and the case may go on indefinitely. Such cases, and others of similar character are not so very rare as is generally believed. In still other instances the symptoms become suddenly so grave that an immediate operation is indicated.

All these cases point to the fact that the process is often latent giving rise to no symptoms. If such a large number of unrecognized latent cases were not going around, how would it be possible for so many pathological changes to be found in the sinuses at autopsies? George F. Cobb of Buffalo reported several deaths in the course of latent sinusitis, so that there is reason to seriously consider a radical operation at any time. And yet, in spite of all these arguments, operation should not be resorted to in the majority of these cases. The policy is indicated here as in acute mastoiditis. While in the latter a simple incision into the membrana is very often sufficient, in the sinuses the removal of pus by lavage or other minor means will establish drainage and cure a large percentage of cases. Bulging of the eye, edema of the lids or upper lip, persistent fever, persistent severe headache,—not to mention brain symptoms—are indications for immediate radical intervention.

When we have to deal with a chronic empyema the decision is much more difficult. Every operation of the frontal sinus, for example, has to be considered as dangerous. Right here I wish to emphasize the fact that the results of operative procedures on this sinus are most satisfactory. I have had two cases that left the hospital on the fourth day after the operation and were completely cured in a remarkably short time. At a meeting of one of the

*Or are these symptoms only due to an outbreak of a latent empyema?
local medical societies I presented ten consecutive cases of operation for chronic frontal sinusitis that had recovered in a very satisfactory manner. In the next case operated upon, the patient,—a strong healthy woman of 27 years,—died of brain infection. Keeping that last accident in mind, I would ask: Shall we postpone an operation so long that perhaps the pus breaks through into the bulbus spontaneously or forms an abscess of the frontal lobe, with a fatal termination; or shall we leave the decision to the patient? The last proposition is considered the wisest by many, but I absolutely condemn it. A patient, no matter how intelligent he may be, is never in a position to judge what is best for him. We have to do that for him and take our chances. True enough, a radical operation is not always a radical cure, and in some instances the patient may succumb to an operation. But if you watch a chronic case carefully you will be able to judge whether or not it is necessary to operate. Symptoms like those mentioned above, in referring to acute or latent cases, will have to be considered also as strict indications for radical intervention.

But take a case with a chronic purulent discharge and occasional headaches which may at times become quite severe. If the patient is anxious to get rid of his trouble, or if he cannot properly follow his vocation on account of its presence he will readily submit to the radical operation proposed by you. If these same symptoms, however, do not impair the patient's health I should hesitate to suggest an operation, for such patients would rather endure all these slight ailments than take even a remote risk of dying soon after its performance. As much as it is our duty to insist with all our authority upon immediate intervention in cases with the urgent symptoms mentioned above, there is no justification for persuading a patient to undergo a radical operation in a case like the one just mentioned. It requires large experience, good judgment, and careful attention on the part of the physician to determine when to operate, and the best men may occasionally disagree as to its necessity.

In presenting the histories of some of the cases seen by me, you will note that some of the patients who died after operation might have been saved if it had been performed earlier, while others might still be alive if it had not been done at all. Permit me first to report some cases of cerebral infections of dental origin. Although this class does not strictly come within the scope of our theme, they have all been referred to my service at the hospital and similar ones have probably come under your own observation. Besides, the infection often spreads through the sinuses before affecting the brain. In this category, however, are not included those chronic empyemas
of the antrum due to carious teeth. These cases have been recognized for many years; in fact, ever since the beginning of our knowledge of sinus disease. What I am alluding to are the acute infections following extraction of teeth, and of that class I have seen an unusually large number. This is due to two factors: The hospital to which all these cases were brought is situated in the poorest and dirtiest part of Manhattan, and it is more than likely that these persons were infected in their own tenements. Moreover, many of these infections were undoubtedly due to negligence on the part of the dentist. This is not an accusation against American dentistry, for we all know that its achievements have been remarkable. American dentistry is superior to that of all other countries, and we laryngologists who have adopted many an instrument and device invented by dental surgeons fully appreciate that. But that many dentists utterly neglect all asepsis is a matter of common knowledge. Of course, an infection may occur in spite of the utmost care, but I have seen many cases in which the dentist was not free from responsibility. Let me give you an example:

