THE PROBLEM OF CHRONIC FRONTO-ETMHOIDITIS.

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Two sweeping statements—"Once a nose, always a nose," and "Sinusitis cases don't do well in India"—prompted the author's curiosity; and the results of treatment along the lines indicated below have led him to doubt their veracity, and inspired this article.

It is uncommon for inflammation to be present in the cells of the ethmoidal labyrinth without there being a similar causative or associated condition in the neighbouring paranasal sinuses as well. In this article the frontal sinus and anterior and posterior ethmoidal cells will alone be considered.

ANATOMY.

The anatomy of the areas under consideration need not be discussed in detail: it will be sufficient to state that the ethmoidal cells are divided into the anterior group, opening into the middle meatus under cover of the middle turbinate and situated in close relation to the fronto-nasal duct, and the posterior group opening into the superior meatus. Numerous atypical outlying cells are frequently present, coming from one or other group and invading the crista galli of the ethmoid, the orbital plate of the frontal bone, the frontal process of the maxilla, the orbital plate of the maxilla and the body of the sphenoid.

The frontal sinus is extremely variable in both its vertical and horizontal extent, and it may be very loculated.

The mucosa lining the frontal sinus and the labyrinthine cells is covered with ciliated columnar epithelium and bears scattered mucous glands, which tend to be more numerous in the region of the ostia, where the mucosa is directly continuous with that of the nasal cavity.

The anterior and posterior ethmoidal arteries are the main source of blood supply to the fronto-ethmoidal region.

The venous drainage is mainly via the sphenopalatine foramen to the pterygoid plexus; branches, however, also join the superior ophthalmic vein in the orbit and the anterior facial vein. There are thus direct or indirect connections with the cavernous sinus on the one hand and with the internal jugular vein on the other.

The lymphatics drain to glands situated at the vault and upper lateral walls of the pharynx; and the perineural lymphatics of the olfactory nerves (which lie in relation to the medial aspect of the upper half of the middle turbinate) open directly via the lamina cribrosa into the pia-arachnoid space.

The frontal sinus derives its sensory innervation from the ophthalmic
division of the fifth cranial nerve, via the supraorbital branch of the frontal nerve; the ethmoidal cells are supplied by the naso-ciliary branches of the ophthalmic division, and by the orbital and postero-superior nasal branches of the sphenopalatine ganglion, and thus from the maxillary division as well.

**Pathology.**

Chronic fronto-ethmoiditis is the result of acute inflammation in this area which has either been neglected or has not received adequate or efficient treatment; the acute attack having frequently been a complication of an acute specific fever, particularly influenza.

The round-celled infiltration of the acute stage undergoes organization with a resultant thickened polypoid-like mucous membrane, partial obstruction of the ostia and inefficient drainage. Well-formed polypi are often found projecting from various portions of the membrane, which may be thrown into folds by unequal contraction of the organizing connective tissue. An underlying rarefying osteitis is not infrequently present, resulting in time in a more or less wholesale destruction of the bony walls. Lastly, the pathological mucous membrane is bathed in a discharge varying in nature from sero- or mucopurulent to frankly purulent.

At each exacerbation, edema tends to obstruct still further the already narrowed ostia and may produce complete occlusion of the latter.

While the polypus formation, suppuration and osteitis are usually all present, one or other may tend to predominate in an individual case.

**Spread of Intracranial Pyogenic Disease from Infected Paranasal Cavities.**

The results of an investigation carried out by Logan Turner and Kennedy in 1931 showed that there are three probable ways of spread: (1) By loss of bone continuity from operative trauma or inflammatory erosion; (2) by septic thrombosis, embolism, or bacteriæmia; (3) along the perineural lymphatics of the olfactory nerves.

When cario-necrosis of the posterior (cerebral) wall of the frontal sinus has resulted from suppurative inflammation within its cavity, pus can reach the leptomeninges by infiltration through the dura. The infection, previously chronic or "restrained," may become fulminating in type, producing leptomeningitis; operative trauma is not infrequently the determining factor in initiating such active and rapid spread. Less frequently, when such spread is slow, adhesions form between the dura and the brain, localizing the infection, which then advances into the brain substance causing an abscess.

A septic embolus, originating in a minute vein from a paranasal sinus, may extend along a perforating osseous vein into the dural veins, and so into the pial vessels direct or via the dural sinuses. The cavernous sinus usually becomes infected via the blood-stream by extension or embolism;
while this is more likely to happen in a case of acute sinusitis, it can also take place when the infection is a chronic one.

