

EXTERNAL OR INTERNAL OPERATION FOR SUPPURATION OF THE ACCESSORY NASAL SINUSES.*

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The extraordinary advances made during recent years in external operations for suppuration of the accessory nasal sinuses have led gradually to the employment of this measure in the therapeutics of chronic empyema in ever-increasing frequency, while a large number of rhinologists with surgical training have come to neglect more and more the internal treatment of such cases.

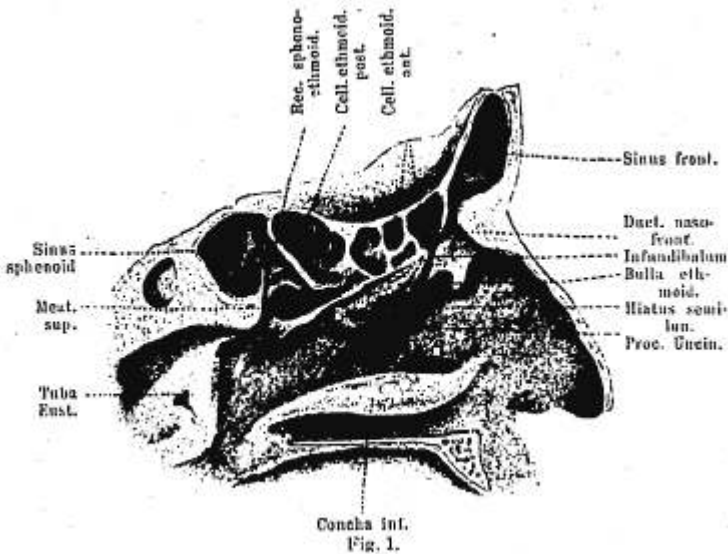


Fig. 1.

Permit me to lay before you my view of the matter, based upon eight years of work, and an experience gained from hundreds of cases of empyema.

Let us recapitulate briefly the anatomical conditions. (Fig. 1.) We recall that the hiatus semilunaris lies in the middle meatus. It contains, in the rear portion, the normal opening or ostium of the antrum of Highmore, in front of this the ostia of the anterior cells of the ethmoid bone, and still farther forward, in the infundibulum, those of the foremost ethmoidal cells and of the frontal sinus. The posterior cells of the ethmoid bone open into the superior nasal

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meatus, as does also the ostium of the sphenoid sinus. Finally, in the naso-pharyngeal space, we find the Eustachian tube, serving as the ostium of the middle ear, which, I think, may be considered an accessory nasal cavity in a wider sense; for the ear is subject to exactly the same conditions as all other accessory nasal cavities, except that it has an elongated opening, and its lateral wall is membranous, not osseous.

We will call to mind that sinus empyema may be of dental or nasal origin, caused either by diseased teeth or by coryza, influenza, or infectious diseases. The therapeutics of empyema of dental origin, which can affect only the maxillary antrum, consists of the extraction of the infected tooth and subsequent treatment of the antrum, which will be discussed later. Empyema of nasal origin either heals spontaneously or becomes chronic. We will now consider the important question of how the cure of acute empyema is effected.

The diagnosis of empyema is arrived at chiefly by means of the pus which flows from the sinuses. It is a question whether we must imagine that the discharge from the maxillary sinus, for instance, is caused by the filling up of the cavity, so that the pus runs over necessarily, or on bending the head forwards, sideways, or backwards. In a number of cases it may be so, but it is hardly the rule. Opposed to it is the fact that if a cavity from which pus has been flowing freely, be tapped, very often no more than a very few drops of pus are found; seldom, at any rate, a quantity corresponding to the capacity of the cavity. Now, it might be that the pus is forced out by reason of the highly inflamed, greatly swollen mucous membrane. But in numerous cases of chronic empyema there is found on tapping only a moderately swollen mucous membrane, which does not greatly reduce the capacity of the cavity. There must, then, be another explanation of this phenomenon, and to my thinking it is to be found in respiration.

The passing of air in the acts of inspiration and expiration exerts, in accordance with purely physical laws, a continuous negative pressure upon the cavities. This negative pressure is increased with stronger inspiration and expiration, and especially through blowing the nose; so much so that by a strong blow pus in the liquid state can be expelled easily from the cavity and brought to the surface. The strength of the negative pressure can be demonstrated easily by having a patient whose antrum has been tapped through the alveolus take a deep breath. It can then be seen with what ease saliva or particles of food will pass into the antrum. In

a like manner, it may be possible to explain the observation made by Hartmann, that with energetic use of the Politzer bag pus will flow from the sinuses, especially if the ostia have been previously cocaineized, and if the pus is thin. That air is forced into the cavities, and pus forced out in turn, is hardly a satisfactory explanation, for the air can escape with much greater ease through the choanae into the pharynx, or through the other side of the nose, and would even easily force open a closed velum palati, which, however, should be avoided in this case because of the danger of infecting the ear. On the other hand, it is quite comprehensible that a current of air blowing forcibly past the sinuses would suck out their contents.