E. B., a poorly nourished child, 6 years old, had suffered from toothache several days before admission to the hospital. A tooth was extracted two days later, and very soon afterward the face began to swell. Pus was discharged from the socket, the face became painful and continued to swell more and more, together with the lips and the eye on the affected (left) side. Fever was present. On admission, the child was stuporous. There was strong fetor ex ore, and marked swelling of the face, which now extended to the right side, so that both eyes were closed. Large amounts of purulent discharge. Temperature 104.2° F.; pulse 150 to 180; respiration 36 to 44. The general condition constantly grew worse. To reduce the very pronounced cellulitis, several incisions were made but no pus was found. Death occurred from septicemia three days after the operation. The report of a physician, who happened to be present at the time of the extraction of the tooth, leaves hardly any doubt that the infection was to be attributed to the carelessness of the dentist.

Another case very similar to the one just mentioned occurred last summer:

Sam W., aged 40; storekeeper; admitted June 9, 1913. Sudden onset after tooth extraction, with chills and fever, restlessness, delirium, swelling of cheek, anorexia and constipation. His present illness dates back to seven days before admission, when patient, after having had his second upper bicuspid tooth extracted, was suddenly seized with chills, followed by high fever recurring prac-
tically every day, swelling of right side of face and upper part of right side of neck, restlessness and delirium; the last had been almost constant for past three days except when asleep and was of a maniacal character. He did not ask for food but seemed very thirsty. There were no urinary or respiratory disturbances.

Operation the same day. The antrum was opened and a great deal of pus was found. The same condition was present in the frontal sinus. There was a defect at the upper inner wall through which the dura was bulging. On incision, pus was evacuated. On following day, exitus letalis, due to septicemia. In this case of abscess of the brain, a colleague witnessed the extraction of the tooth and he too volunteered his opinion as to the absence of asepsis.

The clinical picture is different in a number of other infections of dental origin. In these cases the sinuses are not involved and the infection most likely is transmitted by way of the lymphatics to the meninges and brain. It is quite useless to open the sinuses as one would find nothing pathological microscopically. All these cases give an absolutely bad prognosis.

Of much greater importance are the cases of brain infection originating in the accessory sinuses, and of these the most prominent are the affections of the frontal sinus. Patients with empyema of this or the sphenoidal sinus are in constant danger whenever there is insufficient drainage. Even with drainage established the sinus may close up at the slightest provocation and retention of pus with its sequelae may ensue. For that reason, such patients should be under constant supervision. Fortunately, nature assists in many instances. But, as physicians, we cannot rely upon mere luck or nature. It is of prime importance, therefore, to decide when to advise a radical operation in these cases. With that in view, some cases are narrated here, ranging from the simplest to the most complex.

Case 1. S. A.; aged 29; merchant; has not been able to breathe through his nose for the last three years. Left-sided headache at times, and discharge. He had seen several specialists and had had the septum straightened and both middle turbinates removed. The diagnosis of chronic empyema of the left frontal sinus is positive. In spite of the advice of his family physician I did not urge the necessity of a radical operation and the empyema has remained in about the same condition for the last two years.

Case 2. Mrs. L. R.; aged 48; had suffered from "catarrh" for many years. After an acute tonsillitis there appeared a profuse muco-purulent discharge from the nose. This ceased a few days
ago, and since then there had been severe frontal headache and slight rise in temperature. Diagnosis: Acute empyema of left frontal sinus and right antrum. The left turbinal was removed immediately, but the patient felt worse. Headache more intense and total loss of appetite. Washing out the sinuses gave little relief. As the daughter of this patient is a physician she could watch the case carefully. More than once in the course of the next ten days I was tempted to advise radical operation, when one day there was an immense discharge of pus and patient experienced immediate relief. She has been well for half a year. No doubt the opening of the frontal sinus was clogged higher up and patient was in danger until it was freed.