General blood infection can occur without there being any thrombosis of the intracranial blood sinuses.

The organism responsible for intracranial spread is almost invariably a streptococcus.

Out of a total of 55 cases investigated, the primary focus was in the paranasal sinuses in 45. Of these 19 were the result of spread via the blood stream; 20 cases were the result of direct extension through the bone; 8 cases resulted from a combination of these; the balance were of indeterminate origin.

Out of many hundreds of cases recorded, the percentage of spontaneous intracranial complications was: In acute sinusitis, 2·5 per cent.; in chronic cases, 0·66 per cent. The percentage of post-operative intracranial complications in acute sinusitis was 0·0 (not operated on in the acute stage) and in chronic cases 0·8.

Sixty per cent. of post-operative complications occurred after trans-nasal approach, and by far the majority were cases of general blood infection. The great majority of complications occurred when multiple cavities were infected, but all such infected cavities were not operated on at the same time; either the raw surfaces of the operation areas became infected by the contact of septic discharges from an untouched cavity, or the inevitable operative trauma stirred up the infection in one of the cavities not interfered with.

While statistics are open to grave misinterpretation, even so the above investigation undoubtedly makes out a very strong case for free exposure of the whole area, the establishment of good drainage, and radical methods.

**Symptoms.**

The condition may be entirely latent and may only be revealed in the course of examination to elucidate the origin of such conditions as rheumatic affections, indigestion, bronchial catarrh, laryngitis, inability to concentrate, failure of bodily and mental vigour, visual disturbances, neuralgia, &c.

On the other hand, the following are the symptoms for which the patient may seek advice:—

**Nasal Discharge.**—Catarrh is complained of when the ostia are patent. It is more troublesome in the early part of the day and may be got rid of by blowing the nose. More usually, however, the concomitant nasal obstruction causes it to drip backward into the nasopharynx, etc., and the chief complaint is of "morning hawking," while there is a tendency to distressing crust formation.

**Nasal Obstruction.**—This is present in varying degree, and may be due to the presence of polypi or to oedema of the inferior and middle turbinates. It is apt to be aggravated when the patient is lying down and varies with the position adopted.
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Headache and Pain.—These are very variable and may be absent throughout the whole course of the affection.

Tilley and Wilfrid Harris point out that the most frequent complaint is of a sense of fullness in the region bordering the inner side of the orbit and at the root of the nose, and of a sense of pressure over the vertex; both relieved by cocainizing the upper anterior regions of the nasal fossae.

A dull type of frontal headache with a marked tendency to morning periodicity may be present, and use of the eyes increases it, while it is also increased by pressure over the sinus floor.

Headache may be more diffuse, and is sometimes referred to the occipital region, but usually tends to be unilateral; when, therefore, generalized headache is complained of, either there is general toxæmia or bilateral sinus involvement.

It should be remembered that there may be some cause for headache quite independent of a local chronic inflammatory lesion. It is therefore essential that a preliminary overhaul of the patient be made, especially as regards heart, lungs, blood-pressure, kidneys and bowels.

Anosmia, halitosis, vertigo and tinnitus are less common symptoms.

Signs.

A careful examination of the patient should be made by both anterior and posterior rhinoscopy after preliminary cocainization; while direct examination with a nasopharyngoscope is of great value.

Pus.—The discovery of pus in the middle meatus by anterior rhinoscopy indicates involvement of the anterior group of paranasal cavities. It tends to run down over the anterior end of the inferior turbinate when coming from the anterior ethmoidal cells or frontal sinus; but to run down over the middle of this structure when coming from the maxillary antrum. (A negative result of proof-puncture definitely excludes the latter.)

A fleeting glimpse of pus in the middle meatus, when coming from the same sources, may be obtained by posterior rhinoscopy.

The discovery of pus in the olfactory cleft by anterior rhinoscopy, and in the superior meatus by posterior rhinoscopy, indicates that the posterior ethmoidal cells are involved.

When suppuration is present in the sphenoidal sinus, the pus will be found adhering to the vault of the nasopharynx and may show “crusting”; while it also tends to appear as streaks in the line of the ciliary flow from this sinus (i.e. horizontally to a point above and behind the eustachian orifice and then down into Rosenmüller’s fossa).

The nasal picture is, however, a very variable one, and signs of diagnostic significance may be present at one examination and absent at the next. Accordingly, in the absence of pus it must not be assumed that there is no need for further investigation.

Edema.—Edema of the mucous membrane over the anterior end of the inferior turbinate or the uncinate process should suggest the existence
of purulent discharge as the causative source of irritation. So-called "mulberrying" of the posterior end of the inferior turbinate has the same significance.