The negative pressure of the air of respiration has, then, a permanently aspirating effect on the sinuses. This air also acts in another way. It is known that the air is saturated with moisture in the nose. It also draws moisture out of the more saturated air of the sinus, as, by diffusion, nature establishes an equal distribution of moisture in the air contained in both sinus and nose. Thus respiration serves to dry the sinus. At the same time, the well-known high disinfecting power of dry air is brought into play, so that we have these three agencies for the cure of empyema: (a) sucking out of the pus; (b) drying out of the sinus and shrinking of the swollen mucous membrane; (c) disinfection. These factors will operate especially well in a case where the respired air can pass through the nose without obstruction; while extended swellings, deviations, spurs, polypi, etc., in the nose will cause a less efficient respiration, and, therefore, less favorable results. In point of fact, empyema is found most frequently where respiration is thus interfered with, and in such cases generally on the less open side; and on the other hand, empyema is cured most quickly and easily where the nose permits of unhindered respiration. Taking all this into consideration, the spontaneous healing of acute empyema is quite comprehensible; and, in fact, a rapid and complete cure has been noted in a large number of cases under the above-mentioned favorable conditions.

It is apparent that we ought to take notice of the curative efforts of nature, and work along the same lines in the therapy of chronic empyema. The question is only: Can empyema of a chronic nature, that is, of at least half a year's duration, be cured without radical curettage of the diseased cavities? At this point, I might remind you of the generally known fact that chronic empyema of the middle ear, which, as explained above, may in a cer-

tain sense also be regarded as an accessory nasal cavity, may heal of itself after the removal of adenoid tumors, enlargements of the nasal mucous membrane, etc. The compression of the Eustachian tube and the inflammatory swellings disappear gradually, and suppurations of the ear which until then had defied all local therapeutics are often seen to heal in a surprisingly short time. The middle ear, however, is placed under very unfavorable conditions in this respect, as the numerous recesses, bone-cells, pockets and folds, formed by the ossicles and their ligaments, by nerves and vessels in the small space of the middle ear, must render the process of healing extraordinarily difficult.

We know, moreover, that chronic empyema may be cured if treated by means of continued irrigations through the alveolus. Therefore, a considerable degree of pathological change in the mucous membranes must be capable of recovery under favorable conditions.

If this in no wise rare possibility be conceded, we must ask ourselves whether the therapeutic methods heretofore in use create the most suitable conditions for healing.

MAXILLARY SINUS.

Let us start with the antrum of Highmore, which is the most frequently diseased cavity, and placed under the most favorable conditions. Here the attempt was made, at first, to effect a cure by boring through the alveolus (Cooper's operation), and long-continued irrigation. This method has the advantage that the cavity is easily accessible, and can be conveniently treated by the patient himself. It has also been considered of great importance that the cavity have an opening at the lowest point, as the pus can then flow off most easily. This, however, is the case only as long as the opening in the alveolus is unobstructed, that is, during the irrigation; at other times the aperture is kept closed by means of a metallic obturator, or the caoutchouc obturator specified by Herzfeld. And now we have again a cavity closed on all sides, and with the excretory duct at the highest point. As far as the cavity is concerned, it is absolutely of no importance whether the irrigation proceeds from the highest or the lowest point. It cannot be a matter of indifference, however, whether communication with the mouth is established, from where on account of the continued negative pressure of nasal respiration an unceasing, if only capillary, flow of liquid must be drawn into the cavity alongside the obturator. Moreover, the obturator itself must produce constant irrita-

tion, as its antral end is likely to be surrounded with numerous granulations which, on their part, cause or at least favor further secretion. And, lastly, the one or two irrigations daily, even with physiological salt solution, act upon the mucous membranes as a continually recurring stimulus for secretion. We have long since renounced frequent irrigation in the surgical treatment of all other cavities—I will remind you here only of empyema in the pleura—because we have come to the conclusion that, in general, irrigations are not favorable to healing. This measure is resorted to only when retention of pus is suspected. What is recognized to be of but little value in all branches of surgery, cannot be retained as justified in this field only. Again, continual drainage, the unobstructed flowing off of pus which is rightly insisted on in surgical practice, is on the one hand in no wise guaranteed by making an opening in the alveolus; on the other hand, the drying out and disinfection of the mucous membranes through respiration, which we consider an important factor in the process of healing, is permanently hindered. The only advantage which the alveolar method offers, the self-treatment by the patient, can be obtained as well or better in another way, as we will see later; and for these reasons I personally have refrained from using this method of operation for years, and do not think it commendable.

The intervention by way of the canine fossa is that method which makes possible a full survey of the cavity and a radical extraction of the diseased mucous membrane. In this way, tumors, sequestra, etc., can be diagnosed and removed. As a radical operation, therefore, this method will always be of value, and none other will be able to replace it. In other respects, however, it has all the disadvantages of the alveolar method in a higher degree. The opening into the mouth is very much wider, its closing up by means of obturators, cotton, etc., much less feasible; a continual irritation of the diseased cavity from saliva, mouth washes, particles of food, etc., is unavoidable. Various efforts have been made to meet these objectionable features; it has been attempted to line the entire antrum with epithelium; but until the present no altogether satisfactory results have been attained.