In marked contrast to this case is one reported by the writer in the fall of 1908, the history of which may be briefly recorded again.

Case 3. The patient, a woman of 25, came to the clinic with an acute suppuration of the right frontal sinus. The middle turbinate body was not removed because her family physician objected. Several weeks afterward she returned with edema of the eye and cheek, retention of pus, vomiting, etc. Operation revealed an abscess of the frontal lobe of which she died four days later. There is little doubt that this woman's life would have been saved by an early operation on the frontal sinus, or perhaps by the simple removal of the turbinal.

I shall not mention the cases reported by me in 1910, which can be found in The Laryngoscope (January, 1910), but ask permission to describe several new cases which I think you will find of great interest.

Case 4: Stanislaus K.; aged 35; chef; was referred to me through the kindness of Dr. D. of this city on April 8, 1913. Patient said that he had recovered from an attack of appendicitis a week ago. A few days later, his head ached over the right temple, the pain spreading to the center and then to the back of the head. The nose was free. Dr. D. had seen him on April 4, and examination of the eyes disclosed the following conditions: "Conjugated deviation of the eyes to the right. R>L=0.5; V=½. Presbyopia, D. III. Ophthalmoscopically: Slight congestion of both optic nerves, with hyperemia. R>L. Field normal; no scotoma; no enlargement of blind spot."

As the doctor had some suspicion in regard to the accessory sinuses, he sent the patient to me. The man was led into my office by his wife, his gait being unsteady. In walking he leaned toward the right and he said that he also felt dizzy while lying in
Butted into objects to his right. On examination, an acute right frontal sinusitis was found and the sinus was irrigated. Some pus was evacuated and the patient felt easier immediately.

April 10: Part of right middle turbinate removed. Daily irrigations of sinus. April 11: Could not move his eyes to the middle line. This occurred after syringing the sinus. April 17: Vomited and felt worse, but after the syringing was better again. The question of a radical operation was seriously considered but patient did not consent.

At the beginning of June, 1913, I saw him for the last time, when his condition had improved remarkably. Dr. D.'s report of June 15 says: "Conjugated deviation as well as congestion of optic nerves has disappeared. Pupils and muscles were always normal, i. e., no paralysis. Diagnosis: Some local focus beyond the corpora quadrigemina. Embolus or frontal sinus affection?"

The writer is inclined to attribute the whole process to the frontal sinus primarily. What followed afterward is difficult to decide; whether it was a mere pressure on the frontal lobes or meningitis will probably be determined later, for sooner or later the symptoms will again recur. The writer does not know the patient's whereabouts since June, and would be thankful for any information.

Case 5: Miss J. S., aged, 25, was referred to me by Dr. Henry S. Oppenheimer. She complained of pain in the eyes and in the middle of the forehead, for which she had consulted several oculists. Dr. Oppenheimer did not find any cause for the pain in the eyes, and sent her to me. Diagnosis: Chronic empyema of left frontal sinus and left sphenoidal sinus. The X-ray plates showed cloudiness over both frontal sinuses and over the region of the anterior ethmoid cells. The frontal sinuses are small, but very deep in the antero-posterior direction. The sphenoidal cells are apparently small, but the air spaces are not occluded." We shall see that this latter statement was erroneous.

The usual treatment was inaugurated, i. e., the establishment of drainage for the left frontal sinus and sphenoidal sinus, with the result that the patient felt better while under treatment. Then she was sent to the mountains for three months. On her return she was like another person—no pain, no discharge—and appeared perfectly healthy. In the middle of the following winter, however, the old trouble recurred, and the latent empyema again became active. At this stage a radical operation was advised but was refused on account of the possibility of a scar. In the summer of 1912, she again went to the mountains and returned apparently well, only to show the old symptoms again in the winter of 1912-13.
Finally, in April, 1913, the family decided to have the operation performed. That was about a year and a half after I had first advised it. On April 2, 1913, the left frontal sinus was opened, and it was found to have a wide communication with the other side. The dura was exposed at two places on the inner wall but appeared normal. The left sphenoidal sinus was of enormous size.