Polypi.—These are usually found in the region of the middle turbinate and perhaps filling the nasal cavity. When multiple they indicate the presence of chronic ethmoidal infection. They may be present with or without recognizable pus in the nasal cavity.

Fistula formation and meningitis are other occasional findings.

**SPECIAL METHODS OF EXAMINATION.**

Lavage and Exploratory Suction.—These are of some use in the case of the frontal sinus, but quite useless for the ethmoidal labyrinth owing to the structural difficulties encountered.

Transillumination.—This is of very little use except in the case of the frontal sinus and even then is merely suggestive.

**X-ray Examination.**—Radiograms are of the utmost value: (a) for diagnostic purposes; and (b) as a guide at operation to the presence, extent, and loculation or otherwise of the frontal sinus, and to the position and extent of the ethmoidal cells.

The use of a Potter-Buckey diaphragm is essential to secure the very fine definition required; and a standardized technique with standard positions is absolutely necessary for accurate diagnosis.

The Graham-Hodgson technique fulfils admirably all requirements; his most useful positions being: (1) True lateral; (2) occipito-mental, by which dissociation of the shadows of the frontal sinus, anterior and posterior ethmoidal cell-groups is secured; (3) right and left obliques for the examination of the posterior ethmoidal cells.

The Americans favour the use of lipiodol and radiography to determine the extent to which the mucosa of the frontal sinus is thickened.

**TREATMENT.**

Tilley [1] has pointed out that temporary or permanent inhibition of the ciliary action in the nasal or paranasal cavities leads to retention of inflammatory products, with pain and other clinical manifestations as probable consequences. While every effort, therefore, must be made to establish free and spontaneous drainage for pathological secretions, equal care must be taken to preserve any inflamed mucous membrane which appears to be capable of ultimate recovery. Neglect of this precaution may cause pain resulting from obstructive scar-tissue and intolerable crust formation.

J. G. Hunt [2] points out that the treatment of chronic fronto-ethmoiditis is too often empirical, and he emphasizes the necessity of first determining the degree and type of the pathological changes in the mucous membrane before beginning treatment; failure to do this is, in his opinion, the cause of the frequent disappointing results of repeated drainage operations and excisions of polypi.
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The various lines of treatment in vogue may be classified as:—

(a) Non-operative, including vaccine therapy, light therapy, vitamin-containing foods, irrigation, astringent applications, cauterization, sclerosing injections and ionization.

(b) Operative, including extensive submucous septal resection, transnasal drainage operations and extra-nasal operations for the complete removal of diseased tissues.

To comment on the above:—

Vaccine Therapy, Light Therapy and Vitamin-containing Foods.—These cannot possibly restore to normal or sterilize the thickened mucous membrane in the cavities under consideration.

Irrigations.—These are obviously futile when chronic pyogenic infection has resulted in polypoid or fibrotic degeneration of the mucous membrane, as fluids are usually unable to pass through the congested and obstructed ostia, and even if they do, merely tend to increase the waterlogging of the tissues, with aggravation of the condition.

Astringent Applications to the Turbinates.—These may, to a slight extent, improve drainage, but even this mild benefit is of very transient duration.

Cauterization of the Turbinates.—This has the same end in view, but also affords merely transient benefit. Cauterization results in destruction of the ciliated epithelium, which is replaced by that of stratified squamous type; repeated cauterization, indeed, so interfering eventually with the ciliary stream that there is an increased tendency to "crusting," and finally the nose may pass into the state of atrophic rhinitis.

Sclerosing Injections of the Turbinates.—These will to some extent improve drainage without producing such disastrous results, but are of strictly limited applicability.

All the last three methods have the additional disadvantage of in no way touching the primary causative focus—the pathological condition present in the paranasal cavities.

Ionization.—This is of undoubted benefit in the treatment of an inflamed mucous membrane, but the sine qua non for its effective action is that there shall be free access to all parts of that membrane and facilities for removing supernatant purulent matter before commencing this line of treatment; and these desiderata are only available after the establishment of free drainage and aeration.

Intranasal operations for the relief of the nasal obstruction produced by chronic sinusitis (e.g. removal of polypi, subtotal turbinectomy, etc.).

These are irrational as they do not remove the cause, and they may be dangerous, when associated with post-operative packing, owing to the risk of producing secondary hemorrhage, generalized suppurative rhinitis and even acute otitis media.