The operation of opening into the antrum through the lower nasal meatus, which was introduced by Mikulicz, and further developed by Krause-Friedländer, makes it possible to irrigate and treat the cavity from very nearly the lowest point. This method also permits the continuous drainage of pus, and, according to Hajek, this favorable effect is produced, that the mucous mem-

brane around the ostium shrinks considerably soon after the first irrigation, and thus facilitates a free discharge of pus by this passage. That the opening is not at the lowest point is of no consequence, as again the effects of suction must be taken into consideration. If the air can lift the pus up to the considerable height of the natural opening, it can surely do so more easily to the gap in the lower meatus.

This method, however, has the disadvantages that the permanent opening is very small, that the *Bone of nasal mucosa* periosteum, which is only

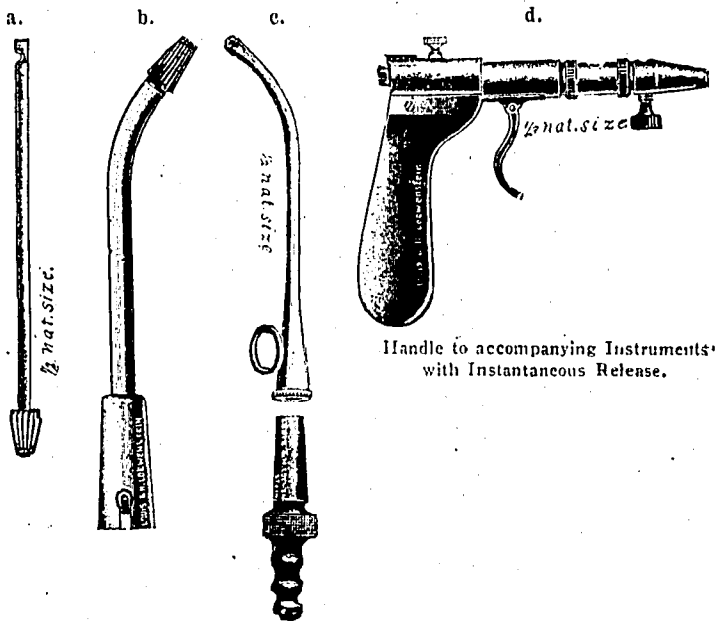


Fig. 2.

pierced, easily closes up again almost like a *sail* ~~safety~~ valve, that the after-treatment is rather painful, and that the patient requires the attention of the doctor for *long* ~~some~~ time. However, the results obtained are on the whole satisfactory. I have seen numerous patients suffering from chronic empyema of the antrum of Highmore healed completely by this method. Still, the difficulties of treatment and the defectiveness of the permanent drainage made a more effective opening into the antrum maxillare seem desirable, and different authors have made numerous attempts to accomplish this. For several years, I myself have been using a trephine-drill

(Fig. 2a), an instrument which has a trephine point with a drill back of it. It is usually straight, but if the medial wall of the cavity bulges to the side ^{and} back I use a curved instrument (Fig. 2b). With this an opening of any desired size can easily be made. When the instrument has pierced the wall, I take a pear-shaped, blunt-pointed drill (see frontal sinus later; Fig. 3d), by means of which I can scrape down the medial wall in most cases to the bottom of the cavity. The after-treatment is carried out by means of a little tube bent like a catheter (Fig. 2c).

This operation offers the following advantages: Continuous mechanical drainage of pus is guaranteed, the suction of the air, the desiccation and disinfection of the cavity can take place without hindrance. Also, the patient can easily syringe and treat himself, if it is desired. The opening must not be made too small, as in that case it tends to become rapidly smaller and to close up again. The lower turbinated bone I leave intact as long as it appears to be normal. If the lower edge is in the way of the drill, I raise it well by means of a dressing forceps, so that the field of operation is left free. Thus the physiological structure of the nose is preserved as nearly as possible, and more favorable conditions for healing are secured. It is naturally of the greatest importance that all considerable deformities of the nose, such as deviations, crests, polypi, hypertrophies of the turbinated bones, etc., be carefully removed, or else the effective action of respiration cannot be brought into play. In spite of the fact that numerous authors have pointed this out, it cannot be called to mind often enough, for experience shows that again and again this principal demand is not regarded.

That it must indeed be the continued suction of the air which draws out the pus, is proved also by the fact that in spite of the large opening in the lower meatus, out of which the matter could easily be discharged, it is seen to flow as well out of the natural opening, by which the air is believed to pass with greatest force. Conversely, this phenomenon is an evidence that at this point there must be the strongest current of air. Though, of course, it must be noted that in the action of blowing the nose, the air, because of the large artificial opening, is easily forced into the cavity, and might eject the pus in this manner.

The after-treatment consists of infrequent irrigations (every 8-14 days), blowing through of dry air by means of a thick catheter-shaped tube, and the occasional dropping in of alcohol; protargol, or argyrol. The insufflation of powder I have long since completely discarded.