April 5: Patient felt comfortable, although always restless; the night before unconsciousness. Temperature, 103°-104° F.; pulse, 74-80. April 7: Very restless. Right arm apparently paralyzed; in left arm, clonic cramps. April 8: Convulsions of right side of face. Stiffness of neck; pupils narrow; little reaction. Babinski positive. Lumbar puncture showed high pressure and dark fluid. April 13: Eleven days after the operation, exitus letalis. Autopsy not permitted. From the clinical symptoms there was reason to suspect meningitis, and, perhaps, a thrombus in the sinus longitudinallis.

Epicrisis: Here we have a case that at no time developed severe symptoms and at no time gave urgent indications for immediate operative intervention, yet on account of the constantly recurring symptoms, the chronicity of the case, and the impossibility of curing the disease by intra-nasal operation (septa in the frontal sinus) the writer advised radical operation. If this had been done when first advised it is probable that we should have found the inner wall of the frontal sinus intact and might have saved the patient's life.

It may be added that the x-ray findings are of interest. At the operation the sphenoidal sinus was found to be of extraordinary large size, while the skiagrams indicated a small sinus. The frontal sinuses, on the other hand, were small but the antero-posterior diameter was very great on the skiagrams. Is there a possibility of the sphenoidal sinus "overshadowing" the frontal sinus?

In connection with this I shall mention two other cases, the histories of which are not yet published but were given to me by Professor Herzfeld of Berlin during the summer. I shall present only excerpts of these interesting cases. The first one was a man of 57, who had sustained a trauma at the inner angle of the right eye at the age of 14. After several years this finally healed, but eighteen years later he was again injured in the same region. A fistula formed which discharged pus from the right frontal sinus for seventeen years. At an attempt to close this fistula it was found that the anterior wall of the frontal sinus was absent, due to the traumatisms and former operations on the sinus. Furthermore, it was observed that the cerebral wall of the left frontal sinus had a small defect, with a normal-looking but bulging dura. After the operation there was a rise in temperature and exitus letalis.
The remarkable points are that the patient's mind was absolutely clear, that he was up and about, without any complaints, and that only two hours before his death coma suddenly set in. The meningitis seems to have been produced by continuity through a defect found in the dura at the autopsy, a defect that could not be detected macroscopically seven days previously at the operation. H. mentions especially the seat of the defect on the left side, i.e., the side affected only secondarily. This has been noted in other cases as we have already shown.

Herzfeld's second case was a man of 29, who had suffered from purulent discharge all his life. Suddenly, acute exacerbation, with fever, edema of the eyelids on both sides, etc. Operation showed a periosteal abscess and empyema of the frontal sinus. After the operation the temperature became high, and there was some headache, stiffening of the neck, etc. For these reasons, a second operation was performed. After the cerebral wall of the frontal sinus was chiseled away a mass of fetid pus was evacuated (epidural abscess). The same night, exitus letalis. Autopsy: Purulent meningitis. "If the epidural abscess had been recognized and opened sooner the patient would probably have been saved. The persistent headache and high temperature after the first operation perhaps pointed likewise in that direction." From such histories we can learn a great deal and in the interest of scientific progress it is desirable that every one should publish his cases.

In regard to suppurations of the sphenoidal sinuses mention should be made of central scotoma as one of the early symptoms of cerebral involvement. This was demonstrated in a case published by the writer in 1910 (loc. cit.), as well as by W. Schulze Passow's Beiträge, 1911, p. 48.

In conclusion, the writer would say that he has operated on a great many cases of suppurative sinus disease—over 150 of frontal sinus affections alone—and that his death-rate has been remarkably low. In the last mentioned class he had only six fatalities. In spite of this, the so-called radical operations on the frontal sinus must be considered as dangerous and should be undertaken only after very careful deliberation. That even then mistakes will occur has been shown in more than one instance. Some cases which might survive for years with a defect in the cerebral wall will die of post-operative meningitis, while others will die if the operation is postponed. These and other problems will have to be solved by the combined efforts of all laryngologists. Their work will, we hope, clear up this very interesting question of rhinogenic brain involvement.

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