There remain to be discussed the various drainage and radical operations. Success in sinus surgery varies directly with the surgeon's ability to locate the diseased cells and to appreciate the treatment called for in each individual case.
Every patient with chronically diseased sinuses does not require a radical operation and the following outlines may help to indicate the procedure advisable under various conditions.

1. When the disease is quiescent and only accidently disclosed by X-rays. Such cases are best left alone.

2. Patients in good general health, but with slight catarrhal symptoms. These are best treated symptomatically.

3. Cases where the symptoms are so severe as to necessitate surgical intervention.
   a. When the infection is limited to the anterior ethmoidal cells. Mosher's method of transnasal approach with removal of the Agger nasi cells and uncapping of the cells of the anterior group will frequently suffice. It should be preceded by removal of the antero-inferior part of the middle turbinate.

   Cutting forceps should be employed, with avoidance of all curettage. If bleeding is excessive, the operation should be done in stages.

   The application two weeks later of cocaine and adrenaline to shrink the oedematous tissues, and then touching the granulations with five to twenty per cent. silver nitrate helps to prevent excessive cicatrization with reclosure of the drainage established.

   b. When the infection is mainly limited to the frontal sinus, with obstruction of the frontal-nasal duct and involvement of the anterior ethmoidal cells adjacent to it.

   Very varying views are held as to the best method of procedure in such cases.

   Coakley [3] favours transnasal approach via Mosher's route, uncapping the cells involved, and, when necessary, rasping away the nasal crest. He does this under "local anaesthesia" by "blocking" Meckel's ganglion and cocaineizing the nasociliary nerves. In the after-treatment he deprecates the introduction of drainage tubes, and advises periodical irrigations starting in the second week and the occasional passage of Watson Williams' bougies.

   Douglas Harmer [4] prefers preliminary removal of the antero-inferior part of the middle turbinate, transnasal uncapping of the anterior ethmoidal cells, and subsequent performance of the Barwell operation on the sinus. In this last-named operation a small funnel-shaped opening is made in the anterior wall of the sinus, and passive dilatation of the fronto-nasal duct is subsequently secured by the use of successively larger rubber catheters, the first of which is introduced via the nose at operation and anchored in place.

   In both the above methods there is, however, risk of leaving behind thickened mucosa, with the probability of subsequent exacerbations.

   Logan Turner [5] is of opinion that transnasal approach to the frontal sinus may occasionally suffice; but that it should be reserved for cases in which the sinus is of average size, is not loculated, has no obvious orbital
extension, and has not as yet got appreciably thickened mucous membrane, while there must be considerable space available between nasal and frontal cavities for instrumentation. For all other types of sinus, especially if associated with ethmoidal suppuration, he favours external approach.

Lewell [6] of San Francisco does not advocate transnasal surgery for chronic frontal sinusitis. He holds that if there is necrosis of the outer table or an acute osteomyelitis, extremely radical external operation is called for, with obliteration of the cavity by allowing the forehead tissues to fall into the depression and fill it completely. This, however, results in a cosmetic catastrophe.

There are two other external operations, the Killian and the Howarth; both will be referred to later.

(c) When both anterior and posterior ethmoidal cells are involved, but the frontal sinus has apparently escaped.

It should be borne in mind that repeated minor operations are unsatisfactory and ill-tolerated by the patient, who becomes more and more unwilling to face the knife.

More or less radical transnasal operation may sometimes suffice, the choice lying between the Sluder operation and the Sluder-Hajek. Both can be done under "local anesthesia" as indicated above, Lithgow advising a preliminary dose of nembutal.

The Sluder operation is, however, dangerous, as it involves complete removal of the middle turbinate, with division of the olfactory nerves and opening up of the perineural lymphatics, and these, as has been pointed out, communicate directly with the subarachnoid space.

In the Sluder-Hajek, on the other hand, merely the lower half of the middle turbinate is removed, and accordingly the olfactory area is left intact.

The disadvantages common to both operations are that it is not easy for the surgeon to see what he is doing, haemorrhage may be troublesome, while unforeseen accidents with intracranial complications, extravasation into the eyelids and orbital cellulitis may all occur. External approach will obviate the above difficulties and is accordingly more popular with the majority of rhinologists.

(d) When both anterior and posterior ethmoidal cell groups are involved together with the frontal sinus.

The chief desiderata for radical operations on the fronto-ethmoidal region are that there shall be: (a) Complete exposure of the whole interior of the sinus; (b) free access to the infected ethmoidal cells, as the removal of all thickened polypoid mucous membrane is the only effective measure for this otherwise intractable disease.

(To be continued.)