My experience with this method is most satisfactory. A large percentage of the patients is permanently cured. Those who still have a slight amount of secretion generally decline further interference. But even in cases where, on account of the persistence of a copious discharge, I have resorted to an operation by way of the fossa canina, I have often not been able to find anything more than a few granulations, and after their removal the suppuration did not decrease in the least. In a few cases, where both cavities were diseased, I have treated one only from the nose, the other because of long continuing suppuration from the fossa canina and the nose, but have not accomplished much more with the latter method. That others do not have extraordinarily favorable results by operating from the fossa canina, would seem to be proved by the patients I have seen in my work as assistant and student in many other dispensaries; one proof among others being also the work of Gerber, who now approaches the antrum almost entirely by way of the nose, though, in point of fact, from the middle meatus. This, to me, does not seem practical; in the first place, because the hiatus semilunaris is situated very close to the orbit, which might very easily be injured during an operation, and, secondly, because the drainage of pus is much more difficult from there, and the treatment by the patient himself, which is often desirable and even necessary, cannot well be managed. In the rare cases where I have made an opening by way of the middle meatus, my experience was less satisfactory than with the broader opening from the lower meatus. At any rate, Gerber lays great stress upon intranasal therapeutics in empyema of the antrum, and he has gotten away more and more from the method of Küster, which he formerly used.

I have never met with considerable difficulties in the above described operation. If the operator exercises some degree of care, and if the opening, in accordance with the object in view, be made near the root of the lower turbinated bone and then extended toward the bottom, only extremely rare anomalies should cause any technical difficulties worth mentioning.

From the large opening which has been established, the operator can survey the cavity in part; and eventually, after the insertion of a long tube, he can form a reasonably certain opinion of the pathological changes in the mucous membrane.

If the intranasal method produces good results under the very unfavorable conditions of the antrum of Highmore, it must offer a good working basis for the therapy of other cavities as well.

SPHENOID SINUS.

Let us next consider the sphenoid cavity, whose ostium is likewise situated rather high up, mostly about on the border between the upper and middle third. Here it is easy, after the removal of the posterior portion of the middle turbinated bone, to attack the anterior wall of the cavity, to establish a more or less large opening, which is kept open according to need with tampons and trichloracetic acid, and by means of which the pus can be drawn off without difficulty, as from the antrum. If the pathological changes are of a high degree, so that the ordinary opening is not sufficient, the whole anterior wall can be removed, and it must only be borne in mind that because of the proximity of the hypophysis cerebri to the upper wall, and the sinus cavernous to the lateral wall, great carefulness must be exercised at these places. For this operation, I use a plain chisel, Cholewa's, and a hammer, and for the removal of the lowest and very hard portion of the anterior wall, a blunt-pointed drill (compare the operation on the frontal sinus later; Fig. 3c), by means of which the cavity can easily be laid bare to the bottom. If it is thought desirable to undertake the removal of the mucous membrane and the obliteration of the cavity, this is now possible without any considerable difficulty.

ETHMOID SINUS.

Empyema of the cells of the ethmoid bone, likewise, rarely offers extreme difficulties for intranasal operation. Of course, on account of the numerous separate cavities, an extensive opening-up or removal of the separate cells, and the creation of a single large cavity, will have to be undertaken, to provide conditions favorable to a perfect cure. After that, however, it will generally be possible, in one or several treatments, to open up all or nearly all of the diseased cells also from within, and to effect a cure. Only the most anterior cells are sometimes more difficult to reach, and we will consider their therapy when we come to speak of the treatment of empyema of the frontal sinus.

FRONTAL SINUS.

The only cavity which so far has seemed rather inaccessible to internal therapy is the frontal sinus. To be sure, a number of attempts have been made to approach this cavity also by way of the nose. I remind you of the attempts of Schäfer to provide an outlet for the pus by forcing a heavy probe up the front of the nose; also of the work of Hajek and Grünwald and others, who have

removed the anterior portion of the middle turbinated bone, probed the cavity, and irrigated it by introducing a canula. Worthy of notice are the interesting experiments of Scheier and Spiess, who have made use of the Roentgen rays for investigating and safeguarding the procedure of opening the sinus by means of the drill. However, a fairly reliable method of conveniently exposing the frontal sinus from the interior has not been found. Ingals, indeed, has announced a way to make a broad opening into the cavity from the nose. He introduces a probe into the frontal sinus, slides a flexible drill upon the probe and, pulling the probe forcibly to the front, he removes the anterior wall and the floor of the sinus. With this method the following anatomical conditions must be considered: (See Figs. 1 and 4.)

The drainage duct of the frontal sinus borders toward the back directly or almost directly on the tabula interna of the frontal bone, toward the side directly or nearly so on the lamina papyracea of the ethmoid bone. In front of the duct a large spina naso-frontalis interna is seen to project, which forms part of the floor of the frontal sinus. This spina naso-frontalis could be taken away without danger, and a broad duct procured, if it were possible to remove only this spine with an instrument, without injuring the tabula interna and the lamina papyracea, and thus endangering the dura and the orbit.

In the first place, it is a question whether the naso-frontal duct can be probed in a living person. That this is possible in many cases, especially after the removal of the anterior portion of the middle turbinate, would seem to be sufficiently proved. In cases of chronic empyema, where the pus has been active for some time, the excretory duct has generally become large enough to admit a probe without difficulty.

Regarding the more exact anatomical relations and the technique of the probe, I might at this point refer to the excellent dissertations of Hajek. I will only recapitulate briefly that the naso-frontal duct generally opens into the hiatus semilunaris or medially to it. If several ducts are to be explored in front, it will be found that the duct from the hiatus semilunaris leads usually into one of the anterior ethmoidal cells, and the one medial to it into the frontal sinus. Without desiring to enter more closely at this point into the difficulties of differential diagnosis, it is my belief that in supposed chronic empyema of the frontal sinus it is possible in the greater number of cases to introduce a probe into the cavity of the frontal bone without difficulty by following the outflow of pus. If,

however, a flexible drill is slipped onto the probe, this drill, even though pulled ever so strongly to the front, is very likely—in view of the anatomical conditions as above set forth—to injure the tabula interna, and by so doing to endanger the life of the patient; and for this reason I consider Ingal's method too dangerous to be recommended.

Myles's method might be mentioned. He proposes to remove the floor of the frontal cavity from the cells of the ethmoid bone by means of a hook-shaped chisel with a sharp lower edge. But this, too, seems to offer no guarantee whatever, as is easily apparent from a consideration of the anatomical relations. I have thought, therefore, that another course should be taken.

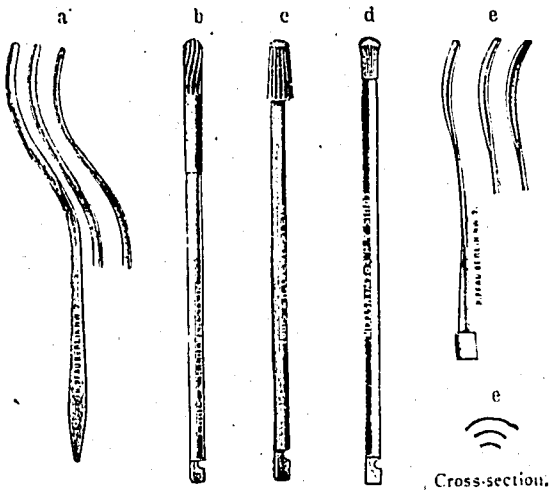


Fig. 3.

I introduce a probe as high as possible into the frontal cavity. Over the probe, I slide a protector of soft, flexible metal somewhat in the manner that Stacke guides his protector into the attic, which adjusts itself to the tabula interna posteriorly and to the orbit laterally (Fig. 3a). After that, I remove the probe. If I now advance with a bore-drill worked by electricity (Fig. 3b) immediately alongside of this protector in a forward and upward direction, taking care to keep always close to the protector (Fig. 4), I can go upward to the front and center without any danger at all¹, and open the floor of the cavity, which is formed by the spina nasofrontalis, to such an extent that I obtain an opening sufficiently large to admit a drill with a blunted point (Fig. 3c). The

¹ The instrument is to be always pressed firmly to the front.

sharp instrument is to be used only up to this time! When this is achieved, I can easily and, because of the carefully rounded, polished point of the drill, without danger to the tabula interna, enlarge the opening sufficiently to introduce into the cavity a

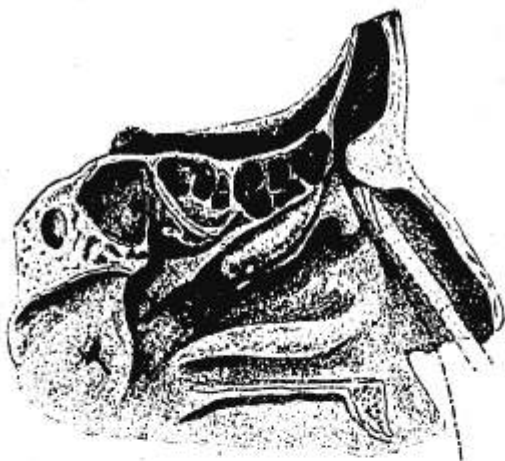


Fig. 4.

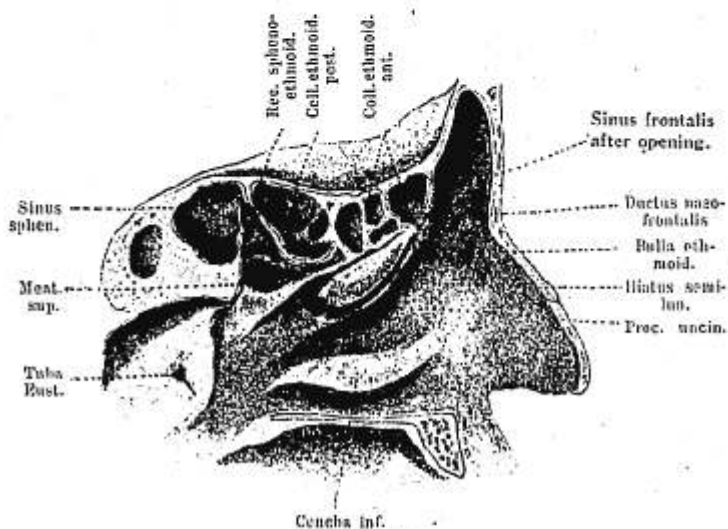


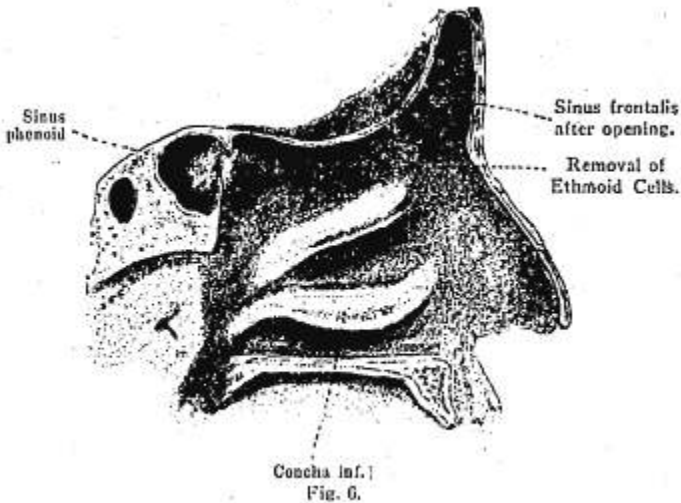
Fig. 5.

pear-shaped drill, whose thickened portion is carefully rounded off and polished. With this instrument, no dangerous injuries can be caused, provided the least care is taken. The entire floor can be drilled away with it, and so large a part of the tabula externa

ossis frontalis in a downward direction that the instrument can be felt from without, and that the opening of the frontal cavity towards the nose becomes almost as large as the distance of the nasal base from the tabula interna. Of course, it is necessary to take the precaution that the assistant pushes his finger well into the orbit, so that he can control the head of the instruments and prevent the drill from going too far to the front or side. If the cocaineization is done with care, and plenty of adrenalin used, the operation can be performed practically without pain and under constant control of the eye; *and it must be performed under constant control of the eye.* On no account should the operator work in the dark, forcing the drill blindly upward, but he must be able to overlook the field of operation closely at all times. In this way, the cavity can be opened to such an extent that it is possible to gain a complete survey of the mucous membrane and those lateral portions of the frontal cavity that are at all within the reach of the eye, so that the operator can acquaint himself sufficiently with the condition of the mucous membrane, the formation of polypi, etc., and get some information that might be of value in case an external operation should be required later. It is also quite practicable, if necessary, to reach and remove diseased mucous membrane, granulations, etc., at quite a distance from the operative opening by means of flexible curettes and sharp spoons. With suitable chisels (Fig. 3c), small, troublesome bony protuberances can easily be removed.

I have demonstrated this operation on numerous preparations, a number of which I am bringing before you to prove how unexpectedly large this opening can be made. In fact, by having the tabula interna securely in sight, all the ethmoid cells to the sphenoid cavity can be conveniently and safely evacuated by using double curettes, etc. (Fig. 6, which has been made from a preparation). On living persons, I have performed this operation so far twelve times in ten cases, that is, twice on both sides, seven of which I present to you today; the others could not be here either because of the distance or other irrelevant reasons. I have never experienced any difficulties worth mentioning in this operation. The dispensary patients generally come back to the dispensary the next day with only moderate, if any, edema of the eyelid or of the skin of the nose. The attendant pains are rarely considerable. As you see, the introduction of a very thick canula without the use of any kind of a speculum can be accomplished easily on all patients. Most of the patients can apply the canula themselves, if

necessary. The mucous membrane is destroyed only to a moderate degree, and besides, since very smooth walls are left by this operation, the granulation and epidermization can be obtained without great difficulty. To keep the opening continuously patent, I pack at first with isoform gauze, and use alcohol, protargol or nitrate of silver solutions to retard granulation and promote the formation of epithelium. Later I let the patient introduce a thick canula formed like an antrum canula, several times a day. Since such wide openings can be made, I have not found it necessary, so far, to establish continuous drainage; and have refrained from doing so also because of the irritation to the mucous membrane. But this can easily be done, if desirable.



This operation also involves the foremost ethmoid cells, which for the greatest part are being removed as well. If the duct from which the pus flows does not lead, as was supposed, into the frontal sinus, but into a large anterior ethmoid cell, it is no calamity if this empyema of the anterior ethmoid cell is opened up during the operation; and from this point the probably diseased frontal cavity can then be reached. It is to be noted as the most important factor that with this method the operator must always work *in front of* the tabula interna, which is covered by the protector, and not advance too far to the side. If the operator advances always closely alongside of the protector and in the direction of its position, then it is quite possible, in rare cases, that he may reach an anterior ethmoid cell instead of the frontal sinus; danger to the

tabula interna, however, is excluded. But if the probe, and then the protector, advances upward and forward $2\frac{1}{2}$ to 3 cm. or more from the infundibulum, they must have come to the frontal sinus or to a large anterior ethmoid cell.²

Of great importance in judging the proposed method of operation is the difficulty of making the diagnosis. I admit that it is often extraordinarily hard to decide whether it is a case of empyema of the frontal sinus or of the foremost ethmoid cells. But this difficulty is of like significance in external operations, and we must concede that such operations are often undertaken without sufficient reason for this course being found afterwards in the pathologico-anatomical conditions of the frontal sinus. Therefore, I see here no difference between external and internal intervention, except that in the latter procedure the external cicatrix is prevented. However, by carefully observing the origin of the pus and examining the patient at different times, the empyema can be located with a fair amount of certainty, and mistaken diagnosis avoided as much as possible.

The indication for internal operations upon the accessory nasal cavities is given in all cases of chronic empyema. The size of the opening, the more or less radical procedure is determined by the difficulty of the case, and the pathologico-anatomical changes; and the question is simply: when to abandon the internal method and to choose an external operation.

When, in empyema of the superior maxillary sinus, the cause in the shape of a diseased tooth is removed, treatment from the alveolus can be undertaken which, in a purely dental empyema, may lead to the desired results. However, in case of prolonged suppuration I would always advise opening the cavity from the lower nasal meatus and closing the alveolar opening.

If suppuration of the antrum in connection with nasal empyema continues a long time, notwithstanding the opening from the lower nasal meatus and the removal of all impediments to respiration; or, if, after several weeks' treatment, the suppuration does not abate to any extent, the indication is, sooner or later, that Küster's operation should be performed, the cavity examined for tumors, sequestra, etc., and any considerable pathological changes removed. After that, however, it seems to me better to close up the cavity again, and to conduct further treatment from the nose, unless the conditions are such that it is desirable to remove the entire mucous

² Care must be taken not to press the drills backward too forcibly against the protector, which, being made of copper, might be pierced, with danger to the tabula interna.

membrane and to let the cavity heal by granulation, or, as Lücke proposes, to widen the opening into the lower nasal meatus, and, after the opening from the fossa canina is closed, to remove the tampon from there.

External operation in empyema of the ethmoid and frontal cavities is, of course, strongly indicated when life is endangered, when there is a rupture into the orbit or to the exterior, and in case of threatening cerebral complications. But here, also, the indication is to be accepted with some caution. Numerous authors report complete recovery by the use of internal therapy without the proposed ample enlargement of the sinus ducts, even when pronounced edema of the eyelids and of the skin covering the nose and forehead has existed, accompanied by most excessive headache and apparently most threatening cerebral symptoms. At any rate, the internal operation may be attempted in such cases unless it is feared that the tabula interna of the frontal bone, or those portions of the pars orbitaria which form the base of the skull, are already perforated or extremely thin. If, later on, the external operation becomes necessary, nothing has been lost. On the contrary, the broad exposure of the ethmoid cells from within, the convenient drainage established by opening the frontal sinus into the nose, the consequent shrinking of the mucous membranes and the reduction of the inflammation will have created much more favorable conditions for the operation. I believe, therefore, that I am right in advising first the internal operation in nearly all cases, and in recommending the external operation only when such a course is strongly indicated, which every operator will decide for himself. For my part, I have always taken the course of advocating a radical method only when I was sure that I would have submitted to a radical operation myself under the same circumstances. With regard to the frontal sinus, a clear indication is given if in severe illness the ductus naso-frontalis cannot be probed with certainty.

Now, it may happen that a very large ethmoid cell is situated in front of the sinus frontalis proper, which may be very narrow, and forced to the front and upward, so that the supposed frontal sinus operation does not at first reach the frontal cavity at all. But, in the first place, such cases are very rare; and in the second place, it is hardly to be assumed that the frontal sinus should be diseased, and the large ethmoid cell below, which is so much more open to infection, should have remained sound. Besides, the same difficulty is encountered in the external operation.

Septa* in the frontal sinus, the sphenoid cavity, or the antrum, need be taken into consideration only when other indications for radical intervention are present as well. If we recognize the effect of the air in respiration as an important therapeutic factor, then, I believe, it also affects cavities that are divided by septa (compare the middle ear); and in the case of the antrum of Highmore even a cavity which may possibly be double is generally opened up sufficiently through the large established aperture to make a favorable result possible.

The internal operations in empyema of the upper maxillary, the sphenoid, and the ethmoid cavities that I have been observing for years, have met with success throughout. The percentage of cures is extraordinarily high. Almost all cases improve so much that they are without any considerable distress, and generally do not want to subject themselves to radical measures. Even though in a number of cases an insignificant amount of discharge remains, it does not involve any danger worth considering because of the broad convenient passage established for the discharge. Besides, we know how comparatively rare are deaths on account of neglected empyema. On the other hand, there is very often a more or less copious discharge after external operations.

That in a great many cases the internal operation must have very considerable advantages over the external intervention is proved also by a large number of patients that apply for treatment with openings made from the canine fossa and the alveolus, who were not cured in spite of treatment extending over several years, in some cases ten or fifteen. In all these cases, I have closed the opening from the alveolus or the canine fossa after regulating the nasal respiration by more or less radical operations, and established an opening from the nose; and in by far the larger number of these cases I have succeeded in effecting a complete cure in the course of a few weeks or months, or at least in delivering the patient from the everlasting irrigations and the dependency upon the physician. It would be difficult to understand why many of these eminently chronic cases should be completely cured, unless, indeed, there had before been very considerable influences unfavorable to recovery in the shape of the presumably harmful factors above delineated, which are eliminated by the internal operation and replaced by favorable ones.

The further prospects for the internal treatment of the frontal sinus cannot, of course, be determined from the twelve cases³ that

³ In the meantime I have operated upon two more cases with greatest success.

have been operated upon so far, especially as I have employed this method only about six months. But all of these cases have remained free from any discomfort. In one instance, where considerable headache is yet in evidence, it is to be accounted for by a well-developed anemia and myalgia in the absence of any notable discharge from the frontal sinuses, which have both been opened. Most of the patients show a very moderate discharge, and in three cases the suppuration has stopped entirely. In all these twelve cases severe combined empyema had existed for many years.

Very interesting and to some extent convincing is the history of an especially bad case which I will take the liberty of relating briefly:

Patient R., 62 years, of Brandenburg, came under my care through the kind efforts of Dr. Dörfer on the 4th of February, 1906. In the course of eight years, he had been operated upon internally and externally, and suffered from empyema of all the accessory sinuses. Only the ears were sound. Above the right eye there was a cicatrix from the external operation upon the ethmoid cells. In the alveolus on both sides were rubber obturators of the size of the little finger, and after their removal a thick stream of creamy, very offensive pus flowed from the cavities. All the teeth of the upper jaw had been extracted. During the rhinoscopy a terrible fetor was conspicuous, which, as the attending physician affirmed, could not be obliterated by any deodorant. A great many polypi, enormous granulations, an abundance of fetid pus, all this, in connection with the man's far advanced decrepitude, at first made me think of a malignant tumor. The maxillary sinus could be fairly well surveyed from the alveolar opening. There were no marked changes in the mucous membranes. Pieces of the ethmoid cells which I extracted proved to be non-malignant. I now operated systematically: corrected the existing considerable deviation of the septum, curetted the ethmoid cells within reach, chiseled away the entire front wall of the sphenoid cavity, and opened the right upper maxillary sinus from the lower nasal meatus with the result that the discharge from the corresponding alveolar opening became at once extraordinarily small, which was especially interesting in comparison with the continuous plentiful suppuration on the left side. Thereupon I operated on this side and *with the same success!* Without touching the seemingly but slightly changed mucous membranes of the antrum, I allowed the alveolar opening to close, and lastly I operated upon

the frontal sinuses on both sides from the anterior, and was enabled to establish canals of such breadth that the patient can insert a canula of 5 mm. thickness without difficulty and thus treat himself.

The result is a relatively splendid success. To be sure, there is still a small amount of discharge from every ostium, but the fetid, excessive formation of pus has stopped entirely, and I see the patient, who enjoys the best of health, only about every four weeks, when, perhaps, I may have to remove an insignificant granulation. The patient, who for eight years had been in extraordinarily sad circumstances, is now, after the short interval of four months, though not entirely cured, yet without distress, able to work, and saved from the most serious mental depression.

This one history is representative of many others resembling it, though not always dealing with equally severe cases. Nothing more, however, could be proved if I were to relate them all in detail.

If we compare with this the success of external operations, we must admit that it is hardly more striking. I have seen numerous patients suffering from empyema that had been treated for years from the canine fossa with the broadest kind of opening, who absolutely could not be cured. I have seen external operations upon the frontal sinus and the ethmoid cells performed by the most skilled experts, cases that had been operated upon two, three, even four times, where a copious discharge remained that, in some instances, could be reduced or removed only by internal intervention after the closing up of the internal wound. These facts are easily understood if we consider the course of external operations, say, for example, upon the frontal sinus. Large and extensive openings may be made; the entire frontal sinus surveyed; diseased mucous membranes, septa, etc., removed; drainage through the nose established;—but then the operator is forced to close up the cavity again completely after two or three days, if only for cosmetic considerations. Whatever now happens inside the cavity, whether, perhaps, the contents of the orbits escape into the cavity, whether pus is secreted from new granulations or polypi that form in connection with unremoved fragments of mucous membrane, whether folds develop in which pus is deposited—all these possibilities are hidden from observation. Only from a broad nasal opening can the cure be influenced to any extent; and it is my belief that patients are much better off who have a broad nasal opening already established before so comprehensive

an intervention. If, on the other hand, the entire anterior wall is removed, and the cavity allowed to close by granulation, the consequences, especially in the case of large cavities, are severe cosmetic disturbances that cannot be sufficiently overcome even with paraffin injections.

To summarize briefly:

1. In every case of accessory sinus empyema, physiological breathing is first of all to be established.

2. In every case it should be attempted to bring about a cure by establishing a blood drainage opening into the nose.

3. In a large number of cases, perhaps in most cases, the frontal sinus also can be opened from within easily and without danger if the proposed method be followed.

4. The external operation is to be resorted to when the discharge is continuously profuse or of long duration; also when life is endangered. The after-treatment in such cases is to be conducted from within, unless the complete obliteration of the cavity by means of granulation is to be effected.

Wilhelmstr., 146